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Abstract

Although nearly all domain experts agree that carbon dioxide emissions are altering the world's climate, segments of the public remain unconvinced by the scientific evidence. Internet blogs have become a platform for denial of climate change, and bloggers have taken a prominent role in questioning climate science. We report a survey of climate-blog visitors to identify the variables underlying acceptance and rejection of climate science. Our findings parallel those of previous work and show that endorsement of free-market economics predicted rejection of climate science. Endorsement of free markets also predicted the rejection of other established scientific findings, such as the facts that HIV causes AIDS and that smoking causes lung cancer. We additionally show that, above and beyond endorsement of free markets, endorsement of a cluster of conspiracy theories (e.g., that the Federal Bureau of Investigation killed Martin Luther King, Jr.) predicted rejection of climate science as well as other scientific findings. Our results provide empirical support for previous suggestions that conspiratorial thinking contributes to the rejection of science. Acceptance of science, by contrast, was strongly associated with the perception of a consensus among scientists.

Keywords

scientific communication, policymaking, climate science

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More than 90% of climate scientists agree that the global climate is changing, largely because of carbon dioxide emissions resulting from human activity (Anderegg, Prall, Harold, & Schneider, 2010; Doran & Zimmerman, 2009).¹ There are indications that the 2007 assessment of the Intergovernmental Panel on Climate Change (IPCC) was conservative rather than “alarmist” (Allison et al., 2009; Freudenburg & Muselli, 2010); however, the scientific indicators of increasing actual risks are accompanied by an apparent decrease in the public's perception of those risks in some countries (Brulle, Carmichael, & Jenkins, 2012; Hanson, 2009; Scruggs & Benegal, 2012).

The reasons for this declining public concern are manifold. Researchers in history and sociology frequently cite the “manufacture of doubt” by vested interests and political groups as a factor (Jacques, Dunlap, & Freeman, 2008; McCright & Dunlap, 2003, 2010; Mooney, 2007; Oreskes & Conway, 2010; Stocking & Holstein, 2009). For

example, more than 90% of books endorsing skepticism toward environmentalism that have been published since 1972 have been sponsored by conservative think tanks (Jacques et al., 2008). Oreskes and Conway (2010) analyzed the shared ideological underpinnings of organized attempts over the past few decades to discredit well-established scientific findings, such as the link between smoking and lung cancer, the causal role of chlorofluorocarbons (CFCs) in eroding the ozone layer, and, most recently, the findings of climate change. Oreskes and Conway documented that a small number of organizations and individuals have been instrumental in those

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contrarian activities, arguably motivated by a laissez-faire free-market ideology that views as threatening any scientific finding with potential regulatory impact, such as interference with the marketing of tobacco products, bans on CFCs, or a price on carbon emissions (cf. Dunlap & McCright, 2011).

These historical analyses complement empirical results showing that people's rejection of climate science is associated with an embrace of laissez-faire free-market economics (Heath & Gifford, 2006; Kahan, 2010). There is little doubt that people's personal ideology—also often referred to as worldview or cultural cognition—is a major predictor of the rejection of climate science (Dunlap & McCright, 2008; Feygina, Jost, & Goldsmith, 2010; Hamilton, 2011; Heath & Gifford, 2006; Kahan, 2010; Kahan, Jenkins-Smith, & Braman, 2011; McCright & Dunlap, 2011a, 2011b).

In the study reported here, we investigated predictors of the rejection of climate science and investigated whether they generalize across content domains. We define the rejection of science as the dismissal of well-established scientific results for reasons that are not scientifically grounded (Diethelm & McKee, 2009; Jacques, 2012; McKee & Diethelm, 2010).² Those reasons may comprise the psychological factors that are of interest here, but they may also include indecision arising from inaccurate or misleading media coverage—for example, the scientific consensus on climate change is often misrepresented in the media (e.g., Boykoff, 2007). Rejection of science must be distinguished from true skepticism, which may prompt the revision of a scientific claim on the basis of evidence and reasoned theorizing. Skepticism not only is at the core of scientific reasoning, but also has been shown to improve people's discrimination between true and false information (e.g., Lewandowsky, Stritzke, Oberauer, & Morales, 2005, 2009).

In addition to a worldview that endorses free-market economics, another variable that has been associated with the rejection of science is conspiratorial thinking, or conspiracist ideation, defined here as the attempt to explain a significant political or social event as a secret plot by powerful individuals or organizations (Sunstein & Vermeule, 2009). The presumed conspirators are typically perceived as virtually omnipotent (Bale, 2007). Thus, internal documents of the tobacco industry referred to scientists doing medical research on the health effects of smoking as a “vertically integrated, highly concentrated, oligopolistic cartel” that—in combination with “public monopolies”—“manufactures alleged evidence, suggestive inferences linking smoking to various diseases, and publicity and dissemination and advertising of these so-called findings” (Abt, 1983, p. 126). Likewise, rejection of the link between HIV and AIDS has been associated with the conspiratorial belief that HIV was created by the U.S.

government to eradicate Black people (e.g., Bogart & Thorburn, 2005; Kalichman, Eaton, & Cherry, 2010). Rejection of climate science has also long been infused with notions of a conspiracy among scientists. As early as 1996, accusations of corruption in the IPCC were aired in the *Wall Street Journal* (Lahsen, 1999; Oreskes & Conway, 2010). More recently, a book by a U.S. senator is called *The Greatest Hoax: How the Global Warming Conspiracy Threatens Your Future* (Inhofe, 2012).

The prominence of conspiracist ideation in people who espouse science denial is not entirely surprising because if an overwhelming scientific consensus cannot be accepted as the result of researchers independently converging on the same evidence-based view, then the very existence of the consensus calls for an alternative explanation. The ideation of a complex and secretive conspiracy among researchers can provide that explanation (Diethelm & McKee, 2009; McKee & Diethelm, 2010). However, there is no empirical evidence about how widespread such ideations are among people who reject scientific evidence, in particular as it relates to climate change. Moreover, to date, analyses of conspiracist ideation in the rejection of science have exclusively focused on conspiracy theories pertaining to the scientific issue under consideration: Thus, denial of HIV's connection with AIDS has been linked to the belief that the U.S. government created HIV (Kalichman, 2009), members of the tobacco industry viewed lung-cancer researchers as an “oligopolistic cartel” (Abt, 1983, p. 127), and climate deniers believe that communists, socialists, and a “global elite” have manufactured global warming as the “biggest scam in history” (Sussman, 2010, p. 215). In all these cases, the conspiracy theory serves to explain away overwhelming scientific evidence. Thus, the conspiracist ideation may be an accoutrement of the denial of an inconvenient scientific fact, rather than an independent and potentially stable psychological variable that is associated with the rejection of science more generally.

It is known that people's propensity for conspiracist ideation is not limited to one theory in isolation. Instead, the belief that AIDS was created by the government is likely accompanied by the conviction that the Federal Bureau of Investigation (FBI) killed Martin Luther King, Jr., or that the Air Force is hiding evidence of extraterrestrial visitors (Goertzel, 1994; Swami, Chamorro-Premuzic, & Furnham, 2009). Douglas and Sutton (2011), in a study supporting the notion of a general disposition toward conspiracist ideation, showed that people's endorsement of conspiracy theories was associated with their willingness to engage in a conspiracy themselves when they deemed it necessary. It is therefore possible that this disposition predicts the rejection of science independently of the scientific domain in question: If conspiracist ideation reflects a stable personality or cognitive

characteristic, then people who believe that NASA faked the moon landing may be likely to reject a range of other scientific propositions, from medical facts on HIV-AIDS to consensus on climate change.

Another attribute common to people who reject science is reliance on the Internet (Diethelm & McKee, 2009; McKee & Diethelm, 2010). By definition, the peer-reviewed literature does not promote denial; for example, questioning the link between HIV and AIDS lost intellectual respectability decades ago (Nattrass, 2010, 2011), and there are few peer-reviewed contrarian climate publications (Anderegg et al., 2010). The Internet, by contrast, provides the opportunity for individuals who reject a scientific consensus to feed “each other’s feelings of persecution by a corrupt elite” (McKee & Diethelm, 2010, pp. 1310–1311). Accordingly, climate-“skeptical” blogs have become a major staging post for denial, although blogs are also used by supporters of climate science to disseminate scientific evidence. The influence of blogs should not be underestimated: For example, one skeptic blogger (Steven McIntyre of the “Climate Audit” blog, at climateaudit.org) has triggered several congressional investigations, and one anonymous proscience blogger (“Deep Climate”) uncovered a plagiarism scandal involving a report skeptical of climate change for Congress, which ultimately led to the retraction of a peer-reviewed article. Popular climate blogs can register upward of 700,000 monthly visitors, a self-selected audience that is by definition highly engaged in the increasingly polarized climate debate.

Climate-blog denizens therefore present a highly relevant population for the study of variables underlying endorsement or rejection of the scientific consensus on climate. We surveyed blog denizens on (a) their views on climate science and a range of other scientific propositions; (b) two constructs that we hypothesized to be associated with rejection of science (endorsement of free-market ideology and agreement with a range of conspiracy theories); (c) a construct targeting sensitivity to environmental problems (e.g., whether previous concerns about acid rain have been addressed); and (d) the perceived consensus among scientists, which has been repeatedly linked to acceptance of science (Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; Dunlap & McCright, 2008; Kahan et al., 2011; Lewandowsky, Gignac, & Vaughan, 2012).

Method

Participants

Visitors to climate blogs voluntarily completed an online questionnaire between August and October 2010 ($N = 1,377$). Links were posted on eight blogs that have a pro-science stance but a diverse audience (see the

Supplemental Material for more on audience composition); an additional five “skeptical” (or “skeptical-leaning”) blogs were approached, but none posted the link.

Questionnaire

Table 1 lists items retained for analysis together with their abbreviated variable names.³ The free-market items were taken from Heath and Gifford (2006). Most of the conspiracy items were adapted from previous research (e.g., Swami et al., 2009). The conspiracies covered the political spectrum, with fears of a “world government” being most pronounced on the political right and a theory that September 11 was an “inside job” being prevalent on the left (Nyhan, 2010). The remaining items were designed for this study. The table shows the ordering of items into groups for one version of the questionnaire; in another version, the conspiracist items were positioned between the items querying free-market ideology and those focusing on acceptance of climate science. The two versions were arbitrarily assigned to blogs.

Results

Following standard recommendations (Gosling, Vazire, Srivastava, & John, 2004), whenever more than one response was submitted from the same Internet Protocol address, we eliminated all those responses ($n = 71$). An additional 161 responses were eliminated because the respondent’s age was implausible (< 10 or > 95 years old), values for the consensus items were outside the range of the rating scale, or responses were incomplete. This left 1,145 complete records for analysis. Items were reverse-scored when necessary, such that larger scores pointed to greater endorsement of the underlying construct. Raw correlation matrices and summary statistics are reported in the Supplemental Material available online (Tables S3 and S4).

Analyses focused on the relations among the constructs of greatest interest: free-market ideology, acceptance of climate science and of other sciences, perceived consensus among scientists, conspiracist ideation, and the belief that earlier environmental problems have been resolved. The overarching analysis used a structural equation model (SEM), with the data preprocessed as follows.

Separate exploratory factor analyses were conducted for the free-market, climate-change, and conspiracist-ideation items. For free-market items, a single factor comprising five items accounted for 56.5% of the variance; the remaining item (FMNotEnvQual) loaded on a second factor (17.7% of the variance) by itself and was therefore eliminated. The four climate-change items (excluding CauseCO2) loaded on a common factor that explained 87% of the variance; all were retained. For conspiracist

ideation, two factors were identified; the 2 items involving space aliens (CYArea51 and CYRoswell) loaded on the second factor, which accounted for 9.6% of the variance, and the remaining 10 loaded on the first one, which accounted for 42.0% of the variance (CYAIDS and CYClimChange were not considered for the reasons

stated in Table 1). Responses to items loading on each conspiracist-ideation factor were summed, so that two composite manifest variables were created. The two composites thus estimated a conspiracist-ideation construct without any conceptual relation to the scientific issues under investigation.

Table 1. Questionnaire Items, Variable Names, and Factor Loadings

Variable name	Item	Loading ^a
Free-market ideology		
FMUnresBest	An economic system based on free markets unrestrained by government interference automatically works best to meet human needs.	.802
FMNotEnvQual	I support the free-market system but not at the expense of environmental quality. (R)	(omitted from analysis)
FMLimitSocial	The free-market system may be efficient for resource allocation, but it is limited in its capacity to promote social justice. (R)	.624
FMMoreImp	The preservation of the free-market system is more important than localized environmental concerns.	.827
FMThreatEnv	Free and unregulated markets pose important threats to sustainable development. (R)	.887
FMUnsustain	The free-market system is likely to promote unsustainable consumption. (R)	.892
Acceptance of climate science		
CO2TempUp	I believe that burning fossil fuels increases atmospheric temperature to some measurable degree.	.941
CO2AtmosUp	I believe that the burning of fossil fuels on the scale observed over the last 50 years has increased atmospheric temperature to an appreciable degree.	.969
CO2WillNegChange	I believe that the burning of fossil fuels on the scale observed over the last 50 years will cause serious negative changes to the planet's climate unless there is a substantial switch to non-CO2-emitting energy sources.	.982
CO2HasNegChange	I believe that the burning of fossil fuels on the scale observed over the last 50 years has caused serious negative changes to the planet's climate.	.921
Perception that problems have been resolved		
CFCNowOK	The problem of chlorofluorocarbons (CFCs) is no longer a serious threat to the ozone layer.	.801
AcidRainNowOK	The problem of acid rain is no longer a serious threat to the global ecosystem.	.927
Conspiracist ideation ^b		
CYNewWorldOrder	A powerful and secretive group known as the New World Order is planning to eventually rule the world through an autonomous world government that would replace sovereign governments.	.742
CYSARS	SARS (Severe Acute Respiratory Syndrome) was produced under laboratory conditions as a biological weapon.	.742
CYPearlHarbor	The U.S. government had foreknowledge about the Japanese attack on Pearl Harbor but allowed the attack to take place so as to be able to enter the Second World War.	.742

(Continued)

Table 1. (Continued)

Variable name	Item	Loading ^a
CYMLK	The assassination of Martin Luther King Jr. was the result of an organized conspiracy by U.S. government agencies such as the FBI and CIA.	.742
CYMoon	The Apollo moon landings never happened and were staged in a Hollywood film studio.	.742
CYJFK	The assassination of John F. Kennedy was not committed by the lone gunman Lee Harvey Oswald but was rather a detailed organized conspiracy to kill the president.	.742
CY911	The U.S. government allowed the 9/11 attacks to take place so that it would have an excuse to achieve foreign (e.g., wars in Afghanistan and Iraq) and domestic (e.g., attacks on civil liberties) goals that had been determined prior to the attacks.	.742
CYDiana	Princess Diana's death was not an accident but rather an organized assassination by members of the British royal family who disliked her.	.742
CYOkla	The Oklahoma City bombers Timothy McVeigh and Terry Nichols did not act alone but rather received assistance from neo-Nazi groups.	.742
CYCoke	The Coca-Cola company intentionally changed to an inferior formula with the intent of driving up demand for their classic product, later reintroducing it for their financial gain.	.742
CYRoswell	In July 1947, the U.S. military recovered the wreckage of an alien spacecraft from Roswell, NM, and covered up the fact.	.891
CYArea51	Area 51 in Nevada is a secretive military base that contains hidden alien spacecraft and/or alien bodies.	.891
CYClimChange ^c	The claim that the climate is changing due to emissions from fossil fuels is a hoax perpetrated by corrupt scientists who want to spend more taxpayer money on climate research.	
CYAIDS ^c	U.S. agencies intentionally created the AIDS epidemic and administered it to Black and gay men in the 1970s.	
Acceptance of other sciences		
CauseHIV	The HIV virus causes AIDS.	.894
CauseSmoke	Smoking causes lung cancer.	.845
CauseCO2	Human CO2 emissions cause climate change	—
Consensus items		
ConsensHIV	Out of 100 medical scientists, how many do you think believe that the HIV virus causes AIDS?	—
ConsensSmoke	Out of 100 medical scientists, how many do you think believe that smoking causes lung cancer?	—
ConsensCO2	Out of 100 climate scientists, how many do you think believe that CO2 emissions resulting from human activities cause climate change?	—

Note: All items used a 4-point scale ranging from *strongly disagree* (1) to *strongly agree* (4), with the exception of the consensus items, which used a scale from 0 to 100. R = reverse-scored. The section headings inside the table correspond to the latent variable names in Figure 2.

^aStandardized loadings of manifest variables on their corresponding latent variables are as shown in Figure 2. All loadings are significant.

^bThere were two composite manifest variables for conspiracist ideation. The same loading is shown for all items that entered into a given composite variable. ^cThese items were not entered as manifest variables to estimate the conspiracist-ideation latent variable because they referred to conspiracies relevant to the scientific proposition being queried. People might therefore have endorsed these items because they represented a convenient way to justify a rejection of science actually motivated by other variables.

Acceptance of science and consensus

Pairs of acceptance-of-science and consensus items (e.g., CauseHIV-ConsensHIV) were entered into an SEM with two correlated latent variables, one capturing the common variance of all acceptance questions and the other representing all consensus questions (see Fig. 1). Pairwise correlations between the residuals for each belief-consensus pair represented content-specific covariance. All SEMs in this article were performed with Mplus (<http://www.statmodel.com>) using ordinal coding of the manifest variables, with the consensus responses binned into nine categories with approximately equal numbers.

The model fit reasonably well, $\chi^2(5) = 53.71, p < .0001$, confirmatory fit index (CFI) = .989, root-mean-square error of approximation (RMSEA) = 0.092, 90% confidence interval (CI) = [0.071, 0.115]. People's content-general inclination to accept science was associated with their content-general perception of scientific consensus, $r = .43, Z = 12.76, p < .0001$, over and above the content-specific links represented by the pairwise correlations. The fact that acceptance of climate science (CauseCO2) and perceived consensus among climate scientists (ConsensCO2) loaded onto their respective latent variables together with items concerning other very different scientific propositions suggests that respondents did not gauge consensus among climate scientists and evaluate climate science independently of their views of other, unrelated domains of scientific inquiry. Rather, their perception of consensus and their endorsement of scientific

findings about the climate reflected in part a content-independent disposition to perceive scientific consensus and a correlated disposition to accept scientifically well-established propositions. This finding replicated the factor structure reported in Lewandowsky, Gignac, and Vaughan (2012).

Ideology, conspiratorial thinking, and acceptance of science

We next examined the interplay among the five constructs of greatest interest: acceptance of climate science, acceptance of other scientific propositions, free-market ideology, the belief that previous environmental problems have been resolved, and conspiracist ideation. For this analysis, climate science was considered separately from the other scientific propositions. Constructs were measured using the manifest variables identified in the earlier factor analyses, and acceptance of other scientific propositions was measured by CauseHIV and CauseSmoke. For the climate-science factor, pairwise correlations were estimated between CO2TempUp and CO2AtmosUp, and between CO2WillNegChange and CO2HasNegChange, as this improved model fit considerably. An exploratory model that estimated correlations among all five latent variables fit well, $\chi^2(78) = 261.0, p < .0001$, CFI = .997, RMSEA = 0.045, 90% CI = [0.039, 0.051]; the pairwise correlations between the latent variables are given in Table 2.

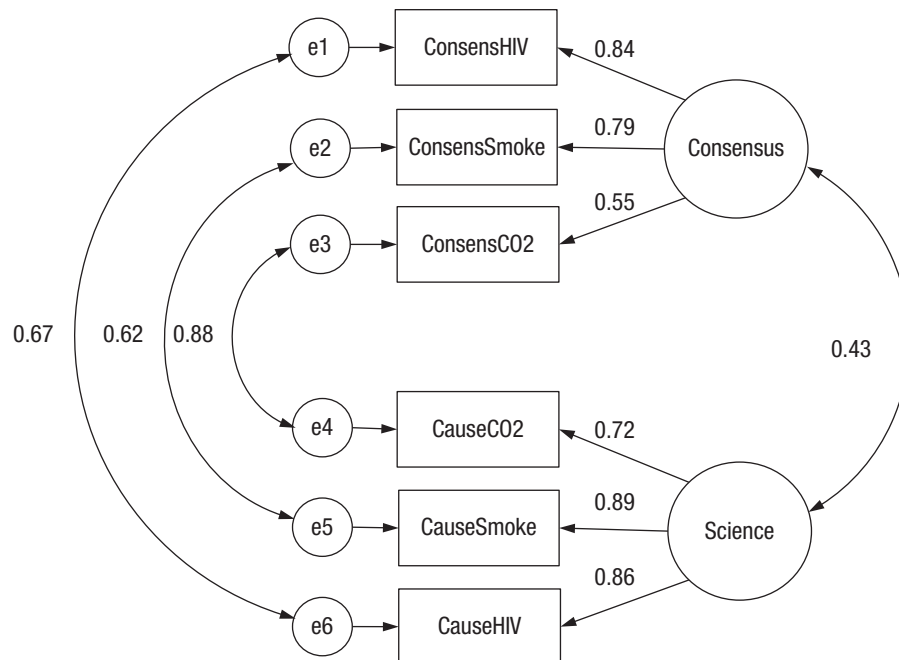


Fig. 1. Latent variable model for the relationship between perceived consensus among scientists and acceptance of scientific propositions, as related to three scientific issues. All correlations (double-headed arrows) and factor loadings (single-headed arrows) are significant and standardized. See Table 1 for an explanation of the names of the manifest variables. e = residuals.

Table 2. Pairwise Correlations Between the Five Latent Variables in the Unconstrained Model

Variable	Acceptance of climate science	Acceptance of other sciences	Perception that problems have been resolved	Free-market ideology
Acceptance of climate science	—			
Acceptance of other sciences	.563	—		
Perception that problems have been resolved	-.586	-.263	—	
Free-market ideology	-.866	-.464	.498	—
Conspiracist ideation	-.197	-.538	.032	.021

We next sought to predict acceptance of climate science and other sciences from the remaining three latent variables while simultaneously simplifying the model by removing nonsignificant correlations and regression weights. This final model fit very well, $\chi^2(82) = 182.1, p < .0001, CFI = .999, RMSEA = 0.033, 90\% CI = [0.026, 0.039]$, and its fit did not differ from that of the unconstrained model that included all correlations, $\Delta\chi^2(4) = 3.525,$

$p > .10.$ Figure 2 shows the model at the level of latent variables, displaying only weights and correlations that were statistically significant, $p < .05.$

Several aspects of the model are noteworthy: First, endorsement of free markets was highly predictive of rejection of climate science, $\beta = -0.77.$ Second, free-market ideology also predicted the rejection of other scientific propositions, although the magnitude of that

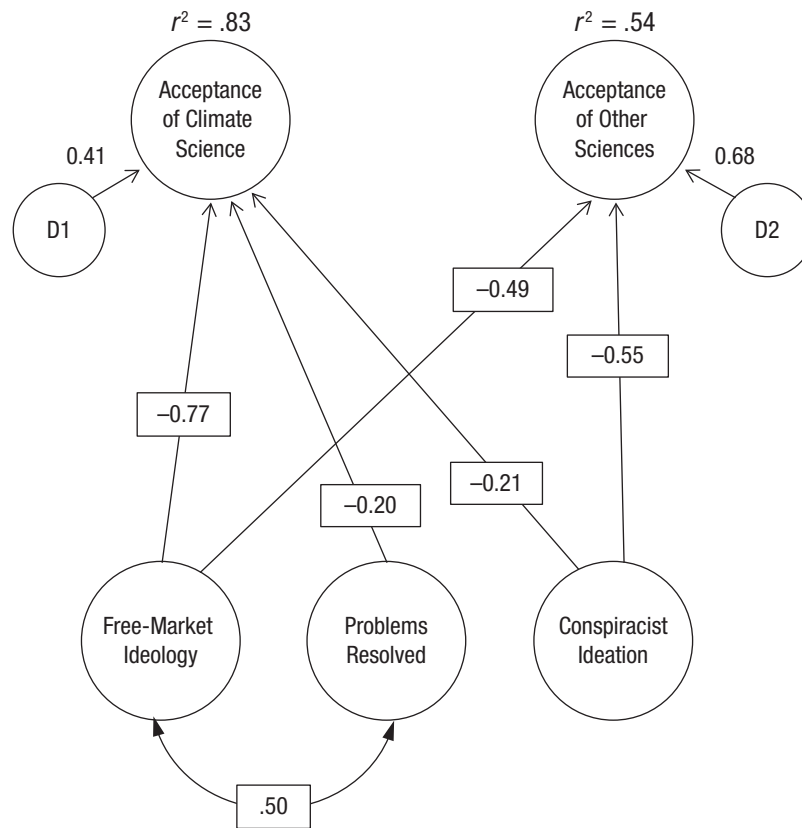


Fig. 2. Latent variable model predicting acceptance of climate science and acceptance of other scientific propositions on the basis of free-market ideology, the perception that earlier environmental problems have been resolved, and conspiracist ideation. All regression weights (single-headed arrows) and the correlation (double-headed arrow) are significant and standardized. Weights and correlations that are not shown were set to zero (e.g., the correlation between the residuals of acceptance of climate science and acceptance of other sciences). Manifest variables for each latent variable and their loadings are provided in Table 1. See the text for further explanation.

link was smaller, $\beta = -0.49$. Third, conspiracist ideation was negatively associated with acceptance of climate science and other scientific propositions, $\beta = -0.21$ and $\beta = -0.55$, respectively. Finally, the perception that previous environmental problems have been resolved was negatively associated with acceptance of climate science, $\beta = -0.20$, but was unrelated to acceptance of other sciences (β set to 0).

The three latent predictors accounted for much of the variance in acceptance of climate science and for about half the variance in acceptance of other sciences. Notably, the three predictors explained the entire association between the two latent criterion variables (initially $r = .563$; see Table 2) because there was no remaining unexplained correlation (r between the residuals of acceptance of climate science and acceptance of other sciences was set to 0 without loss of fit). Conspiracist ideation did not correlate with the other two predictors.

Discussion

Rejection of climate science was strongly associated with endorsement of a laissez-faire view of unregulated free markets. This finding replicates previous work (e.g., Heath & Gifford, 2006), although the strength of association found here ($r = .80$) exceeds that reported in any extant study. At least in part, this may reflect the use of structural equation modeling, which enables measurement of the associations between constructs in a way that is free of measurement error (Fan, 2003).

Another variable that was associated with rejection of climate science and other scientific propositions was conspiracist ideation. This relationship emerged even though conspiracies related to the queried scientific propositions (HIV-AIDS, climate change) did not contribute to the conspiracist construct. By implication, the role of conspiracist ideation in the rejection of science did not simply reflect “convenience” theories that provided specific alternative “explanations” for a scientific consensus. Instead, this finding suggests that a general propensity to endorse any of a number of conspiracy theories predisposes people to reject entirely unrelated scientific facts.

The relative importance of free-market ideology and conspiracist ideation differed between climate science and the other scientific propositions. We suggest that free-market ideology had a larger effect on rejection of climate science than did conspiratorial thinking ($\beta = -0.77$ vs. $\beta = -0.21$) for two reasons: First, climate science has arguably become more politicized than other sciences (Hamilton, 2011; McCright & Dunlap, 2011a), and second, given the fundamental importance of fossil fuels (and hence carbon dioxide emissions) to contemporary economies, climate science presents a far greater threat to laissez-faire economics than do the medical facts that

HIV causes AIDS and that smoking causes lung cancer. For the same reasons but in reverse, conspiracist ideation had a larger effect on denial of facts about AIDS and lung cancer ($\beta = -0.55$), compared with the effect of free-market ideology on denial of these facts ($\beta = -0.49$).

The third predictor, the perception that previous environmental problems have been resolved, predicted rejection of climate science but not of the other sciences. We suggest that this construct reflects a predisposition to dismiss environmental concerns (or consider them resolved) that is prevalent in particular among adherents of the free market (as evidenced by the correlation relating perception that problems have been resolved with free-market ideology, $r = .50$).

Finally, we replicated the finding that perceived scientific consensus is associated with acceptance of science (Ding et al., 2011; Dunlap & McCright, 2008; Kahan et al., 2011; Lewandowsky, Gignac, & Vaughan, 2012). Although the direction of causality cannot be ascertained from these data, it has been shown that providing consensus information can significantly enhance people’s acceptance of climate science (Lewandowsky, Gignac, & Vaughan, 2012).

Potential objections

Our respondents were self-selected denizens of climate blogs. Therefore, one potential objection to our results might be the selected nature of our sample. We acknowledge that our sample is self-selected and that the results may therefore not generalize to the population at large. However, this fact has no bearing on the importance of our results: We designed the study to investigate what motivates the rejection of science in individuals who choose to get involved in the ongoing debate about one scientific topic, climate change. As noted earlier, this group of people has a demonstrable impact on society, and understanding their motivations and reasoning is therefore of importance.

Another objection that might be raised is the possibility that our respondents willfully accentuated their replies to subvert our presumed intentions. As in most behavioral research, this possibility cannot be ruled out. However, unless a substantial subset of the more than 1,000 respondents conspired to coordinate their responses, any individual accentuation or provocation would only have injected more noise into our data. This seems unlikely because subsets of our items have been used in previous laboratory research, and for those subsets, our data did not differ in a meaningful way from published precedent. For example, responses to the Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) replicated previous research involving the population at large (see Table S2 in the Supplemental

Material), and the model in Figure 1 exactly replicated the factor structure reported by Lewandowsky, Gignac, and Vaughan (2012) using a sample of pedestrians in a large city. The Supplemental Material also shows that the results are robust to the removal of potential outliers.

A final concern might be that respondents who rejected science did so on the basis of a general critical stance or predisposition to reject *any* proposition put before them for potential endorsement. We find this highly unlikely because respondents who rejected scientific propositions were quite likely to endorse other items, such as various conspiracy theories or the idea that “an economic system based on free markets unrestrained by government interference automatically works best to meet human needs” (FMUnresBest in Table 1).

Theoretical implications

The pivotal role of personal ideology in the rejection of climate science has been repeatedly demonstrated (Dunlap & McCright, 2008; Feygina et al., 2010; Hamilton, 2011; Heath & Gifford, 2006; Kahan, 2010; Kahan et al., 2011; McCright & Dunlap, 2011a, 2011b). We highlighted the magnitude of this effect among climate-science blog denizens, who have a strong interest in the issue, and we additionally showed that endorsement of the free market also predicted the rejection of two other well-established scientific facts. This novel result is particularly intriguing because only one of those facts, the link between tobacco smoke and lung cancer, has regulatory implications and has a history of organized ideologically motivated denial (e.g., Michaels & Monforton, 2005; Oreskes & Conway, 2010). The fact that HIV causes AIDS, by contrast, seems of little relevance to one’s views on the free market at first glance. However, the association between ideology and rejection of the link between HIV and AIDS is in good agreement with our finding that perceived consensus and acceptance of science were associated via general factors that transcended pairwise correlations (Fig. 1). If acceptance of science is a coherent construct, then it is not altogether surprising that rejection of established facts is also consistently associated with free-market ideology and conspiracist ideation.

Our results identify conspiracist ideation as a personality factor or cognitive style, as numerous conspiracy theories are captured by a single latent construct (cf. Goertzel, 1994; Swami et al., 2009; Swami et al., 2011). The negative association between conspiracist ideation and acceptance of well-established science confirms previous conceptual analyses (Diethelm & McKee, 2009; Goertzel, 2010; McKee & Diethelm, 2010). However, to our knowledge, our results are the first to provide empirical evidence for the correlation between a general construct of conspiracist ideation and a general tendency to reject well-founded

science. This association is particularly notable because it persisted after “convenience theories” were removed, thus reliably linking broad-based rejection of science to ideations that appear quite unrelated at first glance, such as the notion that the U.S. government had advanced knowledge about the September 11th attacks or that the FBI assassinated Martin Luther King, Jr.

We suggest that the study and analysis of conspiracist ideation is of increasing importance: First, the spread of conspiracy theories about the alleged risks from vaccinations has been linked to reduced vaccination rates, with consequent adverse public-health impacts (Goertzel, 2010). In the climate arena, the conspiracist ideation that all of the world’s scientific academies have conspired together to create a hoax known as global warming has found traction in American mainstream politics (Inhofe, 2012). Second, there is evidence that conspiracy theories are capable of influencing people even when they explicitly attempt to discount them. Douglas and Sutton (2008) showed that after exposure to conspiracy theories about the death of Princess Diana, participants were demonstrably affected by those theories even when they tried to dismiss their influence. Third, belief in conspiracy theories appears to be inducible. Swami et al. (2011) were able to induce belief in an entirely fictitious conspiracy theory involving a popular soft drink (e.g., that the drink “raises dopamine levels”), especially among participants who already held other conspiratorial views. That study is arguably a laboratory equivalent of the real-life “experiment” conducted by vested interests and political groups with respect to climate science (cf. Oreskes & Conway, 2010).

In closing, we consider briefly what countermeasures might be available to reduce the influence and spread of conspiracy theories. Conspiracist ideation is, by definition, difficult to correct because any evidence contrary to the conspiracy is itself considered evidence of its existence (Bale, 2007; Sunstein & Vermeule, 2009). Thus, increasing global temperatures are reinterpreted as being the result of government agencies selectively removing thermometers that show a cooling trend and retaining only those that show the “desired” warming trend.

Sunstein and Vermeule (2009) discussed several potential countermeasures that are at the disposal of government officials, several of which agree well with our finding. For example, Sunstein and Vermeule suggested that instead of rebutting single conspiracy theories, scientists and policymakers should try to rebut many at the same time. This conforms with our finding that conspiracist ideation tends to be quite broad. Multiple rebuttals also raise the complexity of possible conspiracist responses (not only must there be a conspiracy to remove thermometers, but there must also be a conspiracy to launch a false “decoy” theory about the absence of a

plane hitting the Pentagon on September 11 in order to detract from the real conspiracy, which was to destroy the Twin Towers, and so on). Sunstein and Vermeule noted the possibility of addressing the “demand” rather than the “supply” of conspiracy theories; that is, rather than being directed at changing the minds of actual believers, communication should be directed at inoculating potential consumers of conspiracy theories against accepting them.

Similarly, Lewandowsky, Ecker, Seifert, Schwarz, and Cook (2012) offered a broad review of “debiasing” techniques that are directly applicable to the rebuttal of conspiracy theories and include suggestions about how to avoid various backfire effects that can arise when people’s worldviews are challenged by corrective information. Some of those suggestions, such as reaffirmation of a subset of beliefs among consumers of conspiracy theories, were echoed by Sunstein and Vermeule (2009).

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Supplemental Material

Additional supporting information may be found at <http://pss.sagepub.com/content/by/supplemental-data>

Notes

1. The existence of a scientific consensus about core principles of climate change does not imply the absence of uncertainty or the absence of legitimate scientific debate surrounding as-yet unresolved issues. The core aspects of climate science for which the consensus is beyond doubt are that the climate is changing, that greenhouse gases are responsible, and that the world is beginning to witness predicted changes in climate patterns (Somerville, 2011). See the Supplemental Material for further evidence about the pervasive scientific consensus regarding climate science.

2. We prefer “rejection of science” to the term “denial,” which in current scholarly usage typically pertains to an active public denial of scientific facts by various means, such as the use of rhetoric to create the appearance of debate where there is none (Diethelm & McKee, 2009; Jacques, 2012; McKee & Diethelm, 2010). Thus, whereas investigations of denial focus on the techniques by which organizations or individuals seek to undermine scientific findings in the public’s eye, our research on the rejection of science focuses on the factors that predispose people to be susceptible to organized denial. We thus use “denial” to refer to public activities connected to the rejection of science and use “rejection” when discussing individuals’ attitudes toward science.

3. The survey included several additional items (e.g., perceived income rank, well-being) that were not relevant to the constructs of interest. The data are available at www.cogsciwa.com.

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