Public perceptions of expert credibility on policy issues: The role of expert framing and political worldviews[1]

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Abstract

How do individuals assess the credibility of experts in various policy domains? Under what conditions does the public interpret particular scientific knowledge claims as being trustworthy and credible? Using data collected from an online survey experiment, administered to 1507 adult residents of Quebec, this paper seeks answers to these questions. Specifically, we examine variation in the way members of the public perceive the credibility of scientific experts in the areas of climate change, shale gas extraction, cell phones and wind farms. Our results contribute to the existing literatures on public perceptions of policy experts, framing and cultural theory. We find that individuals evaluate expert credibility based on the way in which experts frame issues, and on the congruity/dissonance between these expert communication frames and one's underlying worldview. However, we also identify limits to these framing effects. Our findings shed light on the interaction of framing and political worldviews in shaping public perceptions of expert credibility in various policy-making contexts.

Key words: Risk, scientific expertise, expert credibility, framing, Cultural Theory, public opinion

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The importance of elite influence in the formation of policy attitudes has long been recognized in the scholarly literature (Zaller, 1992). As Down's (1957) famously surmised, rational citizens have little incentive to invest their limited time to learn about the entire range of complex issues they face. Rather, all citizens rely on, to various degrees, the information and analysis provided by agents with a legitimate claim to expertise in a given issue area. This fundamental insight has informed decades of public opinion research. Rather than spend time collecting all of the available information on issues, this research finds that people instead rely on a variety of heuristics, such as source cues and value predispositions, that act as mental shortcuts to assist individuals in forming their opinions (Liu & Priest, 2009). Political parties (Kam, 2005), the media (Scheufele & Lewenstein, 2008) and elites (Zaller, 1992) provide information cues to members of the public, having an important impact on the formation public attitudes on a range of policy issues.

In particular, several studies have found that trust in scientific experts is an important heuristic used by members of the public when forming their perception of risks as well as their general attitudes toward emerging technologies (Liu & Priest, 2009). While the public is influenced by source cues, however, this effect crucially depends on perceptions of source credibility. When faced with new information from policy experts, individuals must first decide whether or not they believe the source to be credible. Perceptions of source credibility thus play a key role in the likelihood of being persuaded by an information source (Druckman, 2001), and ultimately, on attitudes toward risk and policy issues more generally.

Despite its importance in the formation of attitudes toward policy issues, who the public trusts for information, and why, is not well understood. For instance, past research has shown that public trust in scientific evidence and expertise is relatively high, especially in complex,

technical and non-moral policy issue domains (Mooney & Schuldt, 2008). Much of the existing literature on the determinants of public trust in science tends to paint scientists with a broad brush (Anderson et al. 2011). In reality, however, scientists often disagree (Montpetit, 2011), providing members of the public with a certain amount of "interpretive flexibility" when deciding on who and what to believe (Brewer & Ley, 2013). Even in those rare cases of relative scientific consensus, individuals are often exposed to differing scientific opinions on complex issues, not least because of such journalistic norms as balanced reporting (Boykoff & Boykoff, 2004). When experts disagree, it is conceivable that other factors, such as value predispositions and issue framing, interact to shape not just overall attitudes toward policy issues, but also perceptions of expert credibility as well (Chong & Druckman, 2007).

In this article, we examine the roles of issue framing and worldviews[1] in predicting perceptions of expert credibility. Specifically, we adapt an experiment administered in the U.S. (Kahan, Jenkins-Smith & Braman, 2011) to a culturally distinct context and on a range of new issues, including in the areas of health and the environment. Consistent with what was found in the U.S., we find that a subject's underlying value predispositions can bias the evaluation of expert credibility. However, we also find that the frames employed by experts to communicate risk matter as well. Indeed, we find that the way in which risks are framed has an effect on perceptions of expert credibility, and that this effect is not consistent across all issues or across individuals predisposed to different worldviews.[2] In particular, we find that the role of cultural biases in shaping perceptions of expert credibility is particularly important for people holding strongly egalitarian predispositions, but less so for others. Moreover, our findings contribute to the understanding of framing effects (Druckman, 2001). Beyond their impact on public opinion toward issues, we find that frames also affect public perceptions of expert credibility. These

framing effects are, however, moderated by their congruity with one's underlying political worldviews and the external media environment in which they are interpreted.

We begin with a discussion of two distinct literatures; that on framing and that on the cultural theory of risk. We argue that these two streams of literature are complimentary, with expert framing of technical policy issues interacting with the worldviews identified by cultural theory. After reviewing this literature, we specify a number of hypotheses that elaborate on the interaction of framing and cultural biases in shaping the public's perception of experts. This section is followed by a presentation of the survey experiment designed to test our hypotheses. We then present results and discuss the relative importance of framing and worldviews in shaping public perceptions of expert credibility. We conclude with reflections on the implications of our findings and outline potentially fruitful areas for further research.

Framing, worldviews and expert credibility

Framing is an important concept in studies of mass opinion and is important at all stages of the policy process, particularly when policy issues are communicated to the broader public. Defined here as the communicative process of making some considerations salient in such a way as to simplify and orient the understanding of a given problem and its policy solutions (Entman, 1993; Chong & Druckman, 2007), issue framing is used by all policy actors in their communication around policy. Policy actors frame issues so that they may be more easily understood, but also because members of the public frequently have little interest and time for learning all there is to know about any given policy issue. Under these conditions, individuals form their opinion on policy issues from the simple heuristics that are available to them. Expert framing of policy issues supplies such heuristics (Druckman, 2001).

The framing literature acknowledges that communication frames are just one source of heuristics. Source credibility is another example. Individuals may accept new information depending on the source's position in society or on their perceived level of expertise (Druckman, 2001). For instance, one study presented subjects with a cogent argument in favor of extending territorial boundaries further into the sea, and manipulated the level of expertise and trustworthiness of the source. Holding the message and framing of the issue constant, the experiment found that an expert's persuasiveness is a function of their perceived trustworthiness and level of expertise in a given policy area (McGinnes & Ward, 1980). Beyond credentials, another possibility is that the framing of issues themselves influences perceptions of expert credibility. Through a variety of cognitive schema, particular individuals may be more or less likely to interpret certain frames as credible, and thus be predisposed to imbue that particular messenger as being trustworthy and credible. To test this, it is necessary to disentangle the source cue (e.g. the social status of an information source) from the information cue (e.g. the framing of the informant's message). To our knowledge, scholars have not explored the possibility that issue framing might in fact shape perceptions of source credibility.

In considering the role of framing, past research has also taken into account people's value predispositions, which shape the way individuals interpret the world around them (Chong & Druckman, 2007). Indeed, the framing literature has shown that at the early stages of opinion formation, individuals tend to rely more on their own prior values, beliefs and opinions than on expert cues, even when the cues put forth by experts contain factual information that challenge these prior beliefs (Druckman & Bolsen, 2011). In this literature it is widely acknowledged that individuals with different values and beliefs are variably receptive to distinctive frames; they easily accept issue frames that are consistent with the values and resist those that are

incommensurable (Cobb, 2005; Nisbet, 2005). Although underlying value dispositions are sometimes included as predictors in such studies of framing effects, the relationship between framing and worldviews remains generally underexplored. Indeed, research on the cultural theory of risk has tended to rely on theoretical axioms that predict how different cultural types are predisposed to perceiving different risks (Dake, 1991; Wildavsky & Dake, 1990), and has tended to ignore the effects of framing (however, see Jones & Song, 2013 for an important exception). In our view, the literatures on framing and on cultural theory of risk are complimentary, and deserve better integration in empirical research.

Cultural theory has been described by one scholar as an "ambitious general theory of politics," which has made a number of contributions to the discipline of political science (Swedlow, 2011). Originally introduced by anthropologist Mary Douglas in the 1970s, cultural theory was later expanded on and applied to the United States in subsequent work (Douglas & Wildavsky, 1982; Wildavsky, 1987). A fundamental insight developed by cultural theory scholars is that risks are socially constructed. Unlike other cultural approaches, however, cultural theory avoids presenting culture as the homogenizing characteristic of a collectivity. Rather, culture is conceptualized as an attribute of individuals, who share orientations in common with others, and who may also contest the cultural preferences of fellow members in their collectivity (Montpetit & Rouillard, 2008).

There are several reasons for taking cultural theory seriously. First, cultural theory has been shown to offer better predictive power in the area of risk perception than one-dimensional indicators of ideology measured along the traditional left-right continuum (Gastil et al., 2011; Wildavsky & Dake, 1990). By moving beyond the left-right dichotomy now common in comparative politics, the more nuanced measures of political-cultural orientations offered by

cultural theory allow researchers to refine their analyses of social cleavages, better understand the bases of coalition formation among different groups and identify areas of potential compromise among different cultural orientations (Swedlow, 2011; Jones, 2011). Second, past research has demonstrated substantially large, systematic differences in perceptions of risks across various cultural orientations (Jones, 2011; Gastil et al., 2011; Ripberger, Jenkins-Smith, & Herron 2011; Dake, 1991; Wildavsky & Dake, 1990; Peters & Slovic, 1996). In this article, we present additional evidence of the way cultural biases shape public perceptions, though we also highlight additional factors that moderate these cultural effects. Lastly, unlike other measures of political cleavages, which differ substantially from one political context to the next, the cultural orientations identified by cultural theory are more general and facilitate comparative analysis. In the spirit of comparative research, we endeavor to adapt a battery of measures of worldviews to a culturally distinct social context, the province of Quebec, Canada.

To better account for diverging perceptions of expert credibility, we distinguish among three worldviews identified by scholars of cultural theory – individualistic, hierarchical, and egalitarian. Although cultural theory specifies up to five distinct cultural orientations (Thompson, Ellis & Wildavsky, 1990), and while there may be more (Marris, Langford & O'Riordan, 1998), this three-fold classification is consistent with earlier studies (Dake, 1991; Wildavsky & Dake, 1990). Moreover, we follow the advice of Swedlow (2011), and include only those orientations we judge as being most appropriate for our research objectives, which in this case involves a first-time application of cultural theory to the specific cultural context of Quebec. Quebec is known for having a population that displays a high level of solidarity, whose appropriateness is occasionally debated by economic elites and other individuals who lament its purported disruptiveness in the province's free-market economy. In addition, the Catholic

Church has historically encouraged Quebecers to think their society in terms of demarcated social roles. Egalitarianism, individualism and hierarchy are thus three key cultural orientations we chose to measure in Quebec.[3]

According to cultural theory, individuals hold to a particular combination of beliefs, values and social relations that constitute a particular "way of life" or political culture (Thompson, Ellis & Wildavsky, 1990; Wildavsky & Dake, 1990). For the hierarch, clearly demarcated social roles, and high levels of social stratification and organization are accepted as legitimate for the proper functioning of an orderly society. Like hierarch's, egalitarians also emphasize the social whole, but shun social differentiation on the grounds of such other values as fairness and equality. Consistent with these values, egalitarians prefer strongly democratic political institutions and self-governance that is free from rules or constraints imposed from an outside source. Individualism also raises suspicion about external rules, but for reasons of individual autonomy. Unlike egalitarians, individualists place greater emphasis on individual, rather than collective, self-determination, and value freedom, autonomy and competition as prerequisites for the proper functioning of society. These underlying worldviews and biases are said to help justify (and are justified by) a particular pattern of social relations, forming a way of life and informing one's perception of what constitutes an important risk (Swedlow, 2011; Wildavsky & Dake, 1990).

Some cultural theory scholars have gone further to identify four distinctive "myths of nature" that are said to correspond to distinctive ways of life (Schwarz & Thompson, 1990; Thompson, Ellis & Wildavsky, 1990). Thus, for individualists, nature is resilient, inherently capable of adapting to intrusive human activities. This construction of nature makes individualists less likely to be concerned about activities that carry environmental risks, and

justifies their preference for unfettered human entrepreneurship. In contrast, the egalitarian is more suspicious of human intervention for profit in the natural world; nature is a communal resource to be shared, and is inherently fragile. Consequently, egalitarians are thought to be more concerned with environmental risks. Hierarchs are conceptualized as being in the middle, believing that nature can withstand human intervention, up to a certain threshold. Under the threshold, humans can go on with their activities, but above the threshold ecological catastrophes can occur (Gastil et al., 2011; Dake, 1992; Thompson, Ellis & Wildavsky 1990; Schwarz & Thompson 1990).

While instructive, this account of risk perception and culture is somewhat constraining, especially when examining risks that have little to do with nature. Indeed, many issues arising in cotemporary society are not reducible to any one type of risk. Rather, complex policy problems and new technologies are liable to raise numerous risks simultaneously and in a variety of different areas, including public health, the environment, the economy, social order and in some cases, public privacy. To the extent that people learn about risks from secondary sources, risks must be communicated and can be framed in different ways, making some risks more salient than others. In this way, we argue that there can be no such thing as risks without framing. The framing literature is thus helpful in connecting the cultural biases identified by cultural theory to both perceptions of particular risks and to perceptions of expert credibility.

Specifically, we propose that the same cultural biases that have been found to inform individual risk perceptions also shape an individual's perception of expertise (Kahan, Jenkins-Smith & Braman, 2011). Information sources that frame risks in a manner that threatens a given orientation will be perceived as less credible among individuals who are predisposed to that particular worldview. In contrast to previous studies (Kahan, Jenkins-Smith & Braman, 2011),

however, we further propose that the role of worldviews and expert framing is itself mediated by an individual's prior understanding of issues, derived from dominant frames propagated by the media as well as from an individual's experience, familiarity and personal observation.

To take a concrete example, the United Nations' Intergovernmental Panel on Climate Change (IPCC) argues that the earth's temperature is increasing, and that such developments are driven predominantly by human activity (IPCC, 2013). The IPCC further argues that risks loom large if nothing is done to reduce the pace of climate change. This prominent risk assessment has been built into a debate frame in which policy proposals to curb planet-warming emissions are pitted against arguments emphasizing the costs of mitigation and its impact on short-term economic growth (Stern 2007; Lachapelle, Borick & Rabe, 2012). An individualist may thus feel threatened by the IPCC's conclusions, as the latter may logically imply policies to rein in emissions through constraints on unfettered economic production, which challenges individualist values of freedom, industriousness and autonomy. We might therefore expect individualists to discount the credibility of those scientists claiming that anthropocentric climate change poses a high risk for human kind and the planet. In contrast, hierarchs may be less likely than individualists to discount the credibility of the IPCC's assessment. Indeed, the IPCC is an example of a highly stratified information bureaucracy – it is ordered, regulated by rules, and based on meritocratic membership – which fits neatly into the hierarch's view that society works best when authority is institutionalized and when decisions are made by authoritative experts with the best knowledge of a given problem. For their part, egalitarians might not so easily accept the authority of an institution such as the IPCC. Rather, we might expect egalitarians to claim that experiential knowledge, of local indigenous communities for example, is just as valid as that of trained scientists working in such reputed institutions as the IPCC. Nonetheless, in the

case of climate change, egalitarians are likely to accept the IPCC's risk assessment, and support policies to curb emissions, since such a frame does not directly threaten egalitarian social relations, and in fact, supports the polluter-pays principle (fairness) as well as that of inter-generational equity (Jones, 2011). Given the dominant media frames around climate change, egalitarians are likely to find the risk assessment produced by the IPCC as providing support for their preferred way of organizing social and political life and in line with their values, predispositions and prior understandings of the issue.

We generalize these conjectures and identify three broad hypotheses. Each of our hypotheses invokes specific worldviews, which may be challenged by a particular expert's framing of risk. Specifically, we hypothesize the following:

H1: The more individualist a respondent's worldview, the less likely they are to perceive as credible an expert making a risk assessment framed in a way that implies a threat to free choice and economic growth.

H2: The more egalitarian a respondent's worldview, the less likely they are to perceive as credible an expert making a risk assessment framed in a way that implies a threat to equality and fairness.

H3: The more hierarchical a respondent's worldview, the more likely they are to exhibit deference to authority, and thus perceive as credible an expert making a risk assessment however it might be framed.

The idea of an interaction between worldviews and expert frames makes it possible that the same orientation encourages different assessments of expert credibility from one policy issue to another. Thus far, work in the cultural theory tradition has found that individualists systematically distrust experts who claim that risks are high while egalitarians systematically distrust experts who claim that risks are low, regardless of the policy issue at stake (Kahan, Jenkins-Smith & Braman, 2011). When expert framing of risk is taken more seriously, and

when different issues are examined, however, it is conceivable that on particular policy issues, experts who argue that risks are low will enjoy a comparable level of credibility among egalitarians and individualists. That is to say, experts may frame issues in such as way that is less likely to directly challenge individualist and egalitarian worldviews. The present study examines this possibility by expanding the range of issues examined, as well as the types of frames used to describe the potential risks involved.

A survey experiment to test the power of framing and worldviews

In order to test the hypothesis that risk frames interact with worldviews to influence perceptions of expert credibility, we analyzed data collected from an online survey experiment conducted on 1507 adult residents in the province of Quebec.[4] The survey was comprised of two major components. First, it measured the political and social values of respondents by employing items developed by scholars of cultural theory (Jones, 2011; Kahan et al., 2007). In the second experimental component adapted from Kahan, Jenkins-Smith and Braman (2011), respondents were asked to read a short text written by a fictitious scientific expert. The author's photo, portraying a middle-aged white man was presented in the same vignette, as were the author's scientific credentials. While holding the author profile constant, each subject was randomly assigned one of two possible risk frames, the experimental treatment. The instrument then asked subjects to indicate on a 6-point rating scale whether they perceived the author as being a knowledgeable and credible expert. Specifically, subjects were asked to indicate the extent to which they agreed with the following statement: "This individual is a knowledgeable and trustworthy expert." An example of an author profile and the treatment provided in the vignette is illustrated in Figure 1.

[Insert Figure 1 about here]

Employing a between-subjects experimental design, we randomized the exposure to high and low risk assessments, with half of the sample assigned to the "low risk" frame, while the other fifty percent was exposed to the same expert framing the issue in question as posing a "high risk." Balance tests were conducted to verify the randomization procedure, ensuring that observed differences in perceptions of expert credibility are in fact due to randomly assigned treatments as opposed to differences in group composition.[5] In total, subjects were presented with experts on four issues – climate change, shale gas extraction using "fracking" techniques,[6] use of cell phones, and wind turbines – and exposed to only one of the high or low risk frames that were randomly assigned for each. The order in which issues were presented was also randomized, to avoid any bias or learning effects as subjects worked their way through the instrument.

To bolster the plausibility of the experiment, we used only "frames with facts" (Druckman & Bolsen 2011). We thus conform to the expectation that most scientists "stick with the facts" and refuse to draw the political implications of their findings. Sticking with the facts in this context means that the experts within our experiment commented primarily on whether risks associated with a given issue are either high or low. Had we made an expert say that the gas industry should stop drilling from shale gas, for example, the external validity of our experiment may have been compromised. The test of whether risk frames are always interpreted differently by individualists who view nature as resilient and egalitarians who think nature is fragile was ascertained through issue variation.

To this end, we constructed low and high risk assessments of climate change, fracking for shale gas and cell phone use in a manner that neatly echoes the media framing of these issues in Quebec at the time the survey was conducted. As in the example of climate change presented

above, the high-risk framing of each of these issues was built on actual arguments pointing at the harmful effects of human activities. Likewise, the low-risk framing by the fictitious expert easily fits into actual arguments concerning the safety of these same activities. A content analysis of the press coverage of these issues in the two-months preceding the administration of our survey confirms the external validity of our expert frames. Of the 100 articles appearing in three primary Quebec newspapers (*La Presse, Le Devoir,* and *The Gazette*) during this period, the issue of shale gas was most prominently covered, with 40 per cent of all articles dedicated to this issue. Crucially, media coverage of shale gas tended to emphasize the risks associated with hydraulic fracking, and our expert framing (Figure 1) draws on many of the same themes presented by the media during this period. With only 4 newspaper articles, the risks of cell phones were least covered. Nevertheless, in a manner similar to the shale gas issue, the risk frames we manipulate closely echo arguments found in the media, suggesting that heavy cell phone use may cause brain cancer for users of this technology. Similarly, the 37 articles on climate change presented arguments consistent with the debate framing discussed in the previous section, and like shale gas, coverage tended to favor a high risk discourse, although journalists sought to provide balanced coverage (Boykoff & Boykoff 2004).

We further produced a treatment for wind energy that is largely inconsistent with the dominant discourse on renewable energy in Quebec. Wind turbines were the main subject of 19 of the articles included in our content analysis. In all cases, the issue was framed as environmental, centering on the debate between proponents arguing that wind energy can alleviate some of the environmental problems caused by the burning of fossil fuels, and opponents suggesting that the production of wind energy is too costly. Importantly, environmental and health risks were absent from the media coverage of wind energy, reflecting

very high levels of support for the development of renewable energy in the province (Léger, 2012). Wind energy is likely to garner greater support among egalitarians who see in this technology an activity that can ease poverty in some rural areas in the province. Moreover, anyone who believes that nature is fragile is likely to prefer wind power to the main alternative, which involves greater human intervention in nature (e.g. by building hydro power plants or burning fossil fuels). Therefore, an expert framing the issue of wind turbines as high-risk would likely create some dissonance among egalitarians. To create such a condition, without sacrificing plausibility, the expert in the high-risk treatment invoked a little known health risk, called the wind-turbine syndrome (Pierpont, 2009), which did not receive media coverage in the two months prior to the survey. The risks in this case apply to individuals living near wind farms and involve migraines and nausea.

Do egalitarians trust such an expert (that is, an expert associated with a plausible high-risk frame on wind turbines), as much as they trust experts invoking high-risk frames on the other issues? In the affirmative, our experiment would confirm the primary importance of worldviews, which predispose egalitarians to be more willing to accept high risk frames independently of the content of those frames. In the negative, our experiment would lend support for our interactive hypothesis, which predicts a more favorable assessment among egalitarians of experts espousing the low risk frame, given the congruence between wind power and such egalitarian values as local community development and decreased emissions.

In sum, subjects were randomly assigned to high or low risk frames on four issues, and asked to rate the credibility of experts assessing risks related to weather disturbances from climate change, water contamination from shale gas fracking, risks of cancer for cell phone users, and nausea and migraines for people living near wind turbines. If individuals discount the

credibility of experts associated with frames that clash with their cultural worldviews, following the logic of H1 to H3, individualists, hierarchs and egalitarians should have distinct appreciations of the climate change, shale gas and cell phone experts. If these patterns fail to hold on the issue of wind turbines, we will have identified some limit to the role of expert framing and political worldviews in shaping opinion, which may be constrained by dominant media frames and one's pre-existing understanding of issues.

Non-experimental survey measures

Subjects were also asked a series of questions designed to measure the extent to which their deeply held value commitments map onto particular worldviews. Specifically, we asked subjects to identify the extent to which they agree or disagree with a series of measures employed in Kahan, Jenkinns-Smith and Braman (2011) and included in Appendix 1. However, rather than treat the twelve items as measures of hybrid cultural types (c.f. Kahan, Jenkins-Smith, & Braman, 2011), we conceptualize the items as measuring three distinct worldviews. This was done due to relatively unsatisfactory reliability scores with these scales ($\alpha = 0.56$ for individualist-communitarian and $\alpha = 0.67$ for hierarchy-egalitarian, respectively).[7] Results from our exploratory factor analysis further suggest that the cultural cleavages in Quebec are not reducible to two continuums, and may reflect the presence of other cross-cutting cleavages in the province. To some extent, this is not surprising, as Quebec's history and language make it culturally distinct even from the rest of Canada. Moreover, Quebec's multi-party system reflects the fact that the debates driving its politics cannot be easily reduced to two dimensions. Although more work is required in this area, which we intend to do in further research, we were relatively successful in our application of cultural theory to the province.

We thus generated additive indices for three political worldviews. As shown in Appendix 1, while individualists and hierarchs are measured by three questions respectively, egalitarians are measured by two, with all scores standardized along a 1-6 scale. We judge this selection of items appropriate for conceptual and empirical reasons. Conceptually, we believe the questions capture the essence of three – as opposed to two – cultural orientations for social and political organization. Hence, hierarchy items measure the importance of social order, individualist items probe the importance of freedom/autonomy, and egalitarian items indicate the importance of fairness/equality for members of the public. In our view, this operationalization improves the validity of these cultural theory measures. Empirically, the three indices also produce more reliable results ($\alpha = 0.71$ for individualists, $\alpha = 0.63$ for hierarchs and $\alpha = 0.8$ for egalitarians). We thus follow more traditional conceptualizations of cultural theory, using separate items to measure distinct worldviews (Dake, 1992; Jones, 2011; Ripberger, Jenkins-Smith, & Herron 2011).

In addition, we include a series of controls for certain demographics commonly analyzed in studies of mass public opinion, including age, gender, education, and income, using standard measures. Other controls include ideology, proximity to wind farms, cell phone use, levels of scientific knowledge, and perceptions of aggregate scientific opinion. For ideology, we use a self-placement scale with values ranging from left, center-left, center, center-right to right. Included in the model is a dummy for left, comprised of left and center-left. The ideology control is particularly important, as one of the claims of cultural theory scholars is that they provide a superior measure of political cleavages relative to a uni-dimensional measure of left and right (Wildavsky & Dake, 1990).

Another important control is an individual's perception of aggregate scientific opinion. We asked subjects to indicate whether they think most scientists agree, most scientists disagree, or whether most scientists are divided on, for instance, the statement that human activities are causing global warming. We expect this variable (coded 1 for most scientists agree and 0 for all others) to be positively correlated with an individual's assessment of expert credibility when exposed to the high-risk treatment. It is logical that perceptions of received scientific opinion on an issue will influence one's perception of expert credibility. For instance, independent of one's cultural orientation, if one perceives most scientists as agreeing that average global temperatures are increasing, and that such increases are due to human activity, they may be less inclined to trust an expert suggesting that the impacts of climate change have been exaggerated.

The scientific knowledge of the subject might also influence the perception of expert credibility. Therefore, we included a control assessing scientific knowledge with a 5-point self-placement scale ranging from very low knowledge of science (=1) to very high knowledge of science (=5). Lastly, we included controls for geographic proximity to wind turbines and cell phone use in estimations relevant to these issues. Proximity to wind turbine was measured with a question asking individuals to state whether they live near a wind farm ('yes' = 1; 'no' = 0). Control for cell phone use relies on a question asking whether subjects are frequent (scored as 1) or infrequent (scored as 0) users of cellular telephones. To our knowledge, we are the first to employ such controls in our models on perceptions of expert credibility.

Results

To test our hypotheses, we first examine a series of comparative bar charts before running ordered logistic regressions on each of the four expert risk assessments discussed above. We include measures for each of the three worldviews in the regressions, so that a single

respondent may theoretically obtain a high score on the egalitarian scale while, for example, scoring relatively high on the hierarchical scale as well. This specification permits variation in the strength of different cultural biases across each subject, allowing us to analyze the impact of individual dispositions toward a particular worldview while holding attitudes toward other cultural orientations constant. The average score for subjects in our Quebec sample is 4.46 for egalitarianism, 3.93 for individualism, and 3.71 for hierarchy. If we simplify and identify each subject with the worldview on which she scores highest, and discard ties as we do in Figure 2, we find that 58% of the sample is egalitarian, 28% individualist and 14% hierarchical.

As illustrated in Figure 2, the extent to which subjects perceive a particular expert as being credible varies across the high and low risk expert framing, cultural orientations, as well as by issue. To facilitate visualization of differences, the horizontal line is set at the score associated with egalitarian subjects exposed to a low risk treatment. For climate change, shale gas and cell phones, the bar for individualists is systematically above the horizontal line. In other words, egalitarians systematically discount the credibility of the low risk experts. This is consistent with H1 and H2. Results for hierarchs raise questions about H3. In fact, differences in the appreciation of the low-risk and high-risk experts among hierarchs should not have been as pronounced as for individualists and egalitarians. Figure 2 indicates that the differences are in fact comparable. Interestingly, the high-risk framing of climate change, shale gas and cell phones is systematically perceived as being more credible than when experts frame the issue as low-risk, irrespective of subjects' particular worldview. This latter result is different from what Kahan et al. 2011 find in the U.S., where the main effect of the high risk treatment actually decreases the likelihood of American subjects perceiving experts as credible on the issues of climate change and gun control. In contrast, we find a relatively robust pattern of 'negativity

bias' in which negative information tends to be more trusted relative to positive messages (White et al. 2003). This pattern observed in Quebec reflects the particular inclination, of the province's media to print negative stories that appear to find a welcoming public across different cultural types. This speaks to the important role of dominant media frames, which help shape prior attitudes toward issues, and thus moderate the effects of expert framing on perceptions of their credibility.

The conditioning role of prior attitudes on framing is particularly apparent on the issue of wind turbines. Here, the difference between the high and low expert framings of risk are much smaller than on the previous three issues. Moreover, the low-risk expert enjoys similar level of credibility across cultural orientations, although individualists' trust in the high-risk expert seems lower than that of hierarchs and egalitarians. Thus, differences in framing and differences in political worldviews do not yield different appraisals of the credibility of experts on wind turbines. These results suggest that opinions on technical issues may in some cases be relatively resistant to elite influence, even when their framings match the myths of nature commonly thought to be associated with different worldviews. We revisit this issue in the next section.

[Insert Figure 2 about here]

In order to further test the roles of framing and worldview in structuring perceptions of expert credibility, we push the analysis to consider more variables, and run a series of ordered logistic regressions. Appendix 2 reports odds ratios for all variables included in the regressions. In each case, the dependent variable is the subject's perception of an expert's credibility measured on a 1-6 scale. We simplify examination of our interactive hypotheses by providing separate regressions for each of the treatment groups across all issues, allowing for a quick

review of main effects and possible interactions between all predictor variables and the experimental treatment. Consistency with hypotheses H1 to H3 requires coefficients above 1 for egalitarians exposed to high-risk frames (except on the issue of wind farms), and coefficients below 1, indicating a negative relationship, for individualists under the same treatment. Coefficients for hierarchy should always be above 1, indicating their deference to scientific authority. Control variables are discussed below.

Building on the regression presented in Appendix 2, and following recent calls to produce more meaningful and interpretable statistical results (Kastellec & Leoni 2007), we simulate predicted margins of expert perceptions across each worldview. While the regression results indicate whether or not a coefficient's impact is significant, odds ratios do not allow for substantive interpretation of results across the entire range of values on a variable. In contrast, the predicted margins provide an estimate of perceptions of expert credibility along each incremental increase in our measures of cultural bias, holding all other variables in the model constant. Thus, by graphing the strength of predisposition toward a particular worldview, the margins enable a more precise estimate of how these orientations may bias perceptions of expert credibility, and allow for the possibility of significant and non-significant results at high and low values of variables measuring cultural orientation. Consistent with our hypotheses, these figures provide some evidence of an interaction between political worldview and expert framing in the assessment of expert credibility.

[Insert Figures 3 to 5 about here]

On climate change, shale gas and cell phone use, individuals with increasingly higher dispositions to an egalitarian worldview discount the credibility of experts associated with low risk frames, and assign greater credibility to the high risk expert. For instance, on climate

change, the probability of perceiving a low-risk expert as credible drops significantly (over 30 percent) moving from low to high on the egalitarian scale. Although the magnitude of the drop is not as important on shale gas and cell phone, the propensity of individuals with higher egalitarian predispositions to discount low risk experts is nevertheless important. Inversely, and consistent with expectations, people with individualist orientations discount the credibility of high-risk experts on all three issues, though not by as much. Overall, our interactive hypotheses H1 to H2 are thus supported by these results and are consistent with previous research on cultural theory and climate change (Jones, 2011).

We also hypothesized that hierarchs trust experts with scientific credentials, independently of their association with high or low-risk frames. We thus expected insignificant differences between the high and low risk treatments at higher values of hierarchical predispositions. On the three issues, however, the results for hierarchs parallel those for egalitarians, although the slopes are not quite as steep. Moreover, as is the case for egalitarians and individualists on climate change, shale gas and cell phones, experts who frame issues as high risk are systematically perceived by hierarchs as being more credible. As was the case in our interpretation of Figure 2, we interpret this as a limit to cultural orientation and framing effects on perceptions imposed by prior attitudes on issues.

This latter observation brings us to the issue of wind turbines (Figure 6). Our construction of this issue was intended to explore the potential limits of expert-framing and cultural orientations in explaining perceptions of expert credibility. Specifically, we consider differences between the patterns displayed in Figure 6, on the one hand, and those illustrated in Figures 3, 4 and 5 on the other. As should be clear from Figure 6, relatively large and overlapping confidence intervals highlight statistically insignificant differences between the two

treatment groups across all categories of cultural bias. In other words, egalitarians are not systematically predisposed to trust experts framing issues as high-risk. Nor are individualists predisposed to low risk frames, as some cultural theories relying on myths of nature might suggest (e.g. Dake, 1992; Wildavsky & Dake, 1990). Rather, these findings indicate that the relationship between risk frames, worldviews and perceptions of expert credibility may actually depend on the extent to which expert framings are consistent with dominant frames found in public discourse. When experts frame an issue in a way that challenges dominant media frames, as is the case with our wind turbines experiment, the public's perception of source credibility may be low and statistically indistinguishable, irrespective of the risk frame and cultural bias introduced by their worldview. By shaping prior attitudes and popular understanding of issues, dominant media frames may thus play an important role in conditioning the effects of framing and political worldviews on perceptions of expert credibility.

[Insert Figure 6 about here]

Results for controls

Proponents of cultural theory claim that it provides a superior measure of political cleavages than the left-right dichotomy traditionally used in studies of mass opinion. As indicated in the regression table in Appendix 2, self-placement on the left is a relatively weak predictor of perceptions of expert credibility. Subjects who identify with the left are significantly different from others only in their positive assessment of the credibility of the shale gas expert who warns against the risks associated with fracking. In contrast, egalitarians are more likely to assign higher levels of credibility to high-risk experts on all issues, except wind turbines. Like the left ideology variable, however, other cultural orientations are comparatively poor predictors relative to the egalitarian measure.

In addition to egalitarian dispositions, pre-existing scientific knowledge also appears to matter. For instance, subjects with a high degree of self-reported scientific knowledge are significantly less trusting of experts who make the claim that climate change and shale gas fracking pose a low risk. This result is not surprising for climate change, given the near scientific consensus on the well-established links between GHG emissions and climate (IPCC, 2007). The result is more surprising for shale gas, on which 48 percent of the subjects believe that scientists are divided (in comparison with 19 percent on climate change). In fact, the perception of division among experts is relatively high on all issues but climate change (51 percent on cell phones and 43 percent on wind turbines). Nevertheless, subjects who believe that most scientists agree on the risks of climate change, shale gas and cell phones tend to discount experts under the low risk treatment, as might be expected. Perception of consensus on risks related to wind turbines does not seem to matter, however. In other words, our construction of the wind energy issue again appears to have created dissonance among subjects who are unfamiliar with the public health framing of wind power, providing additional evidence that dominant media frames matter.

Lastly, proximity to the technology tends to diminish the credibility of experts with high-risk opinions, as both heavy cell phone users and those living in close proximity to a wind farm appear to discount expert credibility under the high-risk treatment. For instance, the more subjects use a cell phone, the more likely they are to view low-risk experts as credible and high-risk experts as lacking credibility. This suggests that experiential evidence structures the way in which new information is received as well as interpreted to form opinions on the credibility of an information source. To our knowledge, we are among the first to test this possibility.

Conclusion

In complex policy domains, scientific knowledge is important for the development of policy preferences and in the making of public policy. In this context, who individuals trust for expertise plays a crucial role in the overall opinion formation process. Looking specifically at perceptions of expert credibility, we find that political worldviews and experts' framing of issues interact to shape public perceptions of expertise on a range of policy issues. For instance, we find that experts who frame a technical issue as posing a low-risk tend to be discredited among members of the public that are predisposed to an egalitarian worldview. Thus, individuals do not automatically assign credibility on the basis of source's credentials alone; rather, they judge the credibility of experts from their discourse and from the perspective of their cultural bias. In this sense, people are not just cue takers. They are also message evaluators. An expert whose message challenges the worldview of an individual will not enjoy the same level of credibility as another whose message comforts those same predispositions. In other words, framing matters in perceptions of expert credibility.

The results presented in this article, however, call for two caveats to this general argument. First, high-risk frames are more likely to be perceived by the public as credible than are low-risk frames for most issues, independent of one's cultural orientation. This caveat speaks to the limitations of cultural biases in predicting perceptions of expert credibility. Although expert frames are interpreted in light of one's underlying worldview, this effect can at times be trumped by prior attitudes, as in the case of wind turbines, for instance. Moreover, the role of cultural biases in shaping perceptions of expert credibility is particularly pronounced for those predisposed to an egalitarian worldview. For instance, unlike what we suggested in H3, for some issues, expert framing matters for hierarchs in a way similar to egalitarians, but with a smaller effect. In the areas of climate change and cell phones, high risk frames comfort, and

low-risk frames challenge, egalitarianism (and perhaps hierarchy) more than they do individualism. These observations call into question the automatic association between cultural orientations and specific risk perceptions and underline the importance of issue framing. If individualists do not react as much as egalitarians to risk frames, it may be that these frames do not challenge or comfort their predispositions as much as they do for other worldviews. More research is needed to better understand the relationship between different risk frames and particular worldviews, as well as in refining measures of cultural bias in different political-cultural contexts.

Second, individuals assign higher levels of credibility to experts when expert framings are consonant with dominant media frames. Where the media have not accustomed individuals to think about a technical issue in terms of a particular set of risks (as in the case of our "Wind Turbine Syndrome" experiment), high or low-risk expert framings fail to influence perceptions of expert credibility. This result speaks to the limitation of expert framing. The limited evidence provided by the case of wind turbines suggest that when expert assessments compete with dominant frames popularized by the media, the influence of the former may be muted.

This latter issue is important in light of the suggestion that experts dominate public attitudes toward policy issues. The results presented here suggest that an individual's receptivity to a particular expert framing depends on their underlying worldview, but also on other factors, like media framing and contact with technologies, that inform their understanding of issues. Therefore, public opinion might not be dominated by experts to the extent suggested by earlier studies of mass policy preferences (Zaller, 1992). At the same time, cultural orientations may provide only one type of mechanism through which expert cues are interpreted. This paper points to additional cues people use when forming opinions. There may of course be more.

Given the importance of framing, value predispositions and public attitudes for new technology and policy, future work should explore these interactions further.

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Figures and Appendices

Figure 1: Example of a Scientific Profile with Low and High Risk Treatments

Scientific Profile

Louis Atkinson
Title: Professor of Geology, University of Colorado
Education: Ph.D. from Princeton University
Member:

- American Association of Geologists
- National Academy of Sciences

Low Risk Treatment

"Shale gas extraction poses no risk to the environment and drinking water. To release the gas from the shale, water mixed with sand and chemical additives (less than 1%) is injected at high pressure into the ground at depths of several hundred metres below the water tables. There are safe methods to retrieve and treat the water from hydraulic fracturing. The water and gas come to the surface through high strength steel tubing, cased in cement throughout the freshwater aquifer zone until the surface. This is a proven method and recognized for lowering the risks of groundwater contamination to nearly zero. In other words, existing technologies allow for the safe extraction of shale gas."

High Risk Treatment

"Shale gas extraction poses significant risks to the environment and drinking water. Shale gas is a form of natural gas that is particularly difficult to extract. To release the gas from the shale, water mixed with sand and chemical solvents are injected at high pressure into the ground below the water tables. These chemicals and gas bubbles risk contaminating the water, as well as the land near the well. In fact, treatment of contaminated water has provided questionable results. Moreover, leaks of methane and hydrogen sulphide, a toxic gas potentially harmful to human health, have been observed in many existing wells. In other words, the extraction of shale gas is still too risky."

Figure 2: Assessment of Expert Credibility

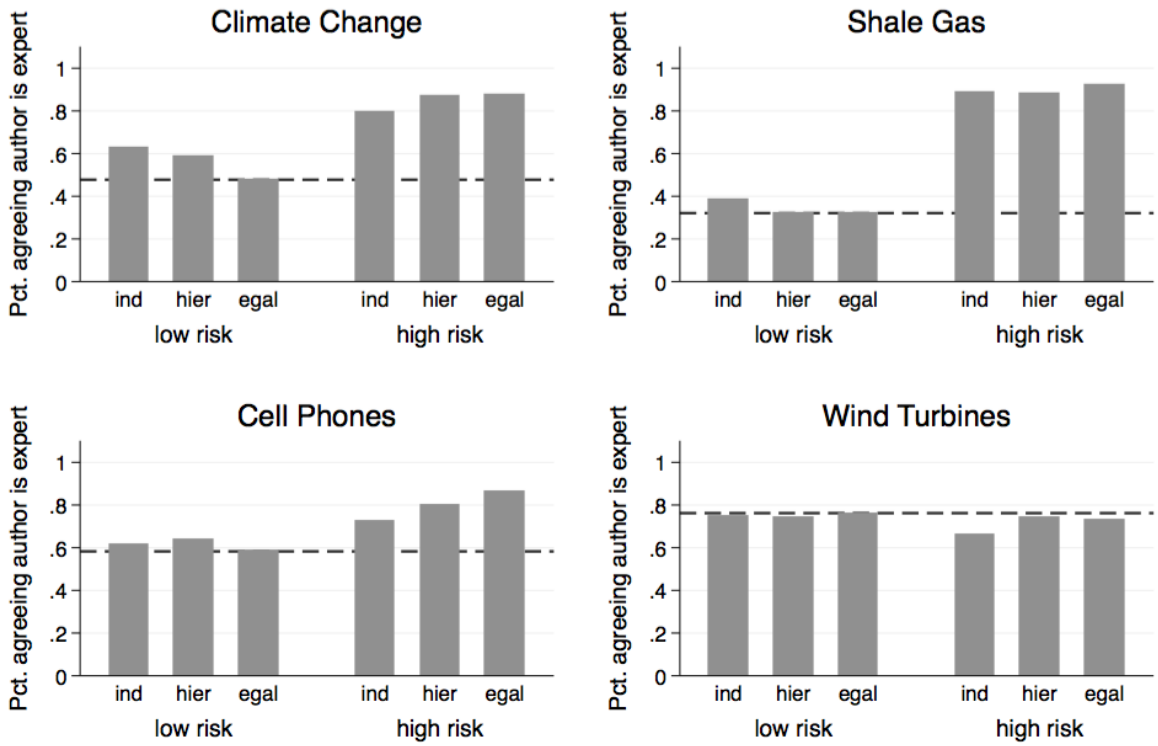


Figure 3: Predicted Margins for Climate Change

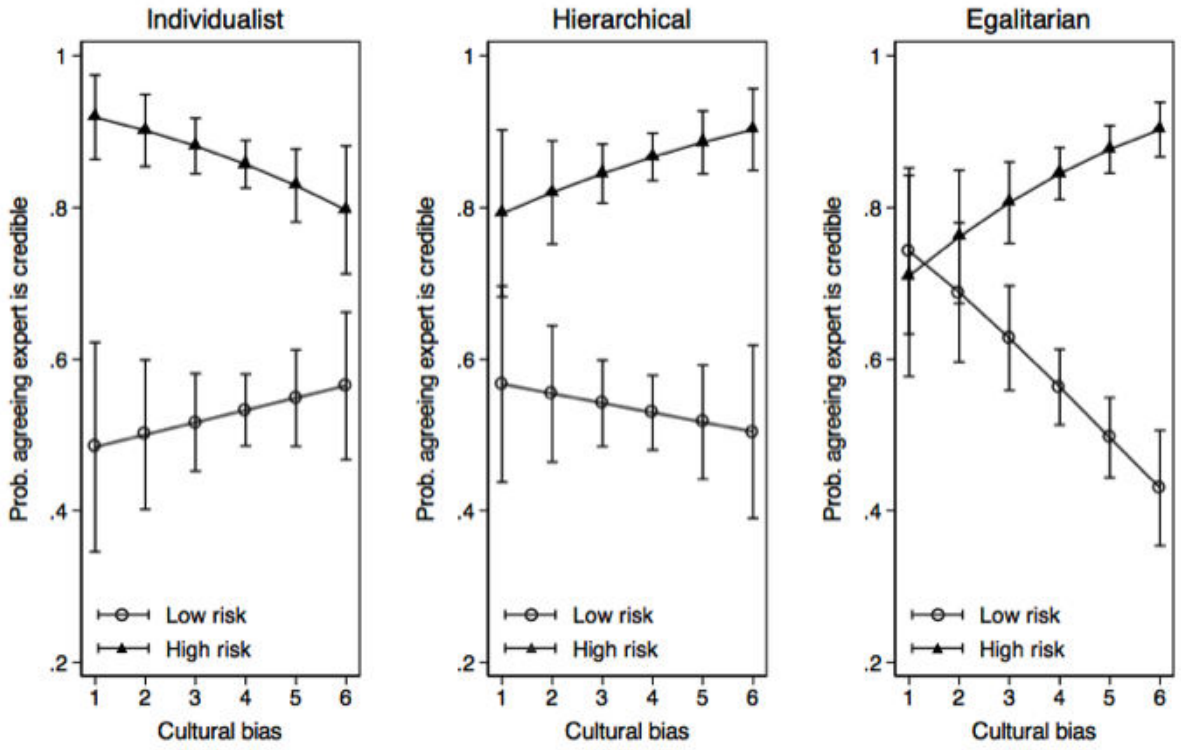


Figure 4: Predicted Margins for Cell Phone Use

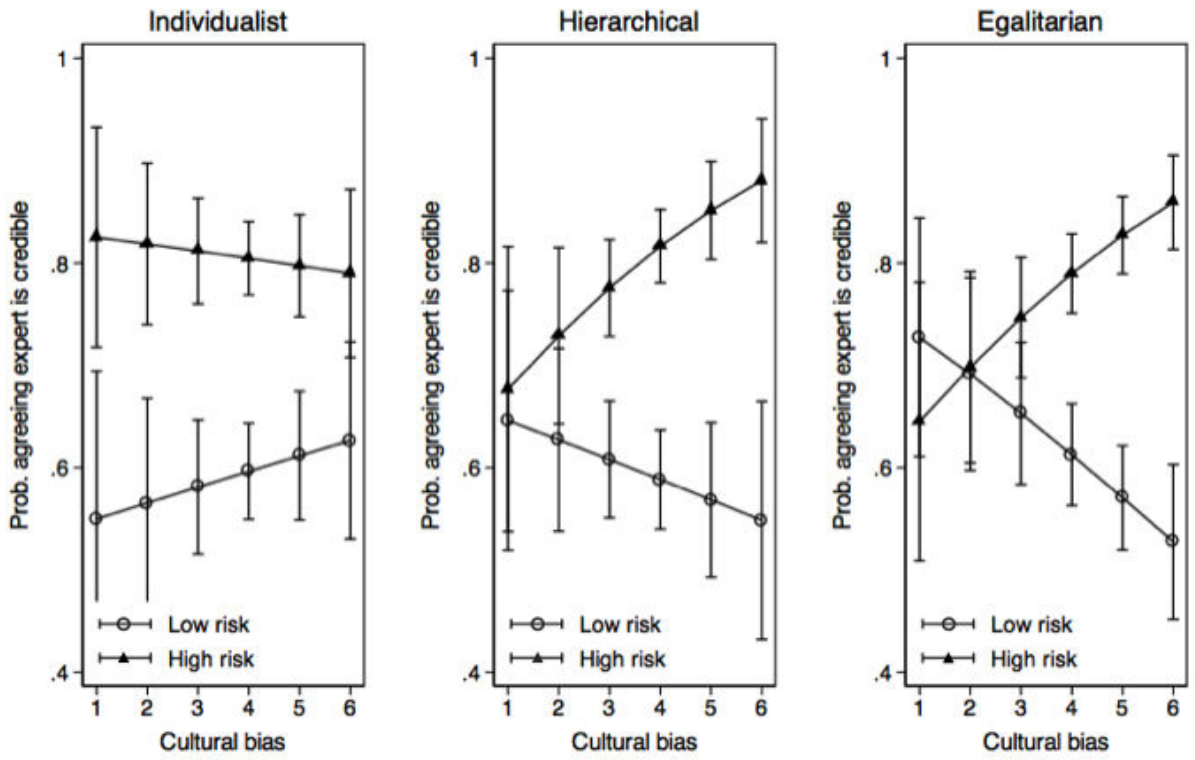


Figure 5: Predicted Margins for Shale Gas

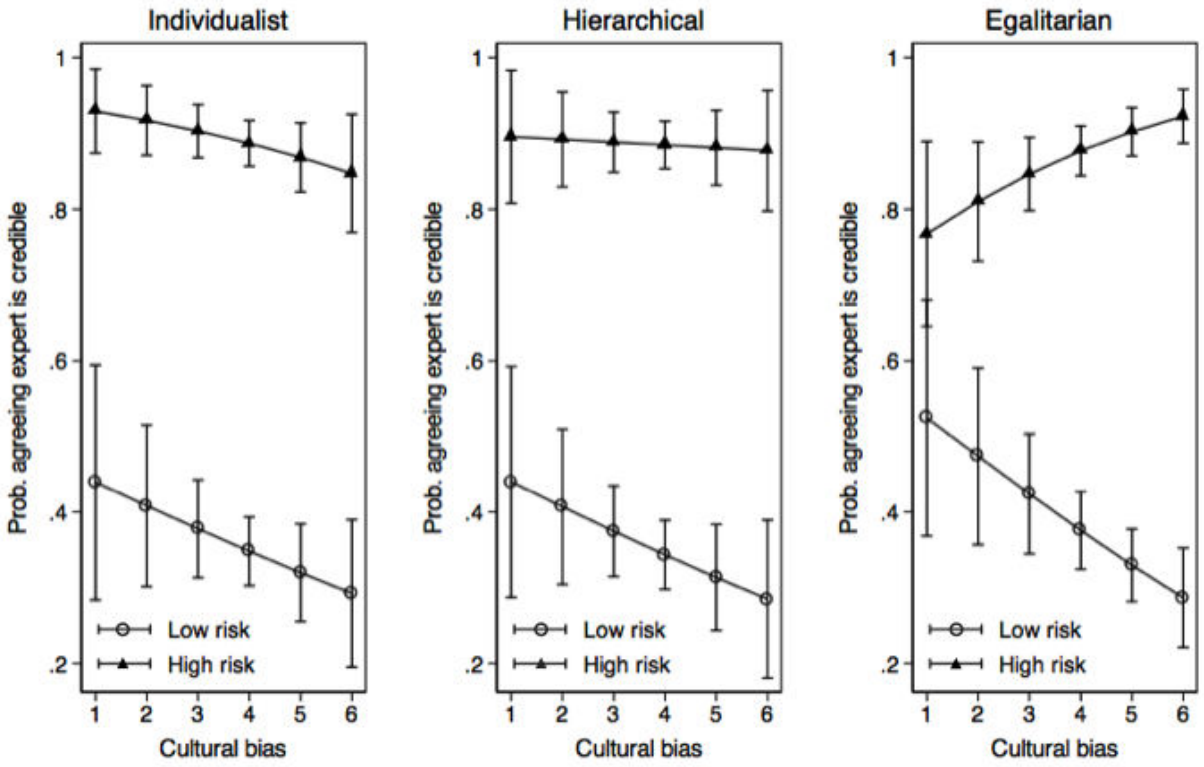
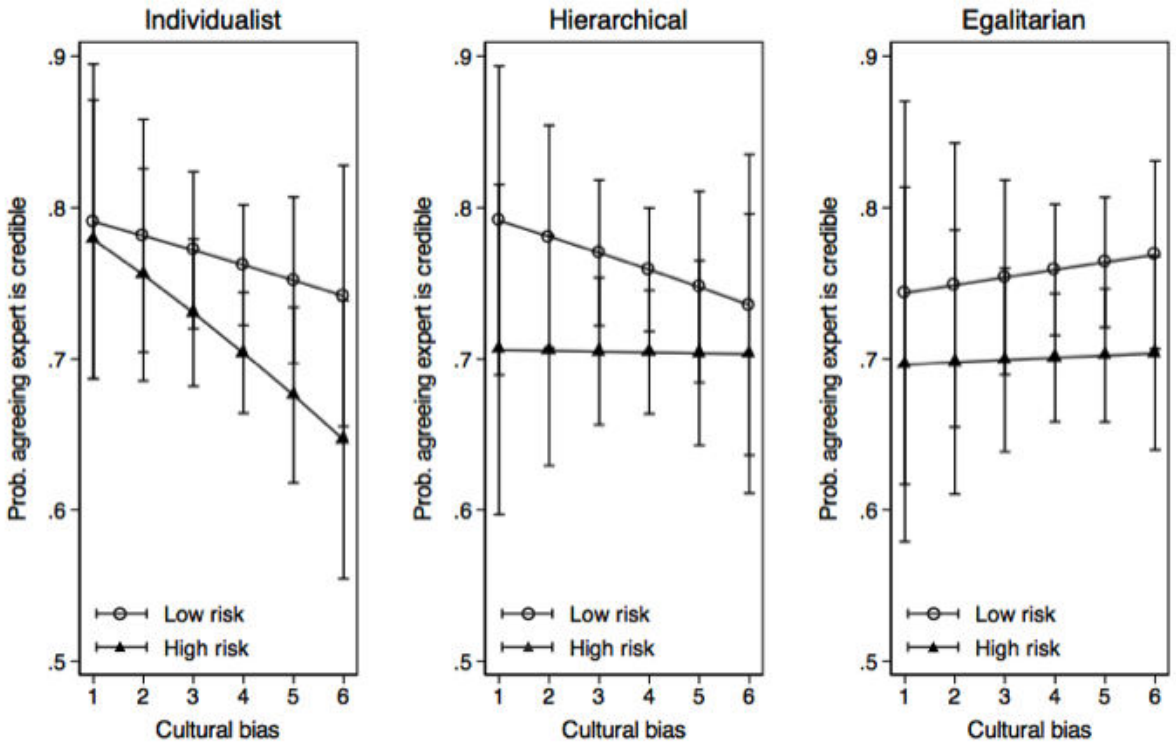


Figure 6: Predicted Margins for Wind Turbines



Appendix 1: Measuring cultural worldviews

Hierarchs

Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.

The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.

Sometimes government needs to make laws that keep people from hurting themselves.

Individualists

It's not the government's business to try to protect people from themselves.

The government should stop telling people how to live their lives.

The government interferes far too much in our everyday lives**.**

Egalitarians

We need to dramatically reduce inequalities between the rich and the poor, as well as between men and women.

Our society would be better off if the distribution of wealth was more equal**.**

Variable coding: strongly agree (4) moderately agree (3) moderately disagree (2) and strongly disagree (1)

Appendix 2: Ordered Logistic Regressions

	Climate Change		Shale Gas		Cell Phones		Wind Turbines	
	Low Risk	High Risk	Low Risk	High Risk	Low Risk	High Risk	Low Risk	High Risk
Bias								
Individualism	1.09 (0.10)	0.92 (0.08)	0.87 (0.09)	1.01 (0.09)	0.89 (0.08)	0.88 (0.07)	1.05 (0.11)	1.01 (0.09)
Hierarchy	1.07 (0.10)	1.05 (0.10)	0.96 (0.09)	0.97 (0.10)	0.95 (0.10)	1.03 (0.09)	0.93 (0.09)	1.15 (0.10)
Egalitarian	0.80 (0.07)**	1.15 (0.09)	0.79 (0.06)**	1.29 (0.11)**	0.99 (0.08)	1.09 (0.07)	0.88 (0.07)	1.26 (0.10)**
Socio-dem. Controls								
Sex	1.07 (0.19)	0.97 (0.18)	0.88 (0.17)	0.69 (0.14)	1.40 (0.25)	0.57 (0.10)***	1.05 (0.19)	1.12 (0.21)
Age	0.99 (0.01)*	1.01 (0.01)*	0.99 (0.01)*	1.02 (0.01)**	1.00 (0.01)	1.00 (0.01)	1.01 (0.01)	0.99 (0.01)
Income	1.02 (0.07)	1.04 (0.07)	0.94 (0.06)	0.98 (0.06)	1.00 (0.07)	1.09 (0.06)	1.04 (0.06)	1.15 (0.07)*
Education	1.09 (0.14)	0.97 (0.09)	1.03 (0.09)	0.97 (0.09)	0.98 (0.09)	1.03 (0.10)	1.09 (0.12)	1.11 (0.11)
Other controls								
Left	0.79 (0.17)	1.33 (0.25)	0.80 (0.16)	1.86 (0.39)**	1.28 (0.25)	0.86 (0.16)	1.28 (0.25)	1.02 (0.20)
Scientific knowledge	0.31 (0.16)*	0.83 (0.41)	0.30 (0.17)*	2.38 (1.38)	0.60 (0.32)	2.77 (1.45)	0.42 (0.23)	2.09 (1.02)
GW Consensus 1	0.51 (0.11)**	1.76 (0.38)**						
GW Consensus 2	0.56 (0.11)**	3.39 (0.63)***						
Shale Gas Consensus			0.60 (0.12)*	1.70 (0.36)*				
Cell Phone Consensus					0.47 (0.09)***	2.78 (0.54)***		
Cell Phone Use					2.60 (0.51)***	0.67 (0.12)*		
Wind Turbine Consensus							1.07 (0.36)	1.58 (0.57)
Proximity to Wind Farm							0.64 (0.31)	0.14 (0.08)**
N	578	591	601	567	560	606	576	593

Note: Odds ratios are reported as coefficients; Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.00$

Endnotes

[1]For our purposes, we treat the terms "value predispositions" "worldview" and "cultural bias" as interchangeable. To avoid excessive repetition, we further refer to "cultural orientations" and "cultural types" to categorize individuals predisposed to a particular cultural worldview as measured in our survey. In a manner consistent with the literature on cultural theory (Thompson, Ellis & Wildavsky, 1990), we only employ the term "way of life" or "political culture" to denote a viable combination of these values, beliefs and worldviews that justify and are justified by a particular pattern of social relations and organization. We sometimes refer to *political* worldviews given the political nature of the beliefs and values that make up one's cultural orientation as described by cultural theory.

[2] To be sure, Kahan et al. 2011 do not specifically refer to framing, but instead to author positions on issues. Whereas they find a majority of subjects to agree that experts are trustworthy and knowledgeable regardless of position, we find that respondents systematically assign higher levels of credibility to experts invoking a high risk frame, regardless of their political worldview, on all issues except wind turbines.

[3] A fourth cultural type, fatalist, is notoriously difficult to measure, and is often excluded from empirical analyses of cultural theory. Where they are included, empirical studies have found the fatalist category to be relatively small (compared to other cultural orientations), and to usually offer insignificant results (c.f. Jones 2011). Given this first attempt at applying cultural theory to the specific cultural context of Quebec, which requires the careful adaptation of existing measures that work well in the U.S., we thought it best to omit fatalism from the present study.

[4] The study was administered by Léger Marketing to its online Web panel, beginning August 15, 2011 and ending August 29, 2011. In total, 1507 adults responded to the survey. Léger Marketing is a leading Canadian public opinion research firm that conducts telephone and online surveys for academic, government and commercial clients.

[5] Specifically, we regress treatment allocation on all predictors in the model and confirm the joint insignificance of all independent variables. We also ran t-tests for independent groups and found no significant differences in means across treatment and control groups for each predictor included in our model.

[6] The term "fracking" is commonly used to describe a method of extracting natural gas from shale deposits found deep below the earth's surface. The method involves injecting water mixed with sand and chemical solvents at high pressure deep below ground to fracture rock sediment, freeing the portion of otherwise trapped natural gas.

[7] As noted by Swedlow (2011a), important differences exist in the way cultural theory is theorized, conceptualized and operationalized across independent studies, though results are largely consistent with the theory's claims. For instance, while some researchers seek to measure each, and test for differences across, the four cultural types identified by CT (e.g. Jones 2011), it is traditional to exclude fatalists (e.g. Ripberger et al. 2011). Others focus items along the two axes to measure "high grid" and "high group" orientations (Chai et al. 2009; 2011), while in other instances, researchers have created hybrids of individualist, hierarchical and egalitarian cultures (e.g. Kahan et al. 2010; Gastil et al. 2011). The relatively weak performance of our individualist and egalitarian indices generated following Kahan et al. (2011) may be a product of this particular way operationalizing cultural theory, or a consequence of the particularities of the Quebec social context. While interesting in their own right, the reasons for the diverging results are beyond the scope of this paper.