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Research Report

The effect of uncertainty communication on public trust depends on belief–evidence consistency

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Abstract

Not everyone perceives the communication of uncertainty about scientific evidence as equally trustworthy. We examine whether these differences in trust can be explained by people's prior beliefs—specifically, the consistency between those beliefs and the evidence presented. We hypothesize that the more consistent the evidence is with people's prior beliefs, the less people will trust both the information and its source when uncertainty is communicated compared with when it is not communicated. Conversely, the less consistent the evidence is with people's prior beliefs, the more people will trust the information and its source when uncertainty is communicated. We tested this crossover interaction in two preregistered online experiments on COVID-19 vaccines (study 1: $n = 600$) and changes in extreme weather events (study 2: $n = 1{,}001$). In both studies, participants rated their prior beliefs on these topics before being randomly assigned to read one of two contrasting evidence conditions, with uncertainty either communicated or not in each condition. The belief–evidence consistency was operationalized by linking people's prior belief scores to the contrasting evidence conditions. We found evidence for our hypothesis for both topics and across people with opposing beliefs. Our results show that people's trust response to the communication of uncertainty depends on how consistent people's beliefs are with the evidence communicated. Furthermore, the effects of uncertainty communication on trust appeared to be independent from its effects on people's subsequent beliefs, with no evidence of polarization in either trust or belief. Implications are discussed.

Keywords: uncertainty, science communication, trust, belief, consistency

Significance Statement

The study advances the field by examining not only whether uncertainty communication increases or decreases trust in scientific information and its sources, but also under what conditions it does so: high consistency between people's prior beliefs and the evidence presented led people to trust less when uncertainty about that evidence was communicated compared with when it was not. Conversely, low belief–evidence consistency led to more trust when uncertainty was communicated than when it was not. This interaction was held for different topics and across people with opposing beliefs. Overall, there was no evidence that uncertainty communication contributed to polarization in trust or belief.

Introduction

People have to decide what information and sources to trust when dealing with science-related issues, such as climate change or vaccines. The increasing complexity and specialization of scientific knowledge and the overwhelming amount of information in the digitized world make it nearly impossible for individuals to evaluate scientific knowledge claims themselves (1). Instead, people have to judge the trustworthiness of information and its sources. One factor that may affect these trust judgments is whether or not the source communicates uncertainty (2).

Uncertainty is inherent to scientific evidence. It can arise from a variety of sources, including inadequacies of measurement, variability within a sampled population, or limited knowledge about underlying processes (3). There are strong ethical, legal, and practical reasons why uncertainties should be communicated (4–7). However, uncertainty information has been strategically exploited by some actors to sow distrust in scientific evidence and reduce support for evidence-based policy interventions in prominent policy debates, such as on climate change or linkages between tobacco and cancer (8, 9). But even in the absence of

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malicious intent, scholars have raised concerns that uncertainty information facilitates motivated reasoning (10) and thus can exacerbate the political polarization over science.

The aim of the present study is to examine how the communication of uncertainty affects people's trust in the information and its source, taking into account their beliefs about the issues communicated. Specifically, the study tests whether uncertainty communication increases or decreases trust compared with no uncertainty communication when the reported evidence is consistent with people's prior beliefs. And conversely, the study examines whether uncertainty communication increases or decreases trust relative to no uncertainty communication when people are skeptical of the reported evidence. Additionally, the study addresses the question of whether people with opposing beliefs respond differently to uncertainty communication. Given potential practical implications, we also explore how uncertainty communication affects people's subsequent beliefs.

So far, research has produced mixed results on how uncertainty communication affects recipients' trust in information and its sources. While some studies find that uncertainty communication increases trust (11, 12), others find that communicating uncertainty reduces trust (2, 13) or has no effect (14, 15). The heterogeneity in these effects may be due in part to studies examining different types of uncertainty (e.g. expert disagreement vs. difficulty in measurement) and/or communicating uncertainty in different ways (e.g. verbally vs. numerically) (2). For example, while presenting uncertainty in terms of quantified error ranges does not seem to affect credibility judgments, introducing uncertainty as a disagreement or conflict in science can lead to a communicating source being perceived as less credible[a] (16, 17). Moreover, people perceive verbal communication of uncertainty as less trustworthy than numerical communication of uncertainty (18). Another explanation for the observed heterogeneity in study results could be individual differences that influence the effects of uncertainty communication on trust.

Findings from qualitative research suggest that not everyone perceives the communication of uncertainty as equally trustworthy (19, 20). For instance, focus groups revealed that uncertainty communication signaled honesty to some participants but incompetence to others (20)—both key determinants of trust (21). Experimental online studies found that the recipient's preference for information about scientific uncertainty moderated source credibility, such that people with a low preference perceived a news article and its source as less credible when uncertainty was communicated compared with when uncertainty was not communicated (22, 23). Conversely, people with a high preference for information about scientific uncertainty perceived the news and the scientific source as more credible when uncertainty was conveyed (22). Another study found that when participants were exposed to conflicting information about mammography screening, scientists were perceived as less credible, but only among people with lower research literacy (24). However, only a few other individual differences have been examined systematically, including ideology and worldview (16), epistemic beliefs (22) and deference to science (16), and no moderating effects were found for these.

It is possible that the effects of uncertainty communication on trust evaluations depend on people's prior beliefs (17). Beliefs are cognitive hypotheses that individuals form through various cognitive processes, ranging from deliberate reasoning to more automatic, heuristic-driven mechanisms (25). These beliefs are held with varying degrees of conviction. Unlike knowledge, beliefs do not necessarily have to align with objective reality (25). Research has accumulated considerable evidence that people tend to process information in a way that is consistent with their beliefs. This phenomenon is expressed by numerous psychological theories, including biased assimilation (26), motivated reasoning (27), and confirmation bias (28, 29). It has been shown to emerge in different forms at all stages of information processing, such as perception, evaluation of information, or the search for new information (30).

In line with belief-consistent information processing, several studies have found that people assign more trustworthiness to both information and sources that align with their own views. For instance, participants judged attitude-challenging sources and news stories as less credible than attitude-consistent sources and news stories (31). Another study found that the perceived credibility of social media posts on health issues depended on how closely these posts aligned with participants' prior beliefs. The more consistent participants' beliefs were with the claim of the post, the more credible the post was perceived (32).

Scholars argue that uncertainty communication facilitates belief-consistent processing of information because it allows for multiple interpretations of the information presented (8, 33, 34). This argument is supported by several studies showing that people evaluate uncertainty information in line with their prior beliefs (10, 35, 36). For instance, people's prior beliefs on climate change and gun policy affected the way they interpreted the underlying distributions of numerical ranges on these issues (35). When people were presented with verbal expressions from the Intergovernmental Panel on Climate Change report that conveyed varying levels of uncertainty underlying projections and conclusions (e.g. *unlikely* or *very likely*), they interpreted these expressions differently. These interpretations were strongly linked to people's ideology and beliefs about climate change (10). Moreover, the exposure to scientific disagreement about vaccines led to higher perceived vaccine efficacy among individuals with prior support for vaccines but lower perceived vaccine efficacy among those with prior opposition to vaccines. In other words, the communication of scientific disagreement, a type of scientific uncertainty, had polarizing effects on beliefs about vaccines (36).

Scholars have argued that these polarizing effects of uncertainty communication may also occur in trust ratings (37). They hypothesized that communicating uncertainty about climate projections may increase trust in the projections among liberals but decrease trust among conservatives and climate skeptics. While the former may intuitively understand that climate projections involve uncertainty, conservatives and climate skeptics may see the uncertainty as a sign of lack of consensus, incompetence, or deliberate misleading, leading to lower trust in the projection. Interestingly, however, their findings revealed the opposite. Republicans, in particular, reported more favorable attitudes toward climate scientists when the Intergovernmental Panel on Climate Change (IPCC)'s climate projections were presented as probabilistic (90% prediction interval) rather than deterministic (mean value) (37). In line with these findings, further research found that communicating probabilistic rather than deterministic climate projections slightly increased trust among skeptics—operationalized as those who did not believe in a rise in global average temperature—but not among believers—operationalized as those who believed in a rise (38).

A similar pattern was found when examining the effects of two communication styles, persuasive vs. balanced, on people's trust in the information and its producer (7): following recommendations on evidence communication (39), balanced messages included uncertainty information along with other message elements, such as information on risks and benefits. Participants who were skeptical or neutral about the topic trusted the balanced messages more than the persuasive ones, while those with more positive views found both messages equally trustworthy (7). However, it is unclear whether these effects would persist if the balanced messages contained only uncertainty information and the other message elements were left out. Furthermore, the study only showed that prior beliefs played a role but could not speak to why this might be the case.

In contrast, other research suggests that the effects of communicating uncertainty on trust in numbers and their sources—relative to not communicating uncertainty—do not depend on people's prior beliefs (2). A series of experiments examined the communication of uncertainty on various topics, including immigration, climate change, and unemployment rates. No interaction was found between the communication of uncertainty and prior beliefs. However, the lack of interaction in these experiments could also be due to the experimental messages themselves being not controversial enough, even though they addressed contentious topics. This explanation is supported by the fact that prior beliefs had mostly small effects on participants' trust in the reported numbers and trust in the source.

Taken together, there is some evidence that uncertainty communication could be perceived as particularly trustworthy by people who are skeptical about the evidence communicated. In the present study, we examine this finding systematically. We suggest that it is not certain beliefs, such as climate change skepticism, that determine whether people find uncertainty communication trustworthy or not but rather the consistency between people's prior beliefs and the evidence communicated. We consider *belief–evidence consistency* as a relational variable. It refers to the degree to which presented evidence aligns with people's prior beliefs. For example, for those who believe that climate change is real, evidence that global temperatures are rising is consistent with their belief, while evidence that global temperatures are stable is not. Depending on the evidence presented and the strength with which people hold their beliefs, new evidence may be more or less consistent with their beliefs. Thus, similar to the Bayesian approach, which characterizes consistency as varying degrees of conditional probability, consistency and inconsistency can be viewed as being on a continuum rather than representing a dichotomy.

We hypothesize that the lower the consistency between what people believe and the evidence presented, the more they will trust the information and its source when the source communicates uncertainty than when the source does not communicate uncertainty. Conversely, the greater the consistency between what people believe and the evidence presented, the less they will trust the information and its source when uncertainty is communicated compared with when it is not.

We derive this hypothesis of a crossover interaction from the idea that the uncertainty information may alter how people *perceive* the consistency between their prior beliefs and the evidence presented, thereby affecting trust. When evidence is consistent with prior beliefs, adding information that questions the certainty of that evidence may reduce how consistent people perceive the evidence to be with their belief. As a result, trust is reduced. On the other hand, when the information presented is inconsistent with people's prior beliefs, questioning that evidence may lead people to perceive higher consistency and consequently trust more.

According to this hypothesis, communicating uncertainty—relative to not communicating uncertainty—should lead to both increases and decreases in trust among people who are at different ends of a belief spectrum, for example, those who believe climate change is occurring and those who do not. The response to uncertainty communication should depend not on the belief, but on how consistent it is with the evidence presented. To test that belief–evidence consistency, rather than the belief itself, drives the interaction effect, we recruit samples with individuals at both ends of the belief spectrum and design our study so that people at both ends experience both low and high belief–evidence consistency. In doing so, our study is—to the best of our knowledge—the first to systematically examine the potential interaction between uncertainty communication and belief–evidence consistency.

We focus on trust as it plays an essential role in shaping people's beliefs on scientific issues (40), is recognized as a critical factor in studies on health behaviors and outcomes (41–43), and has been shown to be associated with people's support for science-related policy measures (44, 45). Following prior work (2, 46), we distinguish two key distinct forms of trust that are highly interrelated (47): people's trust in the information presented (i.e. how accurate, reliable, and trustworthy people perceive the information), and people's trust in the source of this information (i.e. how trustworthy people perceive its source). Although we anticipate similar results for both outcomes based on previous findings (7), we chose to measure them separately as they represent different communication goals.

In addition to the effects on trust, we are also interested in whether communicating uncertainty affects people's subsequent beliefs, and if so, how these effects vary depending on their prior beliefs. One possibility is that people may adjust their beliefs in the direction of the uncertainty information, regardless of their prior beliefs, supporting the *persuasion in parallel* hypothesis (48). This hypothesis states that when people encounter new information (in this case uncertainty), they do not distort it to fit their existing beliefs, but instead incorporate it to a similar extent regardless of their prior beliefs. Alternatively, it is possible that people adjust their beliefs only when the uncertainty information aligns with their prior beliefs, which would support the notion that uncertainty communication can increase polarization (35, 36).

To investigate effects in a real-world relevant context, we selected the issues of COVID-19 vaccines (study 1) and changes in extreme weather events (study 2). In the United States, there is a partisan polarization on both topics (49, 50), which allows us to recruit a sample with polarized beliefs. Unlike previous studies that used categories, such as partisanship or political ideology, as a proxy for prior beliefs, we ask participants directly about their prior beliefs to define our audiences more precisely (see (51) for a compelling argument for using prior beliefs rather than partisanship as a measure).

We examine the communication of verbal uncertainty which we define as making the existence of uncertainty explicit without providing numerical information (18). We chose verbal over numerical uncertainty as research has found that verbal uncertainty tends to have stronger effects on trust ratings than numerical uncertainty (18). In our uncertainty manipulations, we also provide a reason for the uncertainty because explaining uncertainty is considered good practice in evidence communication (39).

Study 1

To test our preregistered hypothesis, we conducted a study with 601 people in the United States in September 2023. Participants first rated their prior belief in the safety of COVID-19 vaccines. They were then randomly assigned to read one of two contrasting evidence statements. The evidence statement either suggested

Table 1. Study 1 and study 2 results of the generalized linear models for trust in the information and trust in the source.

	Study 1		Study 2	
	Trust in information	Trust in source	Trust in information	Trust in source
Uncertainty	−0.03 (−0.18 to 0.11)	0.08 (−0.07 to 0.22)	0.02 (−0.10 to 0.13)	0.12* (0.00 to 0.24)
Belief–evidence consistency	0.58*** (0.47 to 0.68)	0.53*** (0.43 to 0.64)	0.50*** (0.42 to 0.58)	0.46*** (0.38 to 0.55)
Uncertainty ∗ belief–evidence consistency	−0.34*** (−0.48 to −0.19)	−0.26*** (−0.40 to −0.11)	−0.40*** (−0.52 to −0.29)	−0.41*** (−0.52 to −0.29)
n	601	601	1,001	1,001
R^2 adjusted	0.19	0.17	0.13	0.11

Standardized regression coefficients are shown with 95% CI in parenthesis.
*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

a link between vaccination with COVID-19 mRNA vaccines and Bell's palsy, a facial paralysis, or no link. In both evidence conditions (*link* and *no link*), uncertainty was either communicated or not communicated, resulting in four experimental conditions. The exact wording of each condition is shown in Table S1.

Following previous research (32), we operationalized participants' belief–evidence consistency by linking their prior belief scores on vaccine safety to the evidence conditions. We considered the *no link* conditions, which communicated that there was no link between getting vaccinated and Bell's palsy, as consistent with the belief that vaccines are safe. Because higher scores on the prior belief scale indicate that people believe vaccines are safe, we set participants' belief–evidence consistency scores equal to their prior belief scores in these conditions. Conversely, we considered the *link* conditions, which communicated that there was a link between COVID-19 mRNA vaccines and Bell's palsy, as inconsistent with the belief that vaccines are safe. Therefore, in these conditions, we determined the belief–evidence consistency score by reversing participants' belief scores so that participants who believed that vaccines were not safe received high consistency scores. After reading the evidence statement, participants answered questions about how trustworthy they found the information they had just read and its source. These two outcomes—trust in the information and its source—were preregistered as our primary outcomes. Participants also responded to additional questions on covariates—namely, perceived relevance of the topic and subjective understanding—and on secondary outcomes related to trust—namely, perceived competence and sincerity of the source, trust in the communication, willingness to share the information with others, and participants' subsequent belief. The results of these are reported in Tables S4, S5, and S7, Fig. S4, except for participants' subsequent belief and subjective understanding, which are reported below.

Across all experimental conditions, trust in the information ($M = 3.27$, $SD = 1.04$) and its source ($M = 3.31$, $SD = 1.09$) were slightly right skewed, meaning that more people gave higher trust ratings. For both primary outcomes, we fitted generalized linear models using R. To test our hypothesis that the effects of uncertainty on trust depend on belief–evidence consistency, we included uncertainty (communicated vs. not communicated), belief–evidence consistency (continuous), and their interaction as independent variables. The generalized linear models are reported in Table 1.

Belief–evidence consistency predicted both outcomes, such that the more consistent the evidence was with participants' prior belief, the more trustworthy they perceived the information and the information source. As shown in Figs. 1A and B, this relationship between belief–evidence consistency and people's trust was attenuated when uncertainty was communicated. There was a crossover interaction between uncertainty communication and belief–evidence consistency. At high levels of belief–evidence consistency, people trusted the information and its source less when uncertainty was communicated compared with when uncertainty was not communicated. At low levels of belief–evidence consistency, people trusted the information and its source more when uncertainty was communicated than when it was not communicated. Thus, people's trust ratings were less extreme at the ends of the belief–evidence consistency spectrum when uncertainty was communicated than when it was not.

To further examine the interaction, we calculated Johnson–Neyman intervals, which determine the values of belief–evidence consistency at which the effect of communicating uncertainty vs. not communicating uncertainty is significant ($P < 0.05$), visualized as the shaded regions in Fig. 1. Between these shaded areas of belief–evidence consistency, the communication of uncertainty did not indicate an effect on trust in the information (2.47, 4.10) and trust in the source (2.98, 5.48). We checked the robustness of our results by including subjective understanding of the message ($M = 4.21$, $SD = 0.90$) as a covariate, with or without an interaction. The interactions remained for both trust in the information and its source when subjective understanding was included in the models.

To test whether the interaction held for both evidence conditions (*link* and *no link*) separately, and to disentangle how participants at different ends of the belief spectrum responded to uncertainty communication, we split our data by evidence condition and reran the models. Although not preregistered, we used prior belief instead of belief–evidence consistency as the predictor, which does not affect the statistical results. By doing so, high values on this predictor represent people who believe that COVID-19 vaccines are safe, while low scores represent people who believe they are not safe, in both evidence conditions. If we had used belief–evidence consistency as the predictor, the belief score would have been reversed for the *no link* conditions. Using prior belief instead thus allows for a more intuitive comparison of individuals at different ends of the belief spectrum across evidence conditions.

For both outcomes, trust in the information and trust in the source, the interaction was significant when *no link* between COVID-19 vaccines and Bell's palsy was communicated. That is, the more people doubted the safety of vaccines, the more they trusted the information and its source when uncertainty was communicated compared with when it was not. Conversely, the more people believed that vaccines were safe, the less they trusted the information, but not its source, when uncertainty was

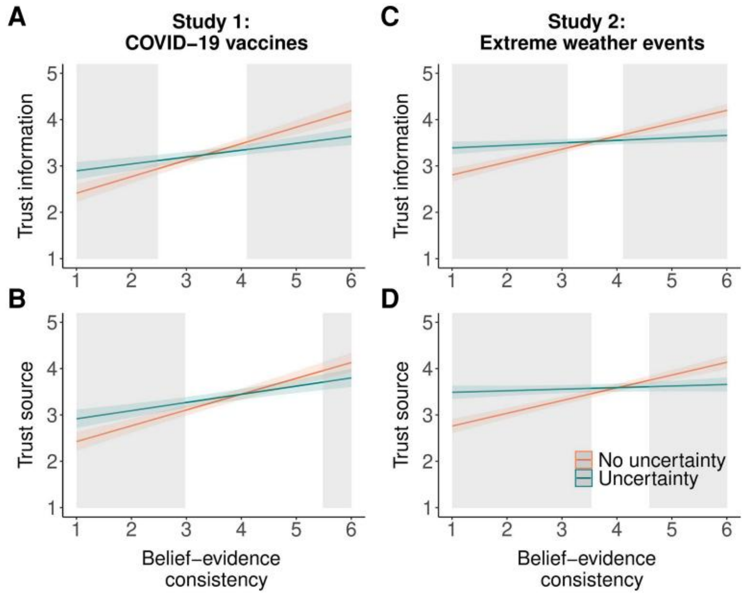

Fig. 1. Interaction effects between uncertainty communication and belief–evidence consistency on trust ratings in study 1 (A + B) and in study 2 (C + D). Plots show predicted values (with 95% CI) on trust in the information and its source for uncertainty communicated vs. not communicated across the range of belief–evidence consistency. Higher values of belief–evidence consistency indicate a greater consistency between people's prior belief and the evidence that is presented. Based on Johnson–Neyman intervals, shaded regions indicate levels of belief–evidence consistency at which the effect of uncertainty communication is significant ($P < 0.05$).

communicated compared with when it was not. In contrast, when a link between COVID-19 vaccines and Bell's palsy was reported, people across the belief spectrum did not respond differently when uncertainty was communicated than when it was not. However, this lack of an interaction in the *link* conditions could be due to methodological reasons. First, the prior belief distribution in the *link* conditions appeared to be less favorable for detecting an interaction. By this we mean that there were fewer people with extreme values on the belief scale and more people with moderate values on the belief scale in the *link* conditions than in the *no link* conditions. Second, we did not power the study for separate analysis of the evidence conditions. Therefore, in our follow-up study, we aimed for a larger sample size that would allow us to draw conclusions from examining the evidence conditions separately. For more information, see the Table S6, Figs. S2 and S3.

We were also interested in how uncertainty communication affects people's subsequent beliefs. Unlike our prior belief measure, our subsequent belief measure focused specifically on vaccine safety regarding the specific disease Bell's palsy, rather than on general vaccine safety. To test the overall effect of uncertainty communication and evidence on their subsequent belief, we ran a generalized model with experimental condition as the independent variable and conducted pairwise comparisons using the *emmeans* package (52). We corrected for multiple comparisons with the Tukey method for comparing a family of four estimates. Note that this analysis was not preregistered. To examine whether the effect of uncertainty communication on people's subsequent belief depended on their prior belief, we fitted a generalized linear model with prior belief, uncertainty (communicated vs. not communicated) and their interaction as independent variables for both evidence conditions separately.

Participants' subsequent belief was influenced by the evidence they were given. Adding uncertainty information, however, did not affect participants' belief in either evidence condition (Table S8 and Fig. S5). When their prior belief was taken into account, a more complex picture emerged (Table S16 and Fig. S6): In the evidence condition where a link between COVID-19 vaccines and Bell's palsy was communicated, the effect of uncertainty communication compared with no uncertainty communication did not differ across the prior belief spectrum (which may also be due to the less favorable belief distribution in the link conditions, and the overall statistical power). However, when no link was communicated, the effect of uncertainty communication varied depending on participants' prior belief. For those skeptical of vaccine safety (lower prior belief ratings), uncertainty communication still had no effect on their subsequent belief. In contrast, people who believed in vaccine safety (high prior belief ratings) were more likely to believe that vaccination was linked to Bell's palsy when uncertainty about there being no link was communicated compared with when it was not. In other words, their subsequent belief was less in line with the evidence presented when uncertainty was communicated around it compared with when it was not. This is an interesting finding, as the uncertainty information led people to diverge more from the evidence in their subsequent belief—and thus diverge from their prior belief in vaccine safety—even though they rated the message including uncertainty as less trustworthy overall.

Study 2

We sought to replicate the findings on trust, focusing on a different topic to assess the generalizability of the results. We believe this is important as prior research has found that the effects of uncertainty communication on trust can vary by topic (16, 53). The study design was identical to study 1. Participants reported their prior belief about whether the number of extreme weather events in the United States has increased since 1900. Between-subjects participants were then given contrasting evidence in which one evidence condition suggested that there had been an increase in hurricane frequency in the United States since 1900 (*increase*) and the other suggested that there had been no increase (*no increase*). Again, uncertainty was either communicated around the evidence or not, resulting in four experimental conditions, the wording of which is shown in Table S1. As in study 1, we operationalized belief–evidence consistency by linking participants' prior belief scores to the evidence conditions. We set participants' prior belief scores on extreme weather events equal to their consistency scores in the *no increase* conditions, and reversed participants' prior belief scores in the *increase* conditions. The measures that followed the evidence statement were the same as in study 1, but we added perceived consistency as a secondary outcome. By asking participants how consistent they perceived the information to be with their prior belief, we aimed to shed further light on how the interaction between uncertainty communication and belief–evidence consistency works. Results on a number of other secondary outcomes are provided in Tables S11, S12, and S14, Fig. S9.

A total of 1,001 participants in the United States took part in January 2024. For this study, we aimed for a larger sample size to reduce the probability of different belief distributions between evidence conditions and to allow interaction analysis for each evidence condition separately. If the interaction occurs in both opposing evidence conditions, this would further support that the effects of uncertainty communication on trust depend on belief–evidence consistency, rather than particular beliefs (e.g. climate change skepticism).

We conducted the same analyzes as in study 1. Across all experimental conditions, participants tended to give above-average ratings for our primary outcomes, trust in the information (M = 3.53, SD = 0.94) and its source (M = 3.52, SD = 1.00). Similar to study 1, there was a crossover interaction between uncertainty communication and belief–evidence consistency for both outcomes. This interaction remained when subjective understanding (M = 4.47, SD = 0.75) was included as a covariate in the models, with or without an interaction.

Figure 1C and D reveals a strong relationship between belief–evidence consistency and trust ratings when uncertainty was *not* communicated. That is, the higher the consistency, the more people trusted both the information and its source. However, it is striking that when uncertainty is communicated, the green lines in Fig. 1C and D are almost flat across the spectrum of belief–evidence consistency. Belief–evidence consistency no longer appeared to be related to people's trust ratings when uncertainty was communicated. Thus, at lower levels of belief–evidence consistency, people trusted the information and its source more when uncertainty was communicated compared with when uncertainty was not communicated. Conversely, at higher levels of belief–evidence consistency, people trusted the information and its source less when uncertainty was communicated compared with when it was not communicated. The shaded areas in Fig. 1 represent the consistency values at which the effect of communicating uncertainty compared with not communicating uncertainty is significant ($P < 0.05$). Between these shaded areas of belief–evidence consistency, communicating uncertainty did not indicate an effect on trust in the information (3.10, 4.11) and trust in the source (3.53, 4.59).

For perceived consistency, we fitted the same generalized linear model as for our primary outcomes. Again, there was a crossover interaction between uncertainty communication and belief–evidence consistency: belief–evidence consistency was strongly related to people's perceived consistency, when uncertainty was *not* communicated. That is, the higher the belief–evidence consistency, the more people perceived the information as consistent with their beliefs. This relationship was weakened when uncertainty was communicated, so that belief–evidence consistency was no longer closely related to people's perceived consistency. Thus, at low levels of belief–evidence consistency, people perceived the information as more consistent with their beliefs when uncertainty was communicated compared with not communicated. At high levels of belief–evidence consistency, people perceived less consistency when uncertainty was communicated than when it was not. Overall, these findings support the idea that people's perceived consistency is affected by the communication of uncertainty and, consequently, could affect their trust ratings. More information on the perceived consistency is found in Table S14 and Fig. S9.

Study 2 had sufficient power to examine the interaction for each evidence condition separately and see how people at different ends of the belief spectrum respond to uncertainty communication. The distributions of people's prior beliefs did not differ between the evidence conditions (see Fig. S8). As in study 1, we used prior belief instead of belief–evidence consistency as the predictor to facilitate comparisons of people at different ends of the belief spectrum across evidence conditions. See Table S13 for details on the results of the interaction models.

As shown in Fig. 2, there was a crossover interaction between prior belief and uncertainty communication in both evidence conditions. When no increase in hurricane frequency was reported (Fig. 2A and B), uncertainty communication—compared with no uncertainty communication—led to lower trust among people with lower belief scores (i.e. people who were less likely to agree that extreme weather events have increased) and higher trust among people with higher belief scores (i.e. people who believed that extreme weather events have increased). Conversely, when an increase in hurricane frequency was reported (Fig. 2C and D), the communication of uncertainty led to higher trust among people with lower belief scores and lower trust among people with higher belief scores. In other words, people at both ends of the belief spectrum responded with either more or less trust when uncertainty was communicated compared with not communicated, depending on how consistent the evidence was with their prior belief. Interestingly, Fig. 2 reveals that these effects were stronger for people with lower belief scores, i.e. people who were less likely to agree that extreme weather events have increased since 1900. Again, Fig. 2 illustrates that there was no relationship between people's beliefs and their trust ratings when uncertainty was communicated. In both evidence conditions, trust in both the information and its source did not differ across the belief spectrum when uncertainty was communicated, as shown by the flat green lines (Fig. 2A–D).

As in study 1, we also explored how uncertainty communication affected participants' subsequent beliefs. Our subsequent belief measure differed from our prior belief measure in that it focused on the increase in a specific extreme weather event, namely hurricanes, rather than on the increase in extreme weather events in general. We applied the same analyses on subsequent belief as in study 1, this time preregistered.

As expected, the evidence (increase vs. no increase in hurricane frequency) affected participants' subsequent belief. Adding uncertainty information produced mixed effects: Uncertainty communication had no overall effect in the conditions where no increase in hurricane frequency was reported. However, when accounting for prior belief, we found that uncertainty communication affected the subsequent belief of those participants who believed that extreme weather events have increased (those with higher prior belief ratings). These participants were more likely to believe that hurricane frequency has increased when uncertainty was communicated about the evidence showing no

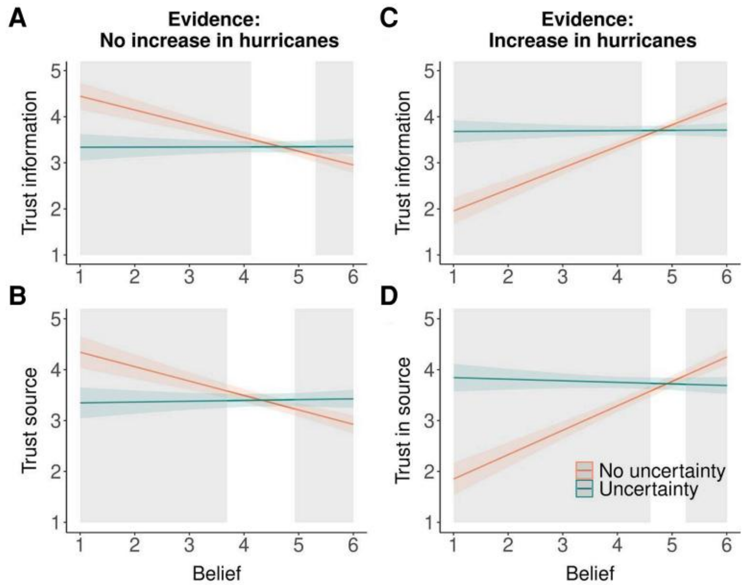

Fig. 2. Interaction effect between uncertainty communication and prior belief on trust ratings for the evidence conditions no increase in hurricanes (A + B) and increase in hurricanes (C + D). Plots show predicted values (with 95% CI) on trust in information and its source for uncertainty communicated vs. not communicated across the spectrum of belief. Higher values of prior belief indicate a greater belief that extreme weather events have increased in the US since 1900. Based on Johnson–Neyman intervals, shaded regions indicate levels of belief at which the effect of uncertainty communication is significant ($P < 0.05$).

increase, compared with when no uncertainty was communicated. In the conditions where an increase in hurricane frequency was reported, there was an overall effect of uncertainty communication. Participants were less likely to believe in an increase when uncertainty was communicated compared with when it was not, regardless of their prior beliefs. Particularly interesting here were the ratings of those who believed that extreme weather events have increased (high prior belief ratings): the uncertainty information caused people to diverge more from the evidence in their subsequent belief—and thus from their prior belief—even though these people rated the message containing uncertainty less trustworthy overall. In summary, we observed that uncertainty communication had small effects on subsequent belief, with a tendency for participants' subsequent beliefs to shift in the direction of the uncertainty information, even if that meant that their subsequent belief was less aligned with their prior belief and trust ratings. For more details, see Tables S15 and S16 and Figs. S10 and S11.

As a manipulation check, we had tested whether the information was perceived as more uncertain when uncertainty was communicated compared with when it was not communicated. We compared the mean responses of perceived uncertainty in the respective experimental conditions by conducting pairwise comparisons using the *emmeans* package (52). As expected, participants who read that there has been no increase in hurricane frequency (*no increase* conditions) perceived the information as significantly more uncertain when uncertainty was communicated ($M = 3.20$, $SD = 1.07$) than when it was not communicated ($M = 2.86$, $SD = 1.20$). Surprisingly, however, participants who read that there has been an increase in hurricane frequency (*increase* conditions) perceived the information as equally uncertain when uncertainty was communicated ($M = 3.06$, $SD = 1.10$) as when it was not communicated ($M = 2.83$, $SD = 1.26$; Fig. S12). In retrospect, we think that this may be due to the way we asked about perceived uncertainty: *How certain or uncertain did you find the information?* In answering this question, participants may have conflated the reported uncertainty with their belief about whether hurricane frequency has actually increased.

Discussion

The aim of the present study was to examine how the communication of scientific uncertainty affects people's trust depending on their prior beliefs—specifically, the consistency between those beliefs and the evidence presented. In two experimental studies, we found empirical support for our hypothesis: the more consistent the evidence was with participants' prior belief, the lower their trust in the information and its source when uncertainty was communicated relative to when it was not communicated. Conversely, the less consistent the evidence was with participants' prior belief, the higher their trust in the information and its source when uncertainty was communicated relative to when it was not. Specifically, when uncertainty was not communicated, people's trust ratings were strongly related to how consistent the evidence was with their beliefs. That is, the higher the level of consistency, the more people trusted the information and its source. However, when uncertainty was communicated, this relationship attenuated and was not even evident at all in study 2. In other words, the communication of uncertainty served to protect against systematic fluctuations in trust, causing trust ratings of people with low and high levels of belief–evidence consistency to converge rather than diverge.

The fact that we observed the interaction between uncertainty communication and belief–evidence consistency for two different topics, namely COVID-19 vaccines and changes in extreme weather events, speaks to the robustness of our results. Furthermore, it suggests that the interaction may also occur when uncertainty is communicated around other topics not examined in this study. Our findings may particularly generalize to other polarized issues, as we found that the effects of communicating uncertainty (relative to not communicating uncertainty) were strongest at the ends of the belief–evidence consistency spectrum. For individuals in the middle of the belief–evidence consistency spectrum, trust ratings did not differ when uncertainty was communicated or not.

Further supporting the robustness of our results, the crossover interaction held across contrasting evidence statements and therefore across people with opposing beliefs. In study 2, people at both ends of the belief spectrum found the information and its source either more or less trustworthy when uncertainty was communicated relative to when it was not, depending on how consistent the evidence was with their belief. The fact that the interaction held across people with opposing beliefs supports the idea that trust responses to uncertainty communication—relative to no uncertainty communication—depend not only on partisanship per se or on the belief itself, but rather on whether the evidence is consistent with the person's beliefs.

We derived our hypothesis that uncertainty communication and belief–evidence consistency interact from the idea that uncertainty information can change how people perceive the consistency between new evidence and their prior beliefs, thus affecting their trust: when new evidence aligns with people's prior beliefs, adding uncertainty may lead people to perceive less consistency, thereby reducing their trust in the information and its source. Conversely, if the evidence contradicts people's prior beliefs, introducing uncertainty might make them perceive greater consistency, i.e. dampen the oppositional nature of the message, which would increase their trust. We found supporting evidence for the role of perceived consistency in our second study, where participants also rated how consistent they perceived the information to be with their prior beliefs about extreme weather events. As expected, uncertainty communication—relative to no uncertainty communication—led people to perceive greater consistency at low levels of belief–evidence consistency, but less consistency at high levels of belief–evidence consistency. However, we cannot determine whether these differences in perceived consistency and trust are affectively and/or cognitively driven. Furthermore, it is conceivable that people's responses to belief–evidence consistency may be moderated by third variables, such as certainty and consensus beliefs, which could have U-shaped relationships with prior beliefs. Such U-shaped relationships may provide further explanations for our observation that the effects of uncertainty communication were most pronounced at either end of the belief spectrum. Future studies could include such epistemic beliefs as covariates to determine whether the interaction effects persist when controlling for these variables.

Notably, the interaction effects in study 2 were stronger for people who believed there was no increase in extreme weather events than for people who believed there was an increase. This asymmetry indicates that the strength of the interaction is not fully independent of the respective prior belief. Individual and contextual factors associated with this belief may explain this asymmetric response to uncertainty communication and warrant further investigation. For example, the belief that extreme weather events have not increased is more common among Republicans (54). Studies have shown that conservatives and right-wingers are much more likely to consume, share, and believe false information than liberals (55, 56). These different information environments could lead to different perceptions and interpretations of uncertainty information around changes in extreme weather events.

We also encourage further research to examine how a potential loss of trust can be mitigated when uncertainty around evidence is communicated to people whose prior beliefs are highly consistent with the evidence. One possible intervention might be to convey that uncertainty is an expected state of science, a concept also referred to as normalizing uncertainty (57). However, the normalization of uncertainty needs to be validated as an effective intervention in further studies.

We were also interested in how uncertainty communication affects people's subsequent beliefs and this exploration yielded further interesting insights. First, the communication of uncertainty had little overall impact on what people subsequently believed. Second, when effects were observed, people's subsequent beliefs were shifted in the direction of the uncertainty information, supporting the notion of *persuasion in parallel* (48). Third, and relatedly, uncertainty communication's effects on trust and belief appeared to operate independently, and sometimes even in opposite directions. That is, for people with certain prior belief ratings (belief in vaccine safety and belief that extreme weather events have increased), we observed that subsequent beliefs were shifted in the direction suggested by the uncertainty information, even though the information containing uncertainty was perceived as less trustworthy than the information without uncertainty. In other words, adding uncertainty information increased or decreased trust depending on belief–evidence consistency, but these effects on trust did not correspond with shifts in subsequent beliefs. Note, however, that these findings on subsequent belief should be interpreted with caution. It is possible that some participants perceived the subsequent belief measure as an attention check, given the measures are closely related to the evidence presented. To gain further insight into belief formation, we recommend that future studies validate these findings using more extensive measures of subsequent belief and a design that allows for greater comparability between prior and subsequent beliefs.

Taken together, we found no polarizing effects of uncertainty communication on either trust outcomes or subsequent beliefs. Our findings challenge the view that communicating uncertainty about scientific evidence increases polarization (8, 58). In fact, the results suggest the opposite: when uncertainty was communicated, trust ratings across the spectrum of belief–evidence consistency converged. We suggest that future research systematically examine whether uncertainty communication could serve as an intervention to *reduce* the polarization about who and what to trust, as this would have important implications for science communication.

We acknowledge that our study results may vary under different conditions and contexts: the interaction effects may have been different depending on who communicates the evidence. In both studies, we referenced an unspecified scientific institute as the evidence communicator. Specifying the institute (e.g. NIH) or having a well-known scientist or even a partisan politician communicate the information would have introduced an additional dimension of consistency—namely, how people feel about the communicator. Depending on the communicator and the audience, different expectations would be raised about the communicator's intentions and competence, which can affect how trustworthy people perceive the communication of (in)consistent evidence and uncertainty (59). Consequently, while we are confident that our results generalize to situations in which the receiver does not know or has no strong existing beliefs about a source, we cannot be sure to what extent our results generalize to situations where the receiver knows the source and has existing beliefs about it. We encourage future research to validate our findings with real-world sources in a variety of contexts and settings.

Relatedly, we found high correlations between trust in the information and its source and similarity in the effects. This may be due to the limited cues we provided beyond the message itself. If we had provided more details about the source, for example, the results on trust in the information and trust in the source might have diverged more. It might be worthwhile to explore when the effects of uncertainty communication on these outcomes differ, and whether individual differences, such as scientific literacy, could explain diverging effects.

Furthermore, our results may not apply to different audiences. Our samples include only US citizens, the majority of whom were white, educated, and probably online literate. It has been demonstrated that people's trust responses to uncertainty communication can vary between countries (18). Therefore, our findings from the United States may not necessarily generalize to other national populations.

External validity is further limited by the abstracted context (a survey experiment) in which we tested uncertainty communication, and the fact that we examined only two communications of verbal uncertainty. The verbal uncertainty could have been phrased in a variety of ways. Our findings may also not generalize to other forms of communicating uncertainty, such as graphical or numerical communication. As research has found smaller effects of communicating numerical uncertainty on trust (18), our results may not have been as strong if we had used numerical rather than verbal uncertainty. In the present study, we included two reasons for uncertainty in the communication, namely missing data and methodological limitations. Uncertainty could also be attributed to different reasons, such as lack of consensus among experts, with potentially differing effects (16).

Despite these limitations on generalizability, we believe our results are meaningful and robust as we found the predicted interaction effect across two different topics, different trust ratings, and among people with opposing beliefs. Our results therefore carry practical implications. For science communicators, the key takeaway from our study is to be aware that people's trust response to uncertainty communication differs depending on the consistency with their prior beliefs. Our findings suggest that adding uncertainty information is particularly effective in maintaining trust among audiences who are skeptical about what is being communicated. Conversely, for nonskeptical audiences, communicating uncertainty can lead to lower trust than not communicating uncertainty. Being aware of these different responses can help science communicators understand recipients' reactions and serve as a starting point for addressing potential adverse effects of uncertainty communication. Moreover, our findings indicate that uncertainty communication may have only a little direct impact on what people subsequently believe, which may reassure communicators that addressing uncertainties will not undermine the evidence presented. Given that uncertainty communication appeared to affect trust and beliefs independently, practitioners should be aware that there may be situations in which uncertainty communication can have differing effects on trust and beliefs.

Regardless of our findings, we would like to encourage science communicators not to withhold information about uncertainties to avoid losing trust or undermining evidence. Being transparent about uncertainties is good science communication practice and is required in applied fields such as health communication (4, 39, 60). Furthermore, previous findings suggest that failure to communicate uncertainty about evidence at the outset can exacerbate the loss of trust in the communicating source when evidence later changes (19, 61). However, it is important to strike a balance: it is equally crucial not to convey excessive uncertainty where it is unwarranted, in order to avoid unnecessary confusion or loss of trust. Moreover, when uncertainty is communicated, it should be done in a way that allows people to assess it effectively. For instance, studies have shown that presenting numerical uncertainty, either alone or alongside verbal explanations, is more effective than relying solely on verbal descriptions to help people accurately gauge uncertainty levels (62).

Overall, our findings underscore the need for further research to identify additional conditions, i.e. contexts and subgroups, under which uncertainty communication increases or decreases trust (63). The identification of moderating factors could help explain the heterogeneity found in the effects of uncertainty communication on trust (17). Moreover, knowing the conditions under which people trust information and its sources, and why, can provide important insights and lead to clearer guidance for science communication.

Conclusion

In this study, we find that the effects of uncertainty communication on trust in information and its sources can depend on belief–evidence consistency. The higher the consistency between the evidence communicated and people's prior belief, the less they trust the information and its source when uncertainty is communicated compared with not communicated. Conversely, the lower the consistency, the more people trust the information and its source when uncertainty is communicated compared with not communicated. These effects on trust appear to be independent of the effects on belief formation.

Materials and methods

Ethical approval for this research was granted by the Ethics Committee of the *University of Potsdam* (no. 67/2023). Both studies were preregistered with aspredicted.org (study 1: https://aspredicted.org/43i4q.pdf; study 2: https://aspredicted.org/54mb5.pdf).

Study 1

Participants

Participants were recruited from *Prolific Academic* in September 2023 and remunerated with £1.06 for an average of 8 min of their time (interquartile range [IQR] = 6–9 min). People could participate if they lived in the United States were 18 years or older, and completed the study on a tablet or desktop. We set 50% quotas for sex. To ensure a uniform distribution of COVID-19 vaccine safety beliefs in our sample, we used a default prescreener from Prolific as a proxy: *Please describe your attitudes towards the COVID-19 (Coronavirus) vaccines* and provided four response options: *For (I feel positively about the vaccines)*, *Against (I feel negatively about the vaccines)*, *Neutral (I don't have strong opinions either way)*, and *Prefer not to say*. We set 30% percent quotas for each category, taking the *Neutral* and *Prefer not say* categories together. A pilot study ($n = 100$) suggested that these quotas led to an approximately even distribution on our vaccine safety belief scale.

The sample size was determined a priori using parameter estimates from a comparable study ((19), dependent variable trust in the source). Results of a series of simulations using the *R* package *paramtest* (64) revealed that a sample size of $n = 576$ would be required to detect a similar interaction (R^2 adjusted = 0.013) with 95% power at an alpha level of 0.05. Based on previous study results (7), we expected similar parameter estimates for trust in information. The data as well as the *R* code for the simulation can be found on OSF (https://osf.io/xjfws/?view_only=0e16d44bceac408eb5d870ec43c2c660).

We set the target sample size at 600 participants and ultimately obtained data from 601 participants who accessed, consented to, and completed the study (149 to 153 participants per condition).

The median age of our sample was 42 years ($M = 44.0$, $SD = 13.6$, range 18–94 years), which is slightly older than the median age of the general population in the United States, reported as 38 years (65). Of the participants, 297 identified as female, 297 as male, 12 as diverse; and 483 participants reported their ethnicity as White. The second most common ethnic group was Black or African American, with a total of 80 participants. Similar to study 1, this sample had an above-average level of education, with 51.7% holding a Bachelor's degree or higher, with roughly equal numbers of participants identifying across the conservative to liberal spectrum (see Table S3 and Fig. S1 for more details).

Materials

The vignettes are found in Table S1. We presented the information as coming from a scientific institute, which was not specified because trust in different scientific institutes in the United States is influenced by political partisanship (66, 67) and we wanted to avoid potential confounds that could arise from participants' prior attitudes toward a particular source. That is, we wanted to prevent the interaction of belief–evidence consistency and uncertainty communication from being masked by people's (polarized) priors toward the source.

The topic of whether mRNA vaccines increase the risk of Bell's palsy was chosen because of the preliminary nature of the evidence, with some evidence suggesting an increase (68) and others showing no increase (69). Uncertainty was reported verbally rather than numerically and a reason for the uncertainty—missing data—was given.

Measures

Participants completed a four-item measure of their prior belief about the safety of mRNA COVID-19 vaccines (example item: *The mRNA COVID-19 vaccines [Pfizer and Moderna] are safe*; 1 = *strongly disagree* to 6 = *strongly agree*; Table S2). To ensure a consistency relation with our evidence conditions, we intended to capture beliefs associated exclusively with vaccine safety, deliberately excluding beliefs around vaccines such as efficacy. As there are no validated scales that specifically measure beliefs about vaccine safety, we selected and adapted individual items from other scales (70–72). In a pilot study ($n = 100$), we assessed the scale's convergent validity by comparing it with the COVID-19 vaccine concern scale (73) (seven items, e.g. *I am concerned about the long-term side effects of getting a COVID-19 vaccine*; 1 = *strongly disagree* to 5 = *strongly agree*), yielding a high correlation of $r = -0.83$. The four items were pooled to a prior belief score, such that higher values indicated a greater belief in vaccine safety (Cronbach's $\alpha = 0.94$). As we intended, the distribution of our vaccine safety belief scale was moderately uniform ($M = 3.43$, $IQR = 2.20–4.40$). Importantly, the extremes of our belief scale were well represented. This distribution does not reflect the belief distribution in the United States, but enhances our ability to detect an interaction (74).

Similar to prior research (2, 7), we measured trust in the source with a single item: *How trustworthy does the scientific institute appear to you here?* (1 = *not at all* to 5 = *very*). Following previous research, trust in the information was measured as the average of three items: *How [accurate/reliable/trustworthy] do you find the information provided by the scientific institute?* (1 = *not at all* to 5 = *very*, Cronbach's $\alpha = 0.95$) (7, 46). These three items capture competence and reliability, which have been identified as key dimensions of trustworthiness (75). As expected, trust in the information and its source was highly correlated ($r = 0.85$).

Participants' subsequent belief was measured by asking them to what extent they thought it was true that vaccination with Pfizer's COVID-19 vaccine increased the risk of developing Bell's palsy (1 = *definitely false* to 5 = *definitely true*). We only measured participants' subsequent belief after presenting the evidence statement, not before, because we thought it unlikely that most people would have an existing belief about whether mRNA COVID-19 vaccines increase the risk of developing Bell's palsy. Measuring this belief beforehand could have created artifacts or preactivated people's beliefs in unintended ways, which could have affected their trust ratings.

We also asked participants how *understandable* they found the information they read (1 = *not at all* to 5 = *very*).

Procedure

Following informed consent, participants rated their belief that vaccines are safe. As a distraction, demographic items and a spot-the-difference task were completed between the prior belief assessment and the presentation of the vignette. The distraction task was intended to reduce the interference of participants' belief ratings on their ratings of the dependent measures. After reading the scientific institute's statement, participants were asked to rate their trust in the information and its source, with the order of these measures randomized. When rating these outcomes, participants were presented with the statement from the scientific institute as a reminder. Afterwards, participants assessed their subjective understanding of the statement and their subsequent belief. The survey concluded with information about the nature and purpose of the present study as well as the current state of knowledge regarding the evidence presented, i.e. does vaccination with COVID-19 vaccines increase the risk of developing Bell's palsy? The study included additional measures of secondary outcomes, covariates, and exploratory measures. Further information on these is found in Table S2.

Study 2

Participants

Similar to study 1, eligible participants from the platform *Prolific Academic* completed the study in January 2024 and were remunerated with £0.94 for an average study duration of 5 min ($IQR = 4–6$ min). As in study 1, participants had to be a resident of the United States, 18 years of age or older, and able to complete the study using either a tablet or desktop computer. Participants were not able to participate if they had participated in study 1. We applied gender quotas of 50%. We used a prescreener from prolific as a proxy, to ensure a more or less even distribution of beliefs about extreme weather. The default prescreener was: *Do you believe in climate change?* We screened participants so that our sample included 40% of people who selected the answer *No*, 40% of people who selected the answer *Yes* and 20% of people who selected the answer *Don't know* or *Not applicable/rather not say*. We aimed for an approximately even distribution on our belief item. Since our pilot ($n = 100$) showed a very left-skewed distribution of our belief item (i.e. the majority of participants believed that extreme weather events have increased since 1900), we decided to increase the percentage of people who did not believe in climate change from 30 to 40% and to reduce the percentage of people who did not provide an answer (*Not applicable/rather not say*) from 30 to 20%.

We determined the sample size a priori based on our findings from study 1. For our simulations, we used the parameter estimates for trust in source, as we found smaller effects for trust in source as for trust in information. Our simulations using the R package *paramtest* (64) showed that a sample size of $n = 378$ would be required to detect a similar interaction (R^2 adjusted = 0.018) with 80% power at an alpha level of 0.05 in each evidence condition separately, requiring a total of $n = 756$ across both evidence conditions (R code and data: https://osf.io/xjfws/?view_only=0e16d44bceac408eb5d870ec43c2c660). However, we preregistered a target sample size of $n = 1{,}000$ because, given the left-skewed distribution of our belief item in the pilot, we wanted to ensure that we had enough participants in both evidence conditions who were likely to believe that extreme weather events had not increased.

We analyzed data from 1,001 people who accessed, consented to, and completed the study, with 250 to 251 participants per experimental condition. The median age of participants was 42 years ($M = 43.5$, SD = 13.8, range 19–92 years), again slightly exceeding the reported median age of 38 years for the US population (65) and 51% identified themselves as female, 48% as male, and 0.7% as diverse. Seventy-eight percent indicated their ethnicity as White, followed by 14% who reported their ethnicity as Black or African American. Similar to study 1, our sample had an above level of education: 54% had a bachelor's degree or higher. In comparison with study 1, participants' political orientation was slightly more conservative ($M = 4.37$, median = 4 rated on a scale from 1 = *very liberal* to 7 = *very conservative*). Further details, including information on participants' US state of residence, are found in Table S10 and Fig. S7.

Materials

The wording of the vignettes is found in Table S1. We again refrained from naming a specific scientific institute as the communicator to prevent preexisting (polarized) perceptions of trust in a specific institute from masking the interaction between belief–evidence consistency and uncertainty communication. For the vignette, we selected the topic of whether the frequency of hurricanes in the United States has increased since 1900. Depending on the time frame considered, current research suggests different conclusions as to whether the frequency of hurricanes has or has not increased (76). We selected the period since 1900 as the longer the time period, the greater the uncertainty around the current evidence. This uncertainty allowed us to use two contrasting evidence conditions (i.e. hurricane frequency has increased vs. not increased) without reproducing misinformation. In the uncertainty conditions, participants received information that there was uncertainty due to methodological reasons.

Measures and procedure

For our main analyses, we used the same measures as in study 1 (Table S9). Again, trust in information and its source were highly correlated ($r = 0.86$). Additional or modified measures, the results of which are reported in the manuscript, are presented below.

We measured participants' prior belief about extreme weather events with a single self-constructed item: the number of extreme weather events, such as hurricanes and floods, has increased in the United States since 1900 (1 = *strongly disagree* to 6 = *strongly agree*). The distribution on the belief item was not as uniform as we had anticipated from prescreening. The majority believed that the number of extreme weather events has increased ($M = 4.42$, IQR = 4.00–6.00).

Participants' subsequent belief was measured by asking to what extent participants thought it was true that hurricane frequency in the United States has systematically increased since 1900 (1 = *definitely false* to 5 = *definitely true*). Similar to study 1, the belief was measured only after presenting the evidence statement and not before.

As a manipulation check, we included perceived uncertainty by asking participants how certain or uncertain they found the information (1 = *very certain* to 5 = *very uncertain*). Perceived consistency was measured by asking: to what extent does the information from the scientific institute agree or disagree with your personal view of extreme weather events? (1 = *strongly disagree* to 5 = *strongly agree*). Perceived uncertainty and perceived consistency were presented after all other measures, with the order of these two measures randomized. Otherwise, the procedure was identical to that in study 1.

Note

[a] There is variation in the literature on how the related concepts of trust, trustworthiness and credibility are used. We use the terms trust and trustworthiness interchangeably. For a discussion of these two concepts, we recommend reading the article of Onora O'Neill (75). We will use credibility when citing other studies that use this conceptual framing.

Supplementary Material

Supplementary material is available at *PNAS Nexus* online.

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Author Contributions

All authors contributed to the study design and questionnaire. C.D. performed the statistical analysis and wrote the manuscript. M.M., C.R.S., and F.G.R. provided the editorial input.

Data Availability

The analysis R code developed for this study is available at: https://osf.io/xjfws/?view_only=83b7e17079584656b657c046e9970edc. The data used in this study are available at: https://osf.io/xjfws/?view_only=83b7e17079584656b657c046e9970edc.

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