

## Believing to belong: Addressing the novice-expert problem in polarized scientific communication

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### Abstract

There is a large gap between the specialized knowledge of scientists and laypeople's understanding of the sciences. The novice-expert problem arises when non-experts are confronted with (real or apparent) scientific disagreement, and when they don't know whom to trust. Because they are not able to gauge the content of expert testimony, they rely on imperfect heuristics to evaluate the trustworthiness of scientists. This paper investigates why some bodies of scientific knowledge become polarized along political fault lines. Laypeople navigate conflicting epistemic and social demands in their acceptance of scientific testimony; this might explain their deference to scientific fringe theories, which often goes together with denying established scientific theories. I evaluate three approaches to mitigate denialism: improving the message, improving the messenger, and improving the environment in which the message is conveyed.

### 1. Introduction

Surrounded by devastating wildfires, residents of the town of Redding, California, remained unconvinced that human agency was at least in part to blame for their plight. The town votes predominantly Republican, and the local media are skeptical about scientific explanations for climate change. As one resident said, "I think it's bull. It's just fire season. It's hot" (Wilson 2018). Climate change is a topic about which scientists have a high degree of consensus. Two recent surveys, drawn from large and representative samples of published climate studies, estimate that 97% of climate scientists believe that climate change is to a large extent caused by humans (Cook et al. 2016); some estimates are as high as 100% (e.g., Powell, 2017).

In spite of this (near)universal scientific consensus, views on climate change and global warming are increasingly politically polarized. Since Gallup started tracking American views on climate change, the issue has never been as politically polarized as in 2018. For example, 89% of Democrats believe global warming is caused by human activities,

compared to 35% of Republicans (Brenan and Saad 2018). For the purposes of this paper I will focus on scientific theories that are politically polarized.

As Dewey (1927) already observed, there is a large gap between highly specialized knowledge gathered by scientists, and laypeople's understanding of it. This gap has been widening as scientific disciplines have become increasingly specialized (Millgram 2015). The challenges that novices encounter as they navigate an increasingly complex epistemic landscape can be framed in terms of the novice-expert problem (Goldman 2001). This problem arises because non-experts in a domain  $D$  cannot directly evaluate expert testimony in  $D$ , so they will need to use indirect cues such as speaker reputation or internal coherence of the testimony to gauge the quality of the message. One such cue is consensus: near-universal agreement of specialists has large evidential weight (see Dellsén 2018 for a formal exploration of this intuition). On the face of it, it is puzzling that many people do not trust scientific consensus.

The novice-expert problem is usually framed in purely epistemic terms, but, as I will argue, accepting testimony poses non-epistemic demands as well. These include social and moral considerations. As a result of such non-epistemic factors, people will sometimes accept discredited scientific views if doing so helps them to coordinate better with individuals who hold similar beliefs. I will argue that to adequately explain non-specialists' deference to fringe scientific theories such as climate change denial or creationism we need to understand both their epistemic and non-epistemic motivations.

This paper addresses two related questions. First, how can large swathes of the population believe in discredited scientific theories? Second, how can we improve the reception of mainstream scientific information? Section 2 looks at the problem of denialism (the systematic denial of well-established scientific theories) and examines Levy's (2019) explanation of the problem in terms of epistemic vigilance. In Section 3 I argue that Levy overlooks an additional mechanism in the appraisal of testimony, social belonging. Social belonging can explain why people sometimes accept testimony even if they deem the source inaccurate. I also indicate how this non-epistemic deference is distinct from the cultural cognition hypothesis (e.g., Kahan et al. 2011), which argues that values and ideology act as a filter on how people evaluate scientific testimony. Section 4 examines three solutions to the problem of denialism that science communicators can adopt: improving the message, improving the messenger, and improving the epistemic environment in which the message is conveyed.

## **2. Why does denialism exist? Levy's epistemic solution**

Denialism is the systematic denial of facts and theories that enjoy a high degree of consensus among the scientific community. It is usually associated with one or more of the following features: conspiracy theories, fake experts, and selective use of sources (see Diethelm and McKee 2009 for analysis). Conspiracy theories are utilized to explain away scientific agreement, for example, if medical scientists say that vaccines against childhood diseases do not cause autism, it must be because "big pharma" bought them off. Fake experts are people with no credentials in the relevant discipline (e.g., who lack

a PhD or other higher education credentials, or have no peer-reviewed publications in that discipline), but who are nevertheless put forward as experts in it, and are claimed to be on an epistemic par with genuine scientists who work in that discipline. For example, creationists sometimes have academic credentials, but those are for the most part PhDs in disciplines that are not related to evolutionary biology. Denialism also requires drawing on isolated, highly selective, and often discredited sources, such as Wakefield's now-retracted paper in the *Lancet*, 1998, alleging a link between autism and childhood immunizations.

Neil Levy (2019) has recently drawn on the cognitive psychology of testimony to explain why denialism occurs. He dismisses the commonly-held assumptions that climate change deniers, creationists, and anti-vaxxers, would be less critical, less well-informed, or less rational than those who accept the scientific consensus. Instead, he holds that denialists are epistemically unlucky: their chains of transmitted information through testimony are not as good as those of laypeople who hold correct scientific beliefs.

His epistemic solution to the problem of denialism draws on empirical research on how ordinary people appraise testimony in general. Both denialists and people who accept bona fide scientific consensus are confronted with the novice-expert problem, the problem of evaluating testimony that they have, per definition, no expertise in. Since we cannot directly test whether what experts say is true, how can we ever make up our minds when they (seem to) disagree? The psychological literature (e.g., Johnston et al. 2015) shows that people use two proxies for testifier reliability: competence and benevolence. Through our preference for competent testifiers, we learn from people who are less likely to make mistakes or transmit wrong beliefs. A preference for benevolence means that we prefer to believe people who seem well-disposed toward us. We can gauge benevolence through social closeness or social cues. Toddlers already use competence and benevolence to gauge testifiers: they are more willing to trust testimony from people who have been accurate in the past compared to inaccurate testifiers, and to rely on people they know rather than strangers. It makes sense to do this. If we trust incompetent people, we will not gain reliable information; if we trust people who don't have our interests at heart, they may deceive us. Competence and benevolence are thus key factors in epistemic vigilance, helping us to make sure the information we acquire through testimony is of good quality (Sperber et al. 2010).

Levy (2019, 322) argues that the reliance on benevolence goes awry in denialism, as testifiers to politicized scientific theories come to be seen as less benevolent: "because the topic has come to be politicized, this disposition to defer ensures that they do not defer to (or their chains of deference will not bottom out in) groups of scientists who espouse views contrary to theirs." For example, if a scientist argues that evolutionary theory is correct, it will make her appear less trustworthy in the eyes of Evangelical Christians. In Levy's view, politically liberal Americans are epistemically luckier: while they use the same cognitive mechanisms to monitor testimony as conservatives, conservative politicians have taken maverick theories on board and have increasingly moved away from the scientific consensus. This process already started in the 1970s (Gauchat 2012).

While it is plausible that people of different political leanings use the same cues for appraising testimony, a key move in Levy's proposal remains unexplained: the mere fact of holding a particular belief is seen as signaling a lack of benevolence. How does this happen? Levy (2019, 323) argues that we are disposed to see people who are politically or religiously similar to us as more benevolent toward us: maybe merchants of doubt have politicized "climate science such that it would come to serve as a marker of political affiliation and thereby a cue for benevolence or its lack," a theory that has also been proposed by social scientists (e.g., Dunlap and Jacques 2013). But Levy's account does not explain how this politicizing works, and how some beliefs can come to serve as markers of particular political affiliations.

One key assumption in Levy's proposal is that people are to a large extent driven by epistemic considerations when they evaluate testimony. We care about whether the testifier is part of our in-group because this serves as a cue that the testifier is not trying to deceive us; this is what makes Levy's position an epistemic position. This position, however, leaves out non-epistemic considerations, where in-group membership is not only a cue for benevolence, but also creates a *prima facie* demand to follow the group's beliefs to achieve increased group cohesion. As I show in the next section, empirical evidence suggests that people use non-epistemic considerations in their evaluation of testimony. These social considerations can explain why beliefs can become polarized and how the acceptance of given beliefs can become a marker of group membership.

### **3. Non-epistemic considerations in deference to testimony**

#### **3.1 Epistemic and non-epistemic goals**

When we accept the testimony of others, we are driven by a variety of goals. Some of these are epistemic, for example, we want to believe true things and avoid believing false things, as William James (1896/1965) already held. But we also have other considerations such as friendship, affiliation, and belonging. The epistemic partiality literature investigates whether such considerations should hold any weight (e.g., Stroud 2006), for example, whether we should accord more weight to the testimony of friends compared to strangers.

Non-epistemic values have already been proposed to lie at the basis of denialism: Dan Kahan's cultural cognition hypothesis (e.g., Kahan et al. 2011) proposes that people will fit their perception of risk and related factual beliefs to moral evaluations. But this hypothesis fails to account for several observations. It does not explain why people seem to be sensitive to facts and to scientific consensus (see, e.g., Van Der Linden et al. 2017 for an empirical investigation on the public reception of climate change). It does not explain how beliefs become polarized in the first place either. One could argue that there is something about climate change denial that makes it more congenial to a conservative mindset, for example, if climate change is anthropogenic, this might prompt the need for state interventions to favor clean energy. State interventions are anathema to conservatives who tend to balk at the involvement of governments,

especially in how businesses are run. But this does not explain why Republicans were, in the not too distant past, just as likely to accept climate change as Democrats (Krosnick et al. 2000).

The cultural cognition hypothesis also has difficulties explaining why only the most politically engaged Americans have internally consistent conservative or liberal belief sets. Although people often identify with particular political parties, most voters do not hold clear, well-defined, and internally consistent political positions (e.g., Kinder and Kalmoe 2017, Achen and Bartels 2016). Kinder and Kalmoe (2017) make the strong claim that most voters are politically innocent, and that political polarization is solely driven by political elites. Polarization occurs when people identify with particular groups, and those groups, led by elites, influence which beliefs will be associated with a given ideology, e.g., climate change denial and conservatism. Other authors (e.g., Haidt 2012) claim that political polarization is more bottom-up and driven by values and norms. Given their lack of political knowledge, citizens resort to shortcuts to decide which information they accept as true. Such heuristics include conformist bias (following beliefs of people in the same community) and prestige bias (following the lead of perceived elites).

The empirical literature on the psychology of testimony shows that young children and adults are driven by both epistemic and non-epistemic considerations when they evaluate the testimony of peers or adults. Young children prefer familiar caregivers to strangers, and prefer people with the same accent compared to those with a different one, presumably because accents are reliable proxies for in-group membership (e.g., Corriveau et al. 2013). Such striking patterns of differential trust have sometimes been explained as familiarity being a proxy for benevolence. But as we will see in the next subsection, social considerations are distinct from epistemic goals, and the need for social belonging can sometimes lead both adults and children to be receptive to information they know is inaccurate (Jaswal and Kondrad 2016). It can make sense for people to modulate their beliefs to be in line with those of other group members. Shaping one's beliefs in line with those of one's group confers advantages: it makes one less likely to transgress the social norms of that group and thus invite punishment or ostracism, and it makes relationships in the group more harmonious. The proposal I will outline, that social belonging is a distinct reason to accept testimony, is thus broader than Levy's (2019) view. According to the latter, social cues are only useful to help us acquire the right beliefs, in other words, social considerations are actually indirect epistemic considerations.

### **3.2 Asch-style conformist experiments and the negotiation of conflicting epistemic and non-epistemic demands**

Empirical evidence for the role of social considerations in the evaluation of testimony can be found in social conformity experiments dating back to Solomon Asch's (1952) landmark work. In these experiments, a participant has to perform a straightforward perceptual task. A line of a given length is placed on a left card, together with three lines of differing lengths on a right card, and the participant is asked which of the lines on the right card has the same length as the one on the left. It is easy to see which line

corresponds to the target line. On some occasions, the fellow “participants”—who in reality are colluding with the experimenter—all pick the wrong line, and all agree this one corresponds to the target line. Asch found that people sometimes defer to the majority opinion, even if this obviously conflicted with their own senses. This finding has been replicated in a variety of individualistic and more collectivist cultures (Bond and Smith 1996), and with young children. Four-year-olds also conform their judgments to those of peers of the same age (Haun and Tomasello 2011).

In psychology textbooks, Asch’s experiment has often been interpreted as evidence that people are thoughtless conformists who will bend their perceptual judgment to fit an incorrect majority opinion. One problem with this conformist interpretation is that the results are not clear-cut. Even in Asch’s original experiments, some participants deferred more to the majority than others, and many participants deferred on some trials, but stuck with their own perceptual judgments over the majority opinion in others. (There were 12 trials per participant in the original experiments.) In fact, only about a quarter of the participants were pure “yielders,” who always went with the majority opinion, another quarter were pure “independents,” who always trusted their own judgment. The remaining half of the participants provided mixed responses, yielding on some trials to the majority, and sticking with their own position on others. Hodges and Geyer (2006) contend that this complex pattern cannot be purely explained by epistemic demands, including trust in one’s own perceptual judgments and in the judgments of others. They argue that test subjects also want to show to the other “participants” that they pay attention to what they were saying, and perhaps also wish to signal that they are not contrarian people who would be difficult to collaborate with. The participants’ verbal responses that were preserved, for instance, where they apologized to the other “participants” for sticking with their own judgments, lend further weight to this interpretation.

This suggests that an additional factor is at work when we evaluate testimony. Hodges and Geyer (2006) argue for an alternative, non-conformist interpretation of Asch-style experiments, the value-pragmatics account. When we appraise testimony, we are not only guided by epistemic considerations, such as believing true things and avoiding false things. We are also guided by moral and social considerations, namely we want to be seen as team players and as reasonable, collaborative people who take into account what others think. As evidence for this alternative interpretation, Hodges and Geyer (2006) remark that participants in Asch-style conformity experiments did not in fact see the lines differently. From post-experiment interviews it was clear that they were confident that the line the majority picked was the wrong length, and yet would in some cases agree with the majority anyway. Asch-style conformity experiments intentionally put two kinds of values in tension: on the one hand, social values such as belonging to a group and holding beliefs that acknowledge one’s sense of interdependence with it, and on the other hand epistemic values such as valuing truth and being committed to promulgate it. The mixed results of partial deference in the experiments can be explained as attempts of people to try to navigate these social and epistemic concerns, “participants work pragmatically to negotiate these conflicts in ways that acknowledge their interdependence with others and their joint obligations to values such as truth” (Hodges and Geyer, 2006, 2–3).

Levy (2019) makes the plausible claim that merchants of doubt deliberately politicize or aim to politicize minority views in science, so as to harness support for these views among receptive members of the electorate. Still, such partisan tactics only work if a belief can become a proxy for group membership. From an evolutionary perspective, there are many reasons to trust the beliefs that are predominant in the group one is a member of. For example, not going near the local swamp might be a good idea if malaria-infested mosquitos lurk there. But even beliefs far removed from everyday survival concerns, for example, religious beliefs, might be advantageous to hold. Believing what one's group holds helps people to coordinate action. This would even be the case if the beliefs were mistaken. Holding particular beliefs helps to emphasize within-group similarity and heightens between-group differences. Conformist bias, the bias to acquire the majority of one's in-group's beliefs, is adaptive under a wide range of circumstances, and emerges under a broad range of conditions (Henrich and Boyd 1998). Levy (2019) explains conformist bias as epistemic: adhering to majority beliefs would be epistemically valuable, but as we will see below, a broader social account can explain why people deem it important to hold beliefs that are arcane, prima facie implausible, and not relevant to everyday life, such as theological and political views.

Social identities become salient as people accentuate differences between their in-group and the out-group, and emphasize similarities within their in-group. This is why members of the same group tend to dress and eat similarly, and also hold similar beliefs. One way to enhance within-group homogeneity is to hold beliefs that are less likely to be held by out-group members. This is especially the case when beliefs are counterintuitive, because it is unlikely that another group would hit upon the same counterintuitive belief. For example, the doctrine of the Trinity separated the orthodox from non-orthodox Christians in early Christianity. It separates the notions of substance and person, and holds that the Christian God is three persons in one substance, a tricky concept for non-theologians. In this way, counterintuitive beliefs become an easy marker for in-group affiliation by drawing a clear distinction between the beliefs of the in-group and those of the out-group. Early Christians who defended the doctrine of the Trinity did not particularly want to differentiate themselves from other Abrahamic monotheists, but especially from other early Christian groups such as the Arians (Nicholson 2016).

Denialist beliefs are not counterintuitive in this way.<sup>1</sup> In fact, they are often in line with intuitive beliefs. For example, creationism may be an intuitive stance. When they are under time constraints, professional biologists exhibit teleological tendencies, a hallmark of creationist thinking, endorsing statements such as "Trees produce oxygen so that animals can breathe" (Kelemen et al. 2013). Miton and Mercier (2015) identify two cognitive predispositions that favor anti-vaccination beliefs: an intuitive sense of disgust at the thought of being injected even with a minute amount of active (disease-related) substance. Moreover, people have an omission bias in moral evaluations, feeling it is worse to do something that has harmful effects (i.e., vaccinating one's children with alleged adverse effects) than it is to omit to do something (i.e., failing to vaccinate one's children), even if this were to lead to bad effects such as a measles epidemic. Moreover, religious beliefs might have a special status in that they are less responsive to evidence than other kinds of belief (see Van Leeuwen 2017 for a defense of this claim). Nevertheless, there are relevant similarities between accepting denialist

beliefs and endorsing counterintuitive religious beliefs: both types are beliefs the holder knows are not widely shared in the world at large; they are only shared among her fellow in-group members. Evidence for this claim comes from studies that indicate that even staunch partisan voters are capable of holding factual beliefs that go against the grain of their preferred party's stance. For example, Democrats are more likely to deny that the deficit rose during the Clinton administration than Republicans, and Republicans are more likely to deny that inflation rose under Reagan, but if offered a financial reward for correct responses, the gap between Democrats' and Republicans' acceptance of such factual political claims decreases (Bullock et al. 2015).

Note that in my account belonging is one factor at work in people's decision to defer to specific forms of scientific testimony. Epistemic concerns also play a role. But given that concerns about group membership are often more salient than epistemic concerns, the former often trump the latter. This hypothesis explains recent mixed results and failures to replicate the so-called backfire effect. The backfire effect is a controversial psychological mechanism where people who are presented with corrections to partisan beliefs will, as a result, dig in their heels and become even more emboldened. For example, parents who were concerned about the safety of the MMR vaccine were confronted with various forms of information to counter their vaccine hesitancy. After these interventions, they became even less willing to vaccinate their children (Nyhan et al. 2014). Such observations are in line with the cultural cognition thesis (e.g., Kahan et al. 2010, 2011), where assessments of risk and factual information are mainly, or perhaps even solely, modulated by cultural values.

However, other experiments have found that the backfire effect is unreliable and cannot be induced under a variety of conditions. (Keep in mind while reading the following that these studies do not prove that the backfire effect does not exist, but they do indicate that it can remain absent under some conditions.) In a large-scale experiment involving > 10,000 participants with MTurk<sup>2</sup> Wood and Porter (2019) found that presenting people with corrections to false partisan beliefs leads them to align their beliefs more with correct factual statements. They presented participants with incorrect claims made by politicians, e.g., that immigrants are more criminal (Trump), or that hedge fund managers pay less taxes than workers (Clinton). They then gave people corrections to these false beliefs (e.g., undocumented immigrants have lower records of criminal offences compared to US citizens, hedge fund managers pay more taxes). They did not find that participants dug in their heels. Instead, subjects adjusted their beliefs to be more in line with the facts. Similarly, Van Der Linden et al. (2017) found that showing the public (people from across the political spectrum) that scientists agree that climate change is human-induced increases beliefs that climate change is happening, worrisome, and threatening.

These experiments indicate that people are not solely motivated by purely social concerns (belonging) or epistemic concerns (holding correct beliefs), but rather, by a mix of both. In the experiments where the backfire effect fails to materialize, participants likely were motivated by epistemic concerns as they corrected their partisan beliefs. However, while experiments can induce such changes, there is no large-scale shift in public opinion; beliefs about climate change (and other scientific phenomena) are more polarized than in recent history. One explanation for this might



be that people participating in experiments are isolated, whereas under more naturalistic conditions people are often surrounded by members of their in-group when they receive or digest scientific information.

To sum up, my view is not that our beliefs are exclusively motivated by social belonging (Kahan), nor that they are exclusively motivated by epistemic concerns (Levy). Rather, I hold that both factors play a role in the beliefs we endorse. In due course, the following experimental manipulation could help to test my hypothesis<sup>3</sup>: If a perceived-as-competent expert from an out-group were perceived to be as benevolent as an expert from the in-group, then (on Levy's view) the out-group expert would be just as likely to be believed on a hot-button political issue. On my view, however, the perceived-as-benevolent out-group expert would suffer some credibility deficit, merely because she is seen as an out-group member.

#### **4. Three strategies to help novices pick the right experts**

Given that both epistemic and social concerns matter in the acceptance of scientific beliefs, there are three potential ways to improve science communication, which I will review in this section. The first, improving the message, focuses on people's epistemic concerns by improving their understanding. The second, improving the messenger, focuses on people's need for belonging in accepting scientific testimony. The third, improving the epistemic landscape, focuses both on social and epistemic considerations and seeks to alter the informational ecology of people's beliefs by countering partisan misinformation.

##### **4.1 Improving the message: debiasing strategies**

A central feature of the novice-expert problem is that the novice cannot directly evaluate the testimony of the expert and thus has to use indirect cues, such as fluency of the speaker, or the standing of the speaker in the scientific community. If the message is politically polarized, this can lead to a negative evaluation of the speaker in terms of benevolence, as Levy (2019) argued. Proponents of the cultural cognition thesis, such as Kahan et al. (2010), have proposed that because of the importance of cultural values in the appraisal of scientific research, informing people will not substantially change their minds. However, there have been several historical instances where scientific literacy increased, and as a result, laypeople's acceptance of scientific theories improved. For example, the belief that the Earth is at the center of the universe is no longer widespread. Indeed, whereas the main battle between science and religion used to be in the domain of cosmology, as exemplified by the Galileo affair (Dawes 2016), the current battleground is evolution and religion (see Bowler 2007 for a historical analysis).

Ranney and Clark (2016) argue that improving the message can improve the acceptance of polarized scientific ideas and decrease denialism. In a series of experiments, they demonstrated that the vast majority of Americans do not understand how climate change works. They then went on to show their participants

brief explanatory videos that elucidate the mechanisms behind human-induced climate change. Their key idea was that mechanistic knowledge has a special status: if people understand the mechanisms involved in climate change, and in other contentious scientific topics such as evolution, this will improve their ability to evaluate scientific testimony. A series of earlier psychological experiments has shown that people have an illusion of explanatory depth (Rozenblit and Keil 2002): when participants have to rate how well they understand how a helicopter, a zipper, or the tides work, they consistently give themselves a high rating. However, after they are tasked to explain in detail how these phenomena work (e.g., draw a diagram of how a helicopter lifts), they realized that they have only a shallow, superficial understanding. Mechanistic explanations help to counter the illusion of explanatory depth (Fernbach et al. 2013). Given that mechanistic explanations not only increase understanding, but also make people aware of the limits of their understanding, this might provide people with more incentive to trust scientific consensus.

Ranney and Clark (2016) tested this prediction by providing mechanistic explanations of climate change (see [www.HowGlobalWarmingWorks.org](http://www.HowGlobalWarmingWorks.org) for videos and transcripts). These interventions dramatically increased people's understanding of how climate change works, and their acceptance of it. In several of their experiments they found that conservatism did not interact with people's increased acceptance of global warming. Even among the most conservative-identifying participants, the majority was more convinced that global warming occurred after receiving a mechanistic explanation.

In this experiment, the epistemic factor was manipulated (greater mechanistic understanding), but the social factor (political beliefs) was not. Since epistemic factors play a role in accepting scientific testimony, one can expect that improving understanding produces a positive effect. The problem with individual debiasing strategies such as Ranney and Clark's (2016) is that they require a substantial overhaul of the approach to science communication. Debiasing strategies are most likely to be successful if they are incorporated in school curricula and other long-term structural features of people's learning. If they are just sporadic, then social factors would quickly swamp one's improved understanding: a conservative who feels swayed by the climate change videos might be persuaded by her in-group members that the creators are just left liberal academics who try to indoctrinate her.

#### **4.2 Improving the messenger: the benevolent testifier**

Testimony to scientific information could be improved by having testifiers who appear benevolent and who are part of the audience's in-group, for instance, a political conservative who accepts anthropogenic climate change or an Evangelical Christian who defends evolutionary biology. A benevolent testifier signals that in order to belong to a given religious or political community, it is not a requirement to adopt fringe scientific beliefs such as creationism. Levy (2019, 322) holds that the mere assertion of specific scientific views can signal a lack of benevolence, for example, about anthropogenic global warming (AGW) he claims that, "affirming the 'wrong' view constitutes a signal of a lack of benevolence and thereby of reliability. That is, since the

left has come to be identified strongly with a particular view on AGW, affirming that view is signaling support of a political set of values and thereby a lack of benevolence to conservatives.” However, if denialism is epistemically and socially motivated (rather than purely epistemically motivated), one would expect at least some receptivity to benevolent testifiers. Benevolent testifiers could, in this picture, have a depolarizing effect.

I will here examine the benevolent testifier strategy and its impact on acceptance of evolutionary theory. Although evolutionary theory is widely accepted in European countries, including those with a high percentage of Christians (but see Blancke et al. 2014, on the rise of creationism in Europe), the United States is more polarized. Evolution and religion are commonly regarded as incompatible, particularly among Evangelicals and Latter Day Saints (Mormons). In a systematic review of industrialized countries, Miller et al. (2006) found that only Turkey has a lower acceptance of evolutionary theory than the US. In their study, about a third of American adults firmly reject evolution, and only 14% believe it is definitely true, with the remainder (about 55%) being uncertain. More recent polls conducted in the US (e.g., Swift 2017) show more acceptance of evolution, with about 38% believing in creationism and rejecting evolution, and 57% accepting evolution (the latter number includes both people who believe in theistic evolution and people who believe God played no role in the evolutionary process). Surveys like these consistently show a strong association between religiosity and evolution, at least among Christians, Muslims, and Mormons<sup>4</sup>.

Benevolent testifiers within Christianity include the theologian Denis Lamoureux (2008), the geneticist Francis Collins (2006) and the cell biologist Kenneth Miller (2007). In their popularizing works, these authors signal that they Christian believers who accept evolution, in other words, that they are part of the relevant religious in-group. For example, Lamoureux (2008) starts his book as follows:

I am a thoroughly committed and unapologetic born-again Christian who holds a PhD in theology. And I am a thoroughly committed and unapologetic evolutionist who has a PhD in biology. I often begin public lectures by stating these facts, and as most can appreciate, it certainly captures the attention of my audience! The common perception both inside and outside the Church is that Christianity and evolution are forever irreconcilable. So can a Christian be an evolutionist? Most people today say, “No.” My answer to this question is a resounding, “Yes”. (Lamoureux 2008, xiii)

Throughout the book, Lamoureux (2008) repudiates a literalist reading of the Bible while also defending a model of theistic evolution, which stays quite close to the classical Christian doctrine of creation, in seeing God as the creator of the world and the instigator of natural processes including evolution.

There are only a few empirical studies that investigate whether benevolent testifiers improve acceptance of evolutionary theory among religious people. One such study (Holt et al. 2018) examined whether the presence of Mormon benevolent testifiers influenced the acceptance of evolutionary theory among Mormon students in the US. American Mormons have a low acceptance of evolution, with only 22% believing that

evolution is the best explanation for the origin of humans. Holt et al. (2018) compared acceptance of evolution after a semester of an introductory course in biology by either a benevolent testifier (a professor who was explicitly religious and took time explaining that Mormon doctrine is neutral with respect to evolutionary theory) or a professor who was not explicitly religious. Compared to students who were taught by non-benevolent testifiers, the students of benevolent testifiers had a more accurate understanding of evolution at the end of the semester and held fewer creationist beliefs as assessed by a questionnaire. Since Mormons place a high premium on authority, more work needs to be done within other religious groups to see to what extent benevolent testifiers might improve the uptake of polarized materials.

Nevertheless, Holt et al.'s (2018) study is in line with empirical work in the political domain that show that a benevolent source that communicates factual information not in line with one's political ideology can have a depolarizing effect. For example, Nyhan and Reifler (2013) found that conservative, but not liberal, Americans are influenced by a benevolent source when they learn corrections to politically polarized mistaken beliefs. Conservatives believe that the Obama administration raised taxes, which was not the case. When conservative-leaning participants received testimony that corrects this mistaken belief, they were more likely to accept it if it came from conservative-leaning sources, such as Fox News, whereas their suspicions were increased if the corrections came from liberal media such as MSNBC. While it seems plausible that benevolent testifiers can change minds, these will tend to be the most swayable ones. It is more difficult to reach people who are not actively looking for information that might potentially challenge their ideas. Benevolent testifiers depend on the goodwill of their potential audience to give them a hearing, or would require the active participation of leaders giving them a platform within relevant religious or political groups.

### **4.3. Improving the epistemic landscape**

The third strategy to counter denialism is improving the epistemic landscape, the informational environments in which science is communicated, by denying a platform to denialists. Such a strategy poses no demands on the audience, as it is not required to read up on relevant explanations (4.1) or to seek out benevolent testifiers (4.2). Instead, improving the epistemic landscape occurs by reducing the platform of denialists and thus increasing the overall quality of testimony to scientific theories. There are differing epistemic landscapes in which different forms of denialism thrive. Take climate change denial, creationism, and anti-vaccination (anti-vaxx) beliefs. Though these positions have structural similarities (denial of a widespread consensus by experts and polarization among the lay public), they are transmitted in different ways (i.e., their epistemic landscapes are different).

The public discussion on climate change only started slowly from 1959 and especially 1979 onward (Weber and Stern 2011), and is mainly played out in traditional media, such as newspapers and television, which, as I will show below, have become increasingly politically polarized around this issue. The discussion on evolution and creationism is significantly older: contemporary (old or young earth) creationism and related views such as intelligent design originate in nineteenth-century fundamentalist

Christian opposition to evolution in the US (see Bowler 2007 for a historical sketch). Anti-vaxx beliefs were given a big boost by the publication and media attention around a now retracted paper by Andrew Wakefield et al. in *The Lancet* in 1998 that alleged a link between the MMR vaccine and autism. Social media influencers, including celebrities, and social media groups are currently spreading anti-vaxx beliefs through a variety of channels such as closed Facebook groups and websites with misleading content (Kostkova et al. 2017). I will now discuss these different epistemic landscapes in more detail.

Merkley and Stecula (2018) investigated the role of traditional media in spreading climate science denial. They reviewed media traditionally read and watched by Republican voters, including newspapers (e.g., *Wall Street Journal*, *Chicago Tribune*) and TV channels (e.g., ABC, NBC, Fox News) from the 1980s to 2015. They found that climate skeptic messages in these media were not cloaked in pseudo-authority (fake experts), and that this was especially the case for the cable broadcaster Fox News. If people were solely guided by epistemic considerations in their acceptance of scientific testimony, as Levy (2019) holds, then one would expect that the sources that Republicans defer to would be (pseudo)experts, as these would be most likely judged as competent. Instead, denialist features with such (pseudo)experts were in the minority across the surveyed period. Nonetheless, in a random sample of news coverage from these outlets, party-specific Republican positions against climate change rose considerably, from 25% under the Bush Sr. administration to over 40% during Obama's second term. As these newspapers and TV channels became more climate-skeptic, so did Republican voters. Tesler (2018) obtained a similar picture using survey data, showing a connection between partisan media coverage and acceptance of anthropogenic climate change among voters, but he failed to find such a correlation for the acceptance of evolutionary theory. One possible reason for this disparity might be that the debate between evolution and religion is older than climate science, and so traditional media might not have the same influence on creationist beliefs. Vaccine hesitancy depends heavily on Internet media, including social media, because people frequently turn to the Internet to seek out health advice for themselves and their families. This is in line with a broader shift in patient attitudes away from deference to medical doctors to a more pro-active attitude of seeking out information for oneself. Websites, Facebook groups and anti-vaxx twitter feeds capitalize on this (Kata 2012). Strategies include the use of twitter bots (fake profiles that look genuine, directing followers to websites with anti-vaxx information), and the mobbing on Facebook of medical practitioners who argue for childhood immunizations, thereby attempting to silence them (Wong 2019).

These differing patterns for climate change, evolution, and vaccines indicate that a one-size-fits-all solution for denialism might not be appropriate. For example, given how entrenched the relationship is between denial of evolution and religious self-identification, the benevolent testifier strategy (4.2) might be most effective in propagating the acceptance of evolutionary theory among religious groups. By contrast, climate change denial might be best countered by regulating the media, and the threat to public health by the plummeting childhood immunization rates might be best dealt with by regulating social media.

## 5. Conclusion

I have examined why people defer to scientific fringe theories. A popular explanation of this phenomenon (termed denialism) is that people find themselves at the end of testimonial chains that trace to merchants of doubt and pseudo-experts. Levy (2019) has recently argued that these deferential chains can be explained as a result of epistemic bad luck, as people use sensible heuristics (benevolence and competence) to assess scientific testimony which go awry in the case of denialism. As I have argued, this fails to account for social considerations in the evaluation of testimony. An alternative explanation (Kahan et al. 2010) says that people are driven by cultural values and perceive scientific information through this cultural lens. I have argued that this fails to account for increasing partisanship in the reception of scientific information, especially in the US, and that it fails to explain a lingering concern for epistemic considerations, recently emphasized by failures to replicate the backfire effect.

I have reviewed three strategies that can help combat denialism: improving the message, improving the messenger, and improving the epistemic landscape. The last strategy is likely the most effective, but would require a significant overhaul in how our various forms of media are regulated. Overall, the picture is pretty bleak: without intervention we can expect that partisan denial of scientific information will worsen through increased partisanship in traditional and digital media.

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<sup>1</sup> I owe this point to Neil Levy.

<sup>2</sup> MTurk participants tend to be more diverse in demography and age than the standard population of undergraduate students.

<sup>3</sup> With thanks to Neil Van Leeuwen for this suggestion.

<sup>4</sup> In Hindus in India, by contrast, acceptance of evolution is high (68%), regardless of political affiliation, which is perhaps due to a perceived higher compatibility between evolutionary theory and Hindu beliefs, in particular, avataric evolutionism, which has the concept of the God Vishnu who took on the avatar of different creatures that can be placed on an evolutionary scale, such as fish, amphibian, mammal, human (Bast and Tahiraman 2018).