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Review

# Conspiracy beliefs and science rejection

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**Abstract**

We review recent work on the relationship between science rejection and conspiracy beliefs. We distinguish between conspiracy beliefs about science specifically and the link between general conspiracist worldviews and science rejection. The first imply the scientific community as the center of a conspiratorial endeavor to misrepresent scientific findings. We outline several potential contributors to these beliefs: science is a social enterprise; its policy implications can clash with deeply held personal beliefs; science is inherently uncertain. Second, more general conspiracist thinking and worldviews also contribute to science rejection, for example in the domains of climate change, vaccination and genetic modification. This could be exacerbated by several cognitive biases associated with conspiratorial thinking. Finally, we briefly review pathways to curb (conspiratorial) science rejection.

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**Keywords**

Science rejection, Conspiracy beliefs, Scientist stereotypes, Vaccination, Climate change, GMOs.

There seems to be an increasing gulf between scientific consensus about facts and public acceptance of those facts. This observation is widely shared by concerned scientists, science organizations, politicians, and journalists. It is evident that science skepticism (i.e., the systematic and unwarranted rejection of science) can have severely damaging effects on individual and societal health as well as on the healthy functioning of society. One stark example of the potentially catastrophic impact of the systematic rejection of science on public health concerns COVID-related insufficiencies in vaccination rates, which have led to a preventable spread of COVID-19 and unnecessary cases of patients developing severe symptoms. Science rejection does not just affect public health: it also negatively impacts on the healthy functioning of society (e.g., hospitals functioning at manageable capacity, prevention of future lockdown scenarios). The effects of science rejection can also be seen beyond COVID-19, ranging from potentially irreversible [1] effects of human emissions on global warming stemming from doubts about or denial of climate change, problems with childhood vaccination rates against MMR, anti-GMO sentiments across European countries [2], and anti-evolution lobbies censoring high school education materials.

Progress made in the last couple of years in research programs by our own lab and various others have led to a relatively good understanding of the antecedents of science rejection across the most widely discussed contentious science domains [3–6]. In a nutshell, climate science skepticism is reliably predicted by political conservatism, while vaccine skepticism is predicted by various factors, including spirituality and scientific literacy. Skepticism about GMO's – in contrast – is reliably predicted by low science knowledge, whereas rejecting evolutionary theory is predicted by religiosity, in particular religious orthodoxy.

Of course, while individual differences in ideology, religious and spiritual beliefs, as well as science knowledge are important predictors of science rejection, they explain only part of the variance. This begs the question of what other contributors might be "out there" that help to paint a more complete picture of science rejection within and perhaps across domains. The recent Attitude Roots model [5] identifies various candidate contributors, or "roots", which shape surface attitudes that signal science rejection. One of these roots is belief in conspiracies and conspiratorial thinking [7–10], which will be the main focus of the current article.

While the aforementioned research measured conspiratorial beliefs by tapping into endorsement of (general) conspiracy statements known worldwide and are – in terms of content – unrelated to science, science itself is also often a target of conspiratorial beliefs. While the first can be conceived as generalized tendencies contributing to science rejection, the latter is an integral

part of it — scientific evidence is rejected because it is seen as a product of conspiracy. In the next sections, we dive more deeply into conspiracy beliefs about science, and the impact of general conspiracy thinking on science attitudes. Finally, we briefly review evidence on curbing (conspiratorial) science denial.

## Conspiracy beliefs about science

While famously recognized conspiracy beliefs such as those surrounding the assassination of JFK or the existence of a New World Order are not about science or scientists, science is clearly a target of many conspiracy theories [11]. This is readily evident from the COVID-19 pandemic, throughout which the rise of many alternative theories about the virus' origin became apparent — ranging from the virus being a hoax to it being a bioweapon [12]. This is not a novel phenomenon — new viruses are routinely subjected to origin conspiracy theories (e.g., HIV/AIDS, SARS). In addition, conspiracy theories about science are not limited to the domain of virology — conspiracy theories about climate change, vaccination, genetically modified foods, flat earth, to name a few, all entail perceiving science as the center of a conspiratorial endeavor [13,14]. In other words, endorsing these conspiracies implies that scientists are colluding with each other and/or other interest groups (like governments or corporations) to distort or falsify their findings to fit a certain agenda.

The relatively high prevalence of conspiracy beliefs about science suggests that the public is sensitive to the fact that science is a social enterprise—conducted by individuals with their own ideological values and convictions [15]. Research on public perceptions of scientists corroborates this notion—scientists are stereotyped as highly competent, but potentially dangerous and capable of immoral deeds [16], making them plausible conspirators. Furthermore, populist views on science, which include perceiving scientists as part of the elite, predict less trust in and more negative views on science [17]. Such perceptions of scientists as a powerful elite group might be particularly important in shaping conspiracies about the biomedical and technical science domains, due to an active role scientists have in producing novel technologies, as well as the industry implications of these domains [18].

On the other hand, the existence of conspiracy theories in domains where the primary role of scientists is observing and reporting systems and processes in nature — such as climate change — indicate that conspiracy theories about science extend beyond the domain of biotechnology. It is possible that some people do not make or see a clear distinction between scientific facts and its policy implications [13,19]. For instance, conservatives show less agreement with environmental science, but only when its policy implications clash with their political ideology [20]. It seems likely this effect can be extrapolated beyond mere (dis)agreement with science, onto ascribing conspiratorial intentions to scientists and policy-makers when policy implications clash with deeply-held values (e.g., political or religious identity). More recently, the COVID-19 pandemic has demonstrated the scientific reality of the SARS-CoV2 virus, and its public health implications can be severely downplayed or rejected when perceived to impede personal freedom and autonomy [21,22]. This has implications for the causal direction of the relationship between belief in science conspiracies and important attitudinal and behavioral outcomes. In addition to exposure to conspiracies about vaccination or climate change leading to less intentions to vaccinate and mitigate climate change [23—25], this relationship could be bi-directional [26]. Thus, for example, not being willing to get vaccinated against SARS-Cov2 (for example due to an extreme fear of needles; [7]) could shape conspiratorial views about COVID-19 vaccines [27,28]. Paradoxically, such motivated conspiratorial attitudes are sometimes presented as supported by 'silenced' science (e.g., the 9/11 truth movement claiming it was "scientifically impossible" for the twin towers to have collapsed as they did as a consequence of an airplane crash and explosion; selective referrals to scientists who questioned the necessity of restrictive measures in the COVID-19 pandemic). Future longitudinal research should further uncover these causal connections between conspiratorial science belief and worldview-motivated science rejection.

Finally, some basic realities of scientific research make it a likely target of conspiracies. It is known that uncertainty and ambivalence promote conspiracy beliefs [29], and science is inherently uncertain and complex [30]. Predictions and theories change in light of new information, and scientists often cannot provide general guidelines applicable across contexts (which also relates to the distinction between scientific data and policy implications). When an unequivocally clear scientific explanation is lacking for an uncertain event, people with a strong need for answers (i.e., need for cognitive closure) are more likely to endorse conspiratorial explanations for these events [31].

## Conspiracy beliefs and science attitudes

Besides conspiracy theories about science itself, general conspiracist beliefs have implications for science rejection and skepticism. In this section, we first provide a sketch of some of the work on how general conspiracy beliefs (i.e., conspiracy beliefs unrelated to science) contribute to science rejection. Then, we highlight some of the cognitive biases related to conspiratorial thinking that stand in contrast to scientific thinking.

Consistent associations of science rejection and conspiracy beliefs point to the relative importance of generalized conspiratorial thinking for rejecting scientific evidence. For example, Lewandowsky and colleagues [14] showed that belief in unrelated conspiracies predicted GM food, vaccination and climate change rejection. Similarly, conspiracy thinking was found to be the strongest predictor of vaccination skepticism across 24 nations [7], and consistently contributed to the explained variance for general faith in science [9]. In a similar vein, perceptions of science as being corrupted by corporate influence was found to contribute to science rejection for climate change, vaccination, and GM foods, but not evolution [3].[1] Although this body of research suggests that conspiracy beliefs can be an important contributor to science rejection, more work is needed to systematically scrutinize when this is the case — i.e., the relative importance of belief in conspiracies across science domains, and when other ideological and knowledge predictors are accounted for, requires further attention.

There are several cognitive characteristics of belief in conspiracies which make them difficult to reconcile with scientific reasoning and thinking. First, conspiratorial thinking is related to a number of reasoning errors, such as the conjunction fallacy [32], jumping to conclusions [33], and even endorsing contradictory beliefs [34]. Second, a general conspiratorial mindset is related to a less analytical [35,36], and more intuitive thinking style [37,38]. This reliance on intuition is also reflected in epistemic beliefs. Conspiracy thinkers tend to believe that truth is intuitive and political, and they also require less evidence to form a veracity judgment [39,40]. This poses a challenge for science acceptance, because scientific ideas are often counterintuitive and complex, making their evaluation and acceptance more difficult [41,42]. Given their higher reliance on intuition, this can disproportionately impact conspiratorial thinkers. Furthermore, there is direct evidence linking lower factual science knowledge [43,44], as well as lower understanding of the scientific process [45], to conspiracy beliefs. Although science knowledge and understanding play a limited role in shaping science acceptance across scientific domains [3], it is likely that lower understanding of the scientific process might render it more difficult to navigate the complex world of science-related information, which in turn might contribute to endorsing more intuitively understandable explanations such as conspiracy theories.

## Curbing (conspiratorial) science rejection

Given the far-reaching societal and environmental consequences of science rejection, it is important to consider ways in which it might be reduced. While research on false information more generally [46] provides useful insights into the effects of misinformation and ways to counter it, the current focus is on evidence from studies on science-related attitudes more broadly, and their implications for countering science rejection.

One information-focused strategy for improving attitudes towards scientific topics is communicating the scientific consensus [47,48]. A recent meta-analysis showed that communicating the scientific consensus for climate change and genetically modified foods increases perceptions of that consensus, as well as pro-science attitudes (albeit with small effect sizes) [49]. Despite concerns about the potential polarizing effect of consensus messaging for individuals whose values don't align with it (e.g., consensus about climate change for conservatives; [50]), two recent meta-analyses found little evidence that communicating consensus about climate change [49,51] or genetic modification [49] backfires, at least for conservatives. However, this has not yet been investigated for conspiracism. Given that conspiracy beliefs are associated with a stronger need for being unique [52], which is in turn associated with anti-conformity [53], this requires further investigation. Finally, when it comes to correcting false beliefs, mere exposure to the scientific consensus might not always be equally effective across science domains [54,55]. Taking these issues into account, investigating boundary conditions of consensus message effectiveness, as well as ways to augment it using complementary communication strategies is needed.

In addition, recent research also suggests it is important to consider how scientists are portrayed in science communication. For example, recent work has found that scientists are seen as more trustworthy sources of advice on COVID-19-related measures as opposed to government officials [56]. Moreover, emphasizing communal (vs. self-oriented) motivations of scientists elicited greater trust and funding support [57]. Furthermore, including photographs of scientists in science information on social media increased perceptions of warmth, competence, and trustworthiness of scientists [58], countering the "competent, but cold" scientist stereotype [16]. Also, it is vital that scientists are equipped with knowledge on how to publicly debate science deniers, as it has been shown that not countering a denialist claim can have detrimental effects, while refuting rhetorical techniques used by deniers can be an effective strategy to minimize their influence [59].

Finally, our own lab has been working on an approach relying on perceptions of science in terms of its perceived distance to the self — the psychological distance to science (PSYDISC) model. Initial evidence shows that PSYDISC perceptions predict science rejection across

[1] It is important to note here that these associations were observed while controlling for various demographics, education and/or science knowledge, and various individual differences in ideology and religious belief.

several science domains (i.e., climate change, vaccination, evolution, genetically modified foods, genetic editing in humans) over and above individual differences in ideology, worldviews (including conspiracy beliefs) and knowledge [60]. Crucially for curbing science rejection, our most recent work suggests that presenting information from a specific science domain as closer to oneself improves attitudes in these domains.

To conclude, conspiracy theories (about science) can be intractable (as well as inevitable) antecedents of science rejection. However, various lines of research suggest that curbing (conspiratorial) science rejection is possible. Future research should place effort on honing our understanding of the associated processes and systematically compare the effectiveness of the various ways in which science rejection can be reduced or prevented.

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## Conflict of interest statement

Nothing declared.

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This paper introduces the psychological distance to science (PSYDISC) model of science rejection. The authors construct and validate the PSYDISC scale, and show that higher PSYDISC consistently predicts science rejection across domains, beyond demographic, ideological and knowledge factors, including conspiracy beliefs. Given the potential of psychological distance to be taken into account in science communication, the PSYDISC model provides a much-needed unifying framework for studying, and potentially reducing, science rejection across domains.