A Closer Look to the Problem of Scientific Misinformation

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Abstract

Science is our most reliable producer of knowledge. Nonetheless, a significant amount of evidence shows that pluralities of members of publics question a variety of accepted scientific claims as well as policies and recommendation informed by the scientific evidence. Scientific misinformation is considered to play a central role in this state of affairs. In this paper, I challenge the emphasis on misinformation as a primary culprit on two grounds. First, the phenomenon of misinformation is far less clear than what much discussion about the topic would lead one to believe. The evidence regarding the amount of misinformation that exits as well as its role in people's harmful behaviors is at best conflicting and at worst completely useless. Second, the prominence given to misinformation and its harms on people's behaviors disregards the role of values in policymaking and treats scientific information as if it were the only information necessary to make policy decisions. At a minimum, these problems call for caution regarding the emphasis on this phenomenon. After all, if the problem is incorrectly diagnosed, the solutions that are being offered to address the problem of misinformation are bound to at best inadequate and at worst dangerous.

Keywords: Scientific misinformation; effects of misinformation; science and policy; expertise.

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1. Introduction

Scientific experts are now part and parcel of policymaking in issues ranging from research priorities and public engagement strategies to economic incentives and educational approaches, to climate change initiatives, food consumption recommendations, and pandemic preparedness. It seems reasonable, of course, that scientific experts should have a role in policy advising. The speed of scientific and technological innovation, the complexity of the knowledge often relevant to policy decisions, and the need to manage the various risks associated with scientific and technological advances make expert knowledge crucial to contemporary societies. Policy makers have to make decisions about what labor strategies are more likely to work, how to minimize climate change, what economic policies can lead to lowering inflation, what mechanisms are best able to ensure the safety and effectiveness of drugs, they must determine whether the benefits of this or that new technological intervention are enough or whether they are worth the risks. Scientific information –both from the social and natural sciences-- is necessary to develop appropriate policies in all of those cases. Indeed, there is wide agreement among the general public that scientific knowledge contributes to better society in a variety of ways (Pew 2020).

Nonetheless, a significant amount of evidence shows that pluralities of members of publics are skeptical of a variety of scientific claims. For instance, although the scientific community overwhelmingly agrees that climate change is happening and that anthropogenic factors are a major cause, only about 58% of adults in the USA believe that human activity plays a primary role in climate change (Marlon et al. 2022). Likewise, even though significant amounts of Europeans consider GM foods to be unhealthy and 'unnatural' (Delmond et al., 2018; Scott et al., 2018), the majority of scientists consider them safe for human consumption. Similarly, many people harbor doubts about the safety and efficacy of Covid-19 vaccines (Lazarus et al., 2023;

Norhayati et al., 2022) but the scientific community takes vaccines to be one of the most safe and cost-effective public health interventions in the last century, with millions of lives saved (Li et al., 2021; Zhou et al., 2024).

A common explanation for this state of affairs –this gap between expert claims and what lay publics believe—is that the publics are ignorant, even willfully so, because they loath experts (Nichols, 2017). However, although it seems uncontroversial that scientific experts should be granted authority in scientifically related issues, determining what constitutes appropriate expertise, or who should count as a relevant expert, is not an easy or uncontroversial task (de Melo-Martín & Intemann, 2018). Indeed, science studies scholars and philosophers of science have presented serious challenges to the traditional understanding of expertise (Collins & Evans, 2007; Irwin & Wynne, 1996; Jasanoff, 1990, 2004; Knorr-Cetina, 1999; Selinger & Crease, 2006). Traditional notions of expertise have difficulty accounting for the increasing complexity of knowledge production where large national and international teams of researchers with multiple forms of disciplinary expertise are necessary (de Melo-Martín & Intemann, 2018). Think, for instance, of the many types of expertise relevant to climate change or genomic science. Furthermore, traditional notions of expertise disregard the value-ladenness of science and thus inappropriately grant scientists sole authority to make value judgments that affect a variety of stakeholders. But science is not value-neutral (e.g., (Anderson, 2004; de Melo-Martin & Intemann, 2007; Douglas, 2000, 2009; Dupré, 2007; Elliott, 2013; Longino, 1990; Wylie & Nelson, 2007). Contextual values (social, political, ethical) can exercise unavoidable and desirable influences in decisions regarding experimental design, choice of methodologies, characterization of the data, and interpretation of results. Judgments about how to balance inductive risks, how to interpret evidence, what should be counted as evidence, etc., all involve value judgments. Failing to believe some scientific claims then need not challenge the expertise of scientists as scientists.

A related explanation is that the gap between what the science says and what the publics believe is primarily the result of misinformation. Indeed, attention to the spread of misinformation and its damaging effects on people's beliefs and their behaviors has become so prevalent that the World Economic Forum has listed it as one of the global risks and the World Health Organization has coined a new term –infodemic—to refer to the rapid spread and amplification of vast amounts of valid and particularly invalid information (Eysenbach, 2020; Wilhelm et al., 2023). My goal here is to challenge some of main assumptions that ground the way the problem of misinformation is being framed. According to this framing, misinformation is prevalent, and its presence explains in a significant part the lack of uptake by lay people of scientific testimony about some scientific topics as well as their opposition to various scientifically informed public policies and recommendations. Challenging this framing is important not only because it is incorrect but also because the solutions that are being offered to address the problem of misinformation are bound to be either inadequate or dangerous.

2. Challenging the Misinformation Narrative

As mentioned, the misinformation narrative tells us that there is a global crisis characterized by the rapid spread of false information, or misinformation. Misinformation and its corollaries, such as disinformation, are bad for epistemic reasons: they create, or contribute to, confusion and produce false, inaccurate, or poorly justified beliefs. If misinformation is prevalent, it threatens knowledge not just for those who directly consume and believe it but for all of us (De Ridder, 2021). Where misinformation is widespread, it is more difficult to determine what is true and false or misleading. We must work harder to gain true or justified beliefs. When misinformation is presented in sophisticated ways –as it is now possible to do-- even those who are vigilant and have good critical thinking and media evaluation skills risk acquiring false or misleading beliefs.

Scientific misinformation is also bad for practical reasons. Our beliefs inform our decisions and actions. Hence, such misinformation can lead people to behave in ways that can be harmful to themselves and others. For example, believing that smoking is not unhealthy can contribute to a decision to smoke or to oppose tobacco restrictions. Likewise, believing that global warming is not produced by human action can lead to personal choices that exacerbate the problem, such as driving or challenging policies regulating oil products. Although the epistemic damages of misinformation are obviously important, what is most significant to the misinformation narrative are the social harms that presumably follow: people are simply not following the scientific evidence and they are not supporting, or they are actively opposing, policies and recommendations that are grounded on such evidence.

Of course, my goal here is not to argue that misinformation does not exist or that it does not affect people's beliefs in harmful ways. What I want to do is to question the emphasis on scientific misinformation as the culprit –or a significant one—of a state of affairs characterized by lay people's disregard or opposition to the behaviors or policies that are supported by certain scientific claims. I want to question this emphasis on two grounds. First, the phenomenon of misinformation is far less clear than what much discussion about the topic would lead one to believe –we are actually poorly informed about misinformation. The evidence regarding the amount of misinformation that exits as well as its role in people's harmful behaviors, e.g., failing to receive covid vaccines, failing to support policies to mitigate climate change, etc., is at best conflicting and at worst completely useless. Second, the prominence given to misinformation and its harms on people's behaviors disregards the role of values in policymaking and incorrectly treats scientific information as if it were the only information necessary to make policy decisions. At a minimum, these problems call for caution regarding the emphasis on this phenomenon. It certainly also calls for reflection on the solutions that are proposed to address the presumed damages of misinformation.

2.1 Misinformation and Its Discontents

Terms such as misinformation, disinformation, fake research, fake news are everywhere. Misinformation, in its various guises, seems to threaten every aspect of our lives: political elections, medical advice, and public health policy, to name just a few. Indeed, anyone paying attention to the press, scholarly articles, or the media would be forgiven for believing that most of what is being said about practically anything is simply untrue. By some accounts, the spread of misinformation has acquired epidemic proportions (Eysenbach, 2020; Wilhelm et al., 2023). And, of course, as misinformation has presumably proliferated, research on this phenomenon has also grown (Alvarez-Galvez et al., 2021; Do Nascimento et al., 2022; Mende et al., 2023; Miro-Llinares & Aguerri, 2023; Suarez-Lledo & Alvarez-Galvez, 2021; Wilhelm et al., 2023). Research attempting to determine how common misinformation is, how it spreads, what factors make it more (or less) likely to be believed, what effects it has, how it can be combated, has ballooned in the last few years (Alvarez-Galvez et al., 2021; Chen et al., 2023; Do Nascimento et al., 2022; Melchior & Oliveira, 2023; Mercier, 2020; Miro-Llinares & Aguerri, 2023; Muhammed & Mathew, 2022; O'Connor & Weatherall, 2019; Suarez-Lledo & Alvarez-Galvez, 2021; Zimdars & McLeod, 2020).

However, at least some evidence suggests that estimates of misinformation might be exaggerated (Allen et al., 2020; Grinberg et al., 2019), and thus that the attention to it might be unwarranted. Indeed, reliably determining how much scientific misinformation exists is easier said than done. This is so for various reasons. First, there are various related concepts – misinformation, disinformation, malinformation, fake news and propaganda – that are not always easy to disentangle (Aimeur et al., 2023; Altay et al., 2023; Cacciatore, 2021; Lewandowsky, 2021; Tandoc & Seet, 2022; Zimdars & McLeod, 2020). For example, while misinformation is defined as false or inaccurate information, disinformation involves sharing false or misleading information purposefully. Malinformation, on the other hand, refers to accurate information that

is used maliciously or out of context with the goal of harming a person or a group. Different researchers use different definitions for these terms, putting more or less emphasis on inaccuracy, untruth, falsity, deception, unintended tendencies to mislead, and so on (El Mikati et al., 2023; Habgood-Coote, 2019; Krause et al., 2022; Scheufele & Krause, 2019). These are complex concepts under any circumstances, but their complexity is even more vexing when trying to use "fact-checking" tools to measure these phenomena in social media (Barve et al., 2022; Vinhas & Bastos, 2022; Walter et al., 2020).

Of course, in some cases, identifying a false statement can be relatively easy. But often, it is not. For instance, for those who understand the technologies involved, the notion that Covid vaccines could contain tracking chips is ridiculous, but even people who keep up with new developments in science and medicine can be confused about cutting-edge developments, e.g., AI technologies, genome-editing tools, since the knowledge changes very rapidly and involves complex scientific and technological information. Moreover, there are many legitimate areas of scientific disagreement. Witness, for instance, the controversy over the efficacy of masking to minimize the spread of COVID-19 (Gurbaxani et al., 2022; Jefferson et al., 2023). In cases where the science is in flux, the evidence is limited, uncertainty is high, and various reasonable interpretations can be provided regarding the existing evidence, it is not easy to determine whether someone is disseminating or sharing false or inaccurate claims (de Melo-Martín & Intemann, 2018). Moreover, according to some evidence, studies that operationalize being misinformed mostly in terms of individuated evidence-incongruent beliefs, (e.g., hydroxychloroquine is an effective treatment for COVID-19; only GMO have genes, etc.,) are likely to miss whether people understand the bigger-picture of the phenomenon in question, e.g., Covid-19 spread and treatments; GMO's safety (Reyna et al., 2021; Scheufele et al., 2021).

Assessing whether intentionality is present is an even harder task. Clearly, mistakes can happen, and people can share false or inaccurate claims for a variety of reasons that do not

involve intention to deceive, including simply habit or inattention (Ceylan et al., 2023; Pennycook & Rand, 2021). Furthermore, when assessing intentionality, whose intentionality should be considered relevant? Science is a social enterprise. Scores of researchers are often involved in producing research and their intentions may be varied. Additionally, independently of the intentions of scientists conducting the research, many others, scientists and non-scientists, can use scientific results in various ways. Relevant parties can thus have conflicting motives some of which will be consistent with providing accurate scientific information, while others will not. Furthermore, although producers of disinformation might intend to deceive, those subsequently spreading the false information might not, as many might actually believe that the information that they are sharing is accurate or they might consider obvious that it is false and thus, that no one else will believe it. It is also difficult to determine what exactly will be taken as evidence of intention to deceive and how that can be accurately ascertained (de Melo-Martín & Intemann, 2018; Shu et al., 2018).

With no consensus about the basic concepts and about how to operationalize them, it is obviously difficult to quantify the phenomenon. Hence, claims about an epidemic of misinformation should be taken with caution. This is of course of no small importance. Part of the urgency regarding misinformation and what to do about it is related to its presumed volume. If misinformation is limited or confined only to minor sectors of the information ecosystem, then the amount of attention it receives is misplaced.

Second, even if characterizing and quantifying misinformation were unproblematic, what the impact of such misinformation is would still need to be answered. Remember that misinformation and related phenomena are concerning particularly because of the presumed effects that they have on people's behaviors and thus the consequences that they can ultimately have on people's health and wellbeing (Chua et al., 2021; Tasnim et al., 2020; Van Prooijen et al., 2023), in general public health (Romer & Jamieson, 2020; Roozenbeek et al., 2020), or in public policy action (Cook et al., 2018; Maertens et al., 2020; Oreskes & Conway, 2010; Zhou &

Shen, 2022). But determining how misinformation is received, is far from straight forward. The most common metric used to study the effects of misinformation on people's behavior is evaluating how they engage with it, and particularly, people's sharing behavior. However, evidence about the extent that misinformation is shared is contested. Although some studies indicate that sharing of misinformation is prevalent (Chadwick et al., 2018; Del Vicario et al., 2016), others have found that misinformation is shared by only a small minority of internet users (Allen et al., 2020; Altay, Hacquin, et al., 2022; Grinberg et al., 2019). Furthermore, that people share misinformation is not at all an indication that they believe it (Altay & Acerbi, 2023; Mercier, 2020; Wagner & Boczkowski, 2019). As mentioned earlier, people can share misinformation for all kinds of reasons whether or not they believe what they are sharing, including to express particular emotions (Vosoughi et al., 2018), to signal group identity (Osmundsen et al., 2021), as a form of resistance (Arceneaux et al., 2021), out of habit (Ceylan et al., 2023), or simply because false or inaccurate information is more interesting (Altay, de Araujo, et al., 2022).

Assessing the causal effects of misinformation on people beyond their sharing behavior is even more complex. The assumption is that had factually inaccurate information not been encountered, then the harmful behaviors (e.g., to individual health, public health, policymaking) would not have occurred or at least they would have been less likely. However, the evidence of these effects is again contested. Results are at best mixed, with some studies showing that exposure to, for instance, COVID vaccine misinformation was correlated with reduced intentions to receive the vaccine (Loomba et al., 2021; Romer & Jamieson, 2020), and others showing no effect or inconsistent ones (de Saint Laurent et al., 2022; Greene & Murphy, 2021; Guess et al., 2020). Importantly, none of the studies that take misinformation to be responsible (at least in part) for problematic behaviors actually shows any causal relationship between misinformation and behavior. The majority of the studies simply rely on self-reports about one's willingness to act in particular ways, and often claims about the effects of misinformation on behavior are simply based on correlations. Notably, very few studies actually examine offline behavior itself

(Murphy et al., 2023). The grave concerns over the effects of misinformation on people's behavior is also puzzling given that changing people's behaviors is not that easy even when correct is used (Murphy et al., 2023; Trafimow & Osman, 2022). Additionally, evidence shows that many factors affect the relationship between belief and behavior, which explains the weak relationship between beliefs, attitudes, and behavior (Albarracin & Shavitt, 2018; Soutter et al., 2020; Verplanken & Orbell, 2022).

The problems determining what exactly the effects of misinformation are call for care when making statements about how serious and widespread a problem scientific misinformation is when it comes to people's beliefs and particularly to their behaviors. Poor information environments are not, after all, a recent problem (Adams et al., 2023; Scheufele et al., 2021). People have produced, shared, and believed false or misleading information in the past. Modern communication tools may make misinformation easier to spread, but they also provide unprecedently easy access to accurate information (Murphy et al., 2023).

Given the challenges to characterizing the phenomenon of misinformation, measuring it, and determining its effects, caution seems to be warranted regarding what we should make of this phenomenon and certainly how we should address it. At a minimum, more conceptual and methodological clarity is needed. Correctly understanding the problem is necessary to ensure that the solutions proposed are successful.

2.2 Values in policymaking

Another reason to question the current emphasis on misinformation is that it minimizes, or even completely disregards, the essential role of social, political, and ethical values in people's acceptance or rejection of science-based public policies and recommendations. People's rejection of scientifically informed policies or advice need not be evidence that they reject scientific expertise or scientific information; that is, it needs not be evidence that they are

misinformed. Even if lay people agree that scientist have appropriate scientific expertise and even if they find the information experts provide to be credible, this type of expertise and information are hardly the only relevant ones to policy advice.

It is uncontroversial, that while science is necessary to inform many public policies, science alone does not dictate which policies should be implemented. A variety of value considerations, political, social, ethical, are necessary and appropriate when making policy decisions for which science is also important. Policy makers trying to, for instance, approve vaccines or regulate some substances ought to rely on scientific information regarding whether vaccines are safe and to what extent a particular substance is toxic. But, as mentioned earlier, scientists have no special expertise or authority in making ethical, political, and social value judgments. And thus, they have no expertise to advice about whether vaccines should be mandatory or whether the economic benefits of not regulating the substance in question outweigh the health risks. Moreover, scientists as a group are not representative of the values held by members of pluralistic societies. Indeed, the reliance on scientific experts when making policy decisions has been condemned by many as a sign of increasing technocratization or scientization of policy (Christensen, 2018; Habermas, 2015; Lentsch & Weingart, 2011; Welsh & Wynne, 2013; Wynne, 2006).

To insist that people's opposition to policies to reduce climate change or to receive vaccines, for example, is the result of scientific misinformation is to incorrectly presuppose that scientific evidence alone is relevant to these types of policy decisions or advice. Of course, no one would defend this assumption explicitly. However, it is difficult to make sense of much of the debate on the adverse effects of misinformation on public policy or individual behavior without this assumption.

A reason why this incorrect assumption is so common is that in many cases the values that underlie policy choices are shared ones. For instance, if scientists find that a medical drug is ineffective or unsafe, then it seems that the evidence straightforwardly dictates policies that

restrict or ban the drug in question. If they determine that a substance is extremely toxic when consumed by people, scientific evidence appears to dictate policies that would limit its use. But the direct path from evidence to policy is an illusion. Relatively uncontroversial value judgments accompany these policy decisions, among them that human health ought to be protected. Because the values are widely shared, they go unnoticed, but scientific evidence alone do not dictate policy decisions or advice.

The assumption that opposition to certain policies or advice is largely the result of misunderstandings about scientific claims is, of course, false. There are good reasons to believe that resistance to science-based policy recommendations often arises because of disagreements about the values that underlie policy choices, rather than simply because of confusion or rejection regarding the state of the science. Failure to accept certain scientifically informed policies or actions may be the result of disagreements about what has value, how to interpret particular values that are shared, how to weigh competing goods when they conflict, or how best to promote particular policy goals (de Melo-Martín & Intemann, 2018). These value disagreements are not mutually exclusive and can simultaneously arise in policy debates in interrelated ways. For instance, one might agree –or need not disagree-- with the fact that climate change is occurring, that humans are primarily responsible for it, and that it is a serious threat to the planet, and still oppose mitigation policies on a variety of grounds, including lack of concern about future generations, reservations about the economic effects of such policies, beliefs in humans' ability for innovation, responsibility attributions, lack of trust on institutions to bring about change, or worries about fairness (Armesto, 2021; Bergquist et al., 2022; Faure et al., 2022; Jagers et al., 2021; Kalch et al., 2021).

Indeed, some recent evidence regarding people's attitudes about climate change show that majorities of citizens all over the world feel somewhat or very concerned about the harm they would personally face from climate change and consider climate change a serious threat (Statista 2021, Pew 2022). For example, 77% of Germans consider climate change a global

emergency. Yet only 44% of them fully agree with the statement 'each person is personally responsible and should behave in a climate-friendly way' (Statista 2021). Similarly, in the USA, the majority of people say they see the effects of climate change in their own communities, believe that the federal government is not doing enough to reduce the impacts of climate change, and favor the U.S. taking steps to become carbon neutral by 2050 (Pew 2022). But they also say that the U.S. should use a mix of renewable and fossil fuel energy sources rather than phasing out the use of oil, coal, and natural gas completely (Pew 2022). Believing the science does not lead to agreeing with what to do about it.

The fact that the implicit assumption that science alone calls for particular policies is so common is not problematic merely because it is false. It also has negative consequences for policy debates: it diverts attention away from the values that necessarily play a role in policy-making and prevents assessment of such values, some of which might be illegitimate or unjustified (de Melo-Martin & Intemann, 2013; de Melo-Martín & Intemann, 2018; Hicks, 2017; Pielke, 2007). Furthermore, in obscuring the role of values in policy-making acceptance, the focus on scientific misinformation prevents engagement with relevant stakeholders about the values they hold (de Melo-Martín & Intemann, 2018; Goldenberg, 2021). Eclipsing the role of values in policy disagreements makes their evaluation difficult. Insofar as the values at stake are problematic, and thus difficult to defend publicly, failure to attend to values will leave them not just concealed, but unchallenged.

Of course, value disagreements are not easy to address, but if such disagreements – rather than scientific misinformation—are primarily responsible for people's policy positions, then attending to them is crucial. If disagreements about policies are mainly the result of disagreements about values, then no amount of scientific evidence, even evidence that lay persons find reliable, will resolve such disagreements. Making clear the ways that values play a role in policy decisions and clarifying what the values at stake in particular cases are may go a long way towards advancing policy debates in fruitful ways.

A further advantage of engaging with issues of values instead of simply attending to the role of science misinformation is that it removes the strong incentive that those opposing certain scientifically informed policies have to attack scientific claims and promote misinformation. Importantly also, disregarding the role of values in policy can also hide the need to generate the kind of empirical evidence that would be relevant to ground certain policies or to address stakeholder concerns (de Melo-Martin & Intemann, 2018). Policies that aim to protect against some harms make assumptions about what is valuable and worth protecting. Alternative assumptions about what has value or how to interpret those values may call for different kinds of empirical evidence. In climate change, for example, what evidence is needed for developing effective adaptation policies depends on what it is that we are trying to adapt to, but this in turn also has implications regarding the data that we need to collect and the kinds of models that are important (Eriksen et al., 2021; Intemann, 2015). Similarly, if people refuse to vaccinate their children because they are concerned about risks to their particular child, then evidence about the extent to which such vaccines are safe and effective for achieving herd immunity will be unpersuasive (Goldenberg, 2021). Consequently, attention to values related to policies can help produce science that is policy relevant.

3. Solving What?

In addition to misidentifying what the problems that we need to address are, emphasis on misinformation also calls for solutions that, if my analysis here is correct, are likely to be of little use and can even be dangerous.

If misinformation is a serious problem to science-based policy decisions and recommendations, as the current narrative would have it, then strategies to correct it seem the solution (Ecker et al., 2022; van der Linden, 2022). Fact-based corrections that address inaccuracies in the misinformation and provide accurate information are one of the most

common correction strategies (Lee et all., 2023). Also common is to pinpoint logical fallacies such as highlighting inherently contradictory claims (Cook et al., 2017). Other usual ways of correction involve undermining the likelihood of the misinformation or the credibility of its source (Hughes et al., 2014; Yang & Beatty, 2016). These strategies can be used prior to exposure to misinformation –so called prebunking strategies-- to help people recognize and resist misinformation that they are likely to encounter (Pennycook et al., 2021). They can also be used after exposure to misinformation has occurred –debunking strategies--in order to show why it is false (Walter & Murphy, 2018).

Measuring the effectiveness of these corrections is not without methodological challenges. But given the problems we have just discussed, it should be unsurprising that evidence of effectiveness is mixed (Adams et al., 2023; Altay et al., 2023; Ecker et al., 2022; Fernández-Roldán et al., 2023; van der Linden, 2022). Hence, even assuming that the misinformation narrative is correct, these strategies might not be very effective in correcting scientific misinformation. If, as I argue, this narrative is at best incomplete and at worst misguided, then these strategies, even if successful in correcting misinformation are still unlikely to address the social and political problems of concern.

Another strategy against misinformation and its presumed damage is censorship. As argued elsewhere (de Melo-Martín & Intemann, 2018; de Melo-Martín, 2023), strategies that involve censorship of presumed scientific misinformation present additional problems. Prohibition strategies could focus on severely restricting, or outright eliminating, funding for suspect research (Kitcher, 1993, 2001; Kourany, 2016; O'Connor & Weatherall, 2019). If the research is not conducted, this would limit dissemination of misinformation. Prohibition could also target the dissemination of suspect research. Academic journals and publishers and the media could simply ensure that such research is not published or that it does not receive media attention. This could prevent public confusion and presumably lack of support for needed policies resulting from misinformation. However, if prohibition or significant restriction of some

research or of its dissemination is the goal, we surely need criteria to reliably identify what research is suspect or what constitutes misinformation. Otherwise, we run the risk of prohibiting research that is epistemically valid, and thus the risk of hindering scientific and social progress. As mentioned earlier, given the lack of diversity in science and considering the fact that scientific communities have a bias toward epistemological conservativism (Lee et al., 2013; Luukkonen, 2012), using unreliable criteria to prohibit or severely restrict some scientific information is likely to affect legitimate inquiry coming from marginalized groups and research that challenges common methodologies, background assumptions, or research practices (Epstein, 1996; Harding, 2015; Lacey, 2020; Schiebinger, 2004; Whyte, 2013; Wylie, 2001). This strategy can then not only deter scientific progress and but also contribute to epistemic injustices (Fricker, 2007).

But as the previous strategies, this one is likely to have limited—if any—effect on addressing the epistemic and social problems of misinformation (de Melo-Martin & Intemann, 2018, ch. 6). It presents obvious practical problems, e.g. private funding is commonly used in these cases, and it is not clear what mechanisms could be used to prevent dissemination of research results, at least in democratic societies.

Of course, all of these solutions are also problematic because they fail to attend to the role that scientific –and other—institutions have in facilitating or undermining warranted trust (de Melo-Martín & Intemann, 2018; Goldenberg, 2021). Arguably, in a context where warranted trust is damaged, scientific misinformation finds fertile soil to generate negative epistemic and social effects. Facilitating warranted trust by tackling institutional and social factors that undermine it and promoting mechanisms that contribute to ensuring the trustworthiness of scientists can prove more successful in combatting the effects of misinformation than many of the often-promoted strategies. Exploring how best to do this both empirically and normatively might be a better way to advance these debates.

4. Conclusions

Science-related policy and advice is crucial for addressing pressing needs in relation to individual wellbeing, public health, the environment, and other social goods. When people oppose certain policies, or when they refuse to act in ways that protect these goods, this can have devastating consequences. There has been an increasing focus on the role that misinformation has played in creating public doubt, confusion, and misunderstanding about the relevant science and on resistance to certain policies or individual actions, from policies to mitigate climate change, to vaccinating children, to accepting COVID-19 vaccines, to prohibitions against GMP cultivation. While confusion and doubt about the exiting empirical evidence or about its strength can – and surely does — contribute to these problems, the emphasis on misinformation and its damages is problematic.

As we have seen, a variety of serious conceptual and methodological problems, including definitional problems, faulty survey practices, and flawed inferences, plague much of this research. Harder still is to ascertain the effects of misinformation on people's behaviors. These challenges call for caution in making statements about how serious and widespread a problem scientific misinformation is and what its damaging effects are on accepting scientific advice or opposing some scientifically informed policies.

Furthermore, the emphasis on misinformation obscures the role of values in policy decisions. Values are necessary in grounding choices about how to act and what policies to endorse or reject. People can reasonably disagree about what is valuable, how to interpret shared values, how to weigh conflicting values, and what policies are better for promoting certain valuable goals.

Exaggerating the role of misinformation in policy disputes and neglecting the role of values can lead scientists and policymakers to propose what are likely to be unsuccessful, and perhaps dangerous, solutions to the problems. They can incorrectly view those who disagree

with certain policy proposals as necessarily scientifically illiterate and are likely to insist on strategies to correct misinformation and on educating the public. Clearly, if reasons for opposing some policy or advice is a disagreement about values rather than simply about the evidence, focusing on the misinformation will do little to move the debate forward. They can also insist on censuring scientific misinformation, but without reliable criteria to identify it, such actions risk preventing important research and information and can contribute to furthering epistemic injustices.

Of course, nothing of what I have said here should be taken to mean that we should give up on promoting scientific literary, challenging misinformation where it exists, and finding strategies to reduce it where it happens. We have strong reasons why these are appropriate goals: our interest in avoiding error, valuing an informed citizenry, the desire to nurture democratic institutions. Nonetheless, we might do well in adjusting our attention from one primarily focused on scientific misinformation and its presumably damaging effects, to one interested in promoting trustworthy institutions, clarifying the relationships between policy and science, and finding ways to tackle value disagreements in policy acceptance.

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