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How to move beyond epistemic battles: pluralism and contextualism at the science-society interface

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The COVID-19 pandemic has been the scene of several epistemic battles at the science-society interface, creating deadlocks that have been hard to overcome. To cut through the paralysing elements of these discussions, we present an analysis of three epistemic battles, concerning empirical evidence, expertise, and model projections. Our analysis singles out a crucial factor that drives unhelpful disputes like these: the contested prioritisation of specific types of scientific knowledge, which are considered adequate for policy only if they meet pre-determined standards. To move beyond these deadlocks, we introduce the conceptual tools of epistemic pluralism and contextualism, which give concrete indications in the three controversies we discuss and show us the way forward in debates on science-based policy.

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Introduction

The COVID-19 pandemic has been the scene of several epistemic battles at the science-policy interface. Consider the battle between several governments and public health agencies, for instance in the UK and Germany, claiming to "follow the science" and scientists and commentators questioning whether policy was evidence-based at all. Another battleground has seen journalists, academics, and citizens pointing to fast changing and sometimes conflicting scientific evidence and expertise to question the trustworthiness of scientific experts more generally, while others have not seen it substantially threatened. Further, there have been heated discussions about the utility and problems of predictive computer models for policy.

These epistemic battles have rarely led to fruitful discussions. A key reason is that different parties often defend their own quality criteria and types of scientific knowledge and devalue others, creating deadlocks that are difficult to overcome. For instance, the controversy over the trustworthiness of scientific experts in the COVID-19 context led to vicious oppositions and little discussion and integration of the different types of expertise that are necessary to approach a global pandemic (Lohse and Canali 2021). We clearly need tools to cut through the paralysing elements of these debates and advance evidence-based decision making. Moving beyond epistemic battles is particularly important and timely given the increasing likelihood of public health emergencies and the need for evidence-based policy in this context. Related issues at the junction of science and policy will also benefit from this move, including science communication, debates on the political legitimacy of science-informed policy, and the trustworthiness of scientific institutions. In this sense, we look at the COVID-19 pandemic as a springboard for thinking more broadly about the use of scientific knowledge in the context of policy-making, especially in times of emergency.

We start by arguing that one of the key factors driving epistemic battles is the contested prioritisation of different types of scientific knowledge. Examples of these different types of scientific knowledge include results and claims that differ in their empirical sources and underlying study designs, which might be more quantitative or qualitative in nature, more local or general, very robust or still tentative or fragile. Second, we show how two prominent ideas in philosophy of science can be applied to move away from prioritisation and beyond unproductive epistemic battles in times of crisis: *epistemic pluralism*, which emphasises the utility of a multitude of perspectives, approaches, methods, and types of knowledge (Kellert et al. 2006; Veit 2020), and *contextualism*, which highlights the contexts of production and application of epistemic products in determining the reliability and relevance of scientific knowledge (Stegenga 2014; Cartwright et al. 2022; Leonelli 2017).

Epistemic battles and COVID-19

We consider three epistemic battles on different epistemic products during the COVID-19 pandemic: battles over empirical evidence, expertise, and model projections. We argue that epistemic prioritisation has been a *crucial factor driving these battles* (although not the only one), as interested parties considered scientific knowledge based on or realised in empirical evidence, expertise, or model predictions to be adequate for policy only if it was the type of scientific knowledge that met specific quality criteria, while others denied this.

Empirical evidence. The epistemic battle over empirical evidence in COVID-19 saw the opposition of two different epistemic cultures, one prioritising evidence from Randomised Controlled Trials (RCTs) and the other applying the principle of total evidence. The prioritisation of a specific quality criterion, originating in evidence-based medicine, led the first side to discuss social distancing and lockdown as "not-evidence-based measures"(Ioannidis 2020a, p. 1) and call for the application of non-pharmaceutical interventions tested with randomised trials "to complement the available, tenuous observational data" (Chin et al. 2021, p. 103; see also Ioannidis 2020b). On the opposite side, several public health epidemiologists criticised this position as the blinded application of an idealistic quality criterion with limited applicability and argued that pandemic policy should be based on the use of *all* available evidence (Lipsitch 2020). The opposition created a situation where the two sides of the debate struggled to see the rationale beyond different prioritisations of evidence and a productive debate was practically non-existing (Fuller 2020). It is worth noting that the influence of implicit political factors, notably the authority and public resonance of evidence-based medicine, also seems to have hindered the emergence of a fruitful debate in this case. This illustrates that political power and marginalisation of epistemic standpoints can be ingrained in epistemic battles.

Expertise. In this controversy, which mainly played out on social and public media, two camps drove discussions. On the one hand, some highlighted the lack of uncontroversial advice by experts, holding a high standard of robustness as a precondition for expert advice. Disagreement of scientific experts on the transmission of SARS-CoV-2 and suitable mitigation measures, such as wearing masks, was thus seen as a sign of the fragility of scientific expertise and used to challenge its rationality (for a rich illustration, consider public discussions on social media such as twitter—now called X—on "covid" and "experts disagreement" in 2020–2022). On the other hand, others disputed that COVID expertise was *substantially* unstable and questioned the assumption that a robust consensus among experts is really necessary for policy advice. Accordingly, this camp saw criticism of (mainstream) scientific expertise as exaggerated or uninformed (see e.g. Yong 2021).

Models. Epidemiological computer models have been considered crucial in guiding policy-making at key points of the pandemic (Birch 2021). This is particularly true for governments in OECD countries, which gave high priority to *quantitative* scenario projections from these models in developing mitigation and containment strategies. At the same time, the use of these computer models for policy has been criticised as excessive and myopic. It was argued that these models generated a false sense of certainty, whereas in reality they relied heavily on uncertain assumptions and ignored important aspects of the pandemic, ultimately generating misleading scenario projections (Chin et al. 2021). The high prioritisation of quantitative projections was seen as problematic, contributing to an excessive focus on direct effects of COVID-19, while indirect harms of the pandemic and mitigation strategies, such as increasing inequalities, that were difficult to quantify in the short time available, tended to be neglected (Lohse and Bschir 2020).

Moving forward: applying epistemic pluralism and contextualism

How do we move forward when faced with epistemic battles? In most epistemic controversies at the science-policy interface, we argue that we should not pick sides but sidestep the oppositions and reasons for disagreement. Moving away from prioritisation, it is more helpful to pay attention to the epistemic role that a *plurality* of perspectives can play in specific *contexts*. We will now use the previous epistemic battles to illustrate how epistemic

pluralism and contextualism can be useful ways to overcome deadlocks.

Empirical evidence revisited. A more productive direction in controversies on empirical evidence is an explicit discussion of evidence criteria, their rationale, and the choice of the types of evidence that are more appropriate for a particular context of use. First, this entails an appreciation of the need for triangulating a *plurality* of methods, types of evidence, and models, especially in extremely complex and emergency cases. For instance, the clinical evidence from randomised controlled trials championed by one side of the battle we have discussed is clearly needed to inform and develop various aspects of pandemic policy. But we need more: evidence from "gold standard methods" such as RCTs requires a long time and might not be applicable in many contexts. Thus, observational evidence suggesting the benefits of social distancing might be ranked high for the specific task of containing the spread of the virus.

But this does not mean that all available evidence can be used, as implied by principles of total evidence on the other side of the battle. Contextualism shows that not all evidence will be equally relevant: for instance, the fact that evidence on the effectiveness of a policy intervention was produced in a specific country is crucial when deciding whether to apply the same intervention in another country (Broadbent and Streicher 2022). Recognising the context dependence of knowledge is key to avoid underestimating relevant differences as well as similarities across circumstances. An example of the first issue is the relevance of young age structures in Africa, when considering lockdown measures originally applied in the European context. An example of the second issue is the occasional exaggeration of differences between the Western and East-Asian context when assessing the successful implementation of mitigation strategies.

Context also matters for standards of evidence assessment, choice, and application: depending on the features of a specific context of application, different evidence standards can be applied. Observational evidence is usually considered low-quality in the evidence-based medicine context, but can be very informative about the external validity of policy interventions and thus the possibility that policy might be effective in different contexts of application (Jukola and Canali 2021). Especially when we need to act fast and the external validity of the available evidence is crucial, we need to adapt our evidence standards in the direction of a specific context of application.

Adaption to specific contexts can be challenging when evidence from different sources is in conflict—but that is precisely when contextualisation is essential as it elicits the right kind of questions. For instance: does a study show that intervention X cannot protect against COVID-19, or that it does not work in some situations, or rather that we do not have RCT evidence for the functioning of intervention X in public spaces? If the first is the case, how can this be reconciled with (possibly available) effectiveness studies to the contrary from other fields of study? Without contextualising research findings from different types of studies and situating them in a pluralistic evidence landscape, questions like these cannot be meaningfully addressed (this is one reason why systematic reviews of the general effectiveness of an intervention can sometimes be misleading).

At the same time, applying contextualism and pluralism does not mean that we should dismiss internal validity, randomisation or control when producing evidence. We should aim for all this when practically feasible and especially if we can apply these methods in real-life scenarios and when faced with persisting controversies about the effectiveness of specific policy interventions.

Expertise revisited. The battle on the role of scientific expertise in policy-making can be transformed into a more useful discussion by analysing it through the lenses of epistemic pluralism and contextualism too. First, divergent expert statements do not necessarily imply substantial disagreement. Sometimes they are merely highlighting different but complementary aspects of a complex phenomenon or process. In such situations, there is disagreement only insofar as the respective aspects are seen as the only *relevant* aspects to the epistemic problem at hand, for example when only the average viral load of SARS-CoV-2 in infected children is considered relevant to determine the role of schools in transmission dynamics, but not social scientific knowledge about behaviour routines and contact networks of school children.

In other cases, divergent expert opinions can indicate a *useful pluralism* of perspectives by revealing problematic assumptions of specific viewpoints, for instance when expertise from aerosol research led to questioning the widely held assumption that larger droplets—and not aerosols—are mainly responsible for the transmission of SARS-CoV-2. For a long time, the scientific community and policy-makers relied on experts from biomedicine and their assumption that COVID-19 was transmitted through droplets, similarly to other respiratory viruses (Morawska and Milton 2020). The inclusion of different types of expertise from chemists and engineers on aerosol transmission helped identify gaps in the droplet theory of transmission and the potential for airborne spread of COVID-19, with consequences for key policy decisions on e.g. masks and ventilation (Greenhalgh et al. 2021). The unfolding debate also led to fruitful discussions on classification and terminology around modes of transmission, droplets, and aerosols (Tang et al. 2021). As such this debate can be seen as a positive example where a plurality of types of expertise and evidence were considered, leading to different policy interventions and fruitful scientific discussions (Bschir and Lohse 2022).

Yet we hasten to point out that not all instances of expert disputes are productive, particularly when an emerging scientific consensus is criticised without thoroughly engaging with its arguments, sources of evidence, and epistemic standards. These cases can be classified as "epistemic trespassing" (Ballantyne 2019), and they occur when heterodox perspectives are driven primarily by political values and interests. Identifying this detrimental form of pluralism may not always be straightforward, but the unwillingness to engage with criticism can serve as a useful indicator (Biddle and Leuschner 2015).

Attention to the *context* of scientific expertise in an ongoing public health crisis can also help bring new light on underlying issues. During the pandemic, we have seen science in fast motion. Thousands of new studies on COVID-19 and related issues have been produced in a fraction of the time needed under normal circumstances. This situation has emphasised a key aspect of science to an extraordinary degree: the systematic and continuous self-correction of scientific results. This observation has a threefold implication for the assessment of scientific expertise in times of emergency, which is, after all, based on scientific knowledge in an instable state.

First, expertise should be taken (and articulated) with great caution in these situations. This is a simple consequence of the fact that in times of fast science there cannot be a robust and stable consensus (which would presuppose many iterations of self-correction over a prolonged period). Greater caution in expressing and framing expert opinion in times of uncertainty can go some way toward avoiding unnecessary epistemic battles between experts. *Second*, disagreement should not be seen as a conclusive argument *against* using (diverse) scientific expertise for policy. Despite deep uncertainties and ignorance in acute

crises, the self-correcting methodology of science—realised in part through pluralistic dispute—is still the best epistemic tool we have, in particular when considered in context and thus considering that there may only have been limited self-correction due to time constraints. The *third* implication points to a connection of contextualism and pluralism: We should further diversify our knowledge base and aim for a more transdisciplinary approach to expertise, i.e. an approach that transcends the limits of traditional evidence-based policy. Especially in times of great uncertainty and when assessing instable scientific expertise, we need to expand the pool of relevant experts to include non-scientific experts. The reason is that other societal actors can provide relevant *contextual* expertise that can strengthen our knowledge base through pluralistic triangulation (see above). This includes local knowledge, which can emerge within specific social groups in a timely manner, as exemplified by the attention drawn to Long Covid by patients (Callard and Perego 2021) and practical knowledge on what works and what doesn't by practitioners (for instance, in terms of different containment strategies in homes for the elderly). These points are in line with results from the literature on transdisciplinarity and post-normal science theory, where high levels of uncertainty and decision stakes (such as in the pandemic) have been connected to the need for broader and extended types of public participation in knowledge production and assessment (Funtowicz and Ravetz 2001, 1993).

Models Revisited. Context and epistemic plurality matter also when looking at the epistemic battle focused on computer modelling. Were the quantitative computer projections that informed policy-making uncertain and myopic? Yes. Is this a problem? It depends on the exact *context* of their use. At the early stages of the pandemic epidemiological computer projections were indeed useful for getting a sense of "reasonable worst case scenarios" (Birch 2021). They were helpful to give policy-makers a rough sense of the possible severity of an almost unprecedented public health threat (White et al. 2022). The problems arose when these models did not only inform policy-makers, but *drove* the longer-term political response to the pandemic, hence changing the context of their application (Adam 2020). This happened to the extent that scenario projections were misinterpreted as exact quantitative predictions displacing meaningful risk estimates of pandemic dynamics (Leonelli 2021). However, if this pitfall can be avoided, uncertain model projections can indeed contribute to reasonable pandemic policies.

This becomes even clearer when we consider using models as one epistemic tool that can work together with others in a *pluralistic* response to a public health threat. Computer models can be (and frequently were) enriched with real-life epidemiological data and should be (because they were not) systematically triangulated with social scientific perspectives, thereby facilitating a more realistic analysis of virus transmission patterns on a societal level (Bschir and Lohse, 2022). Model projections can serve as one source of evidence among others informing a more pluralistic harm-benefit analysis that would balance direct health risks of the virus with indirect harms of different intervention strategies. It becomes clear, then, that contextualising model predictions and embedding them in a pluralistic epistemic landscape allows us to disengage from epistemic struggles in this case as well.

Moving beyond epistemic battles

Epistemic battles at the science-policy interface can be paralysing and lead to deadlocks, where opposing camps talk past each other and hinder discussions on crucial elements of science-based policy advice. We have identified a central issue emerging from these battles: the prioritisation of specific types of scientific knowledge, considered adequate for policy only if they meet predetermined standards, leaving little if any room for constructive debate. A way out is to pay attention to the epistemic role that a plurality of perspectives can play in specific contexts (Table 1). This is a way to address unresolved debates around COVID-19 and in other cases—especially in times of urgency.

Table 1 Recommendations from epistemic pluralism and contextualism for controversies on different epistemic products.

Epistemic product	Applications of pluralism and contextualism
Empirical Evidence	■ Use and triangulate a plurality of evidence ■ Consider context where evidence is produced and applied
Expertise	■ Analyse the grounds of pluralist disagreement ■ Contextualise assessment of scientific expertise
Model Projection	■ Pay attention to context of use of model projections ■ Embed models in a pluralistic epistemic landscape

We see our proposal as something that cannot only feed into the public debate, but also be applied at the institutional and policy level. Of course, contextualism and epistemic pluralism cannot completely resolve all instances of paralysing disagreement; for example, when different types of evidence, even after thorough contextualisation, point in different directions, or when disputes are primarily driven by incompatible political values, or in cases of epistemic battles that do not arise from the prioritisation of specific types of scientific knowledge, such as in the humanities. However, they can provide valuable guidance in identifying the core of a dispute about conflicting evidence and in making better informed decisions based on the assessment of different epistemic standards. Consider reignited controversies on face masks, whose role in preventing COVID-19 infection has been recently contested by a series of meta-analyses (Jefferson et al. 2023). Here pluralism and contextualism indicate the need to approach these results with a pinch of salt, understanding the context of production and epistemic standards applied in these studies and considering empirical evidence from other sources, pointing in other directions, as well (cf. the above discussion).

Applying pluralism and contextualism means, among other things, rethinking strict evidence hierarchies and the composition and functioning of policy advisory groups. Beyond the controversies we have discussed in the paper, this would also help to move away from the uncritical application of clinical evidence standards to regulate non-clinical contexts, for instance those involving commercial and digital technologies and artificial intelligence (Canali et al. 2022). Additionally, it would emphasise the importance of devising design principles for pluralistic policy advisory panels capable of functioning under emergency conditions (Bschir and Lohse 2023).

Implementing epistemic pluralism and contextualism in these ways would make evidence-based policy more effective and agile, and help avoid endless epistemic battles. The proposed *combination* of pluralism and contextualism is precisely what enables this outcome and safeguards against an unmanageable clash of perspectives.

Data availability

No original data were collected for this work.

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Both authors contributed equally to writing and research, Stefano Canali led the project.

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was not required as the study did not involve human participants.

Informed consent

Informed consent was not required as the study did not involve human participants.

Additional information

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