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ORIGINAL PAPER

Fairness in Knowing: Science Communication and Epistemic Justice

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Abstract Science communication, as a field and as a practice, is fundamentally about knowledge distribution; it is about the access to, and the sharing of knowledge. All distribution (science communication included) brings with it issues of ethics and justice. Indeed, whether science communicators acknowledge it or not, they get to decide both which knowledge is shared (by choosing which topic is communicated), and who gets access to this knowledge (by choosing which audience it is presented to). As a result, the decisions of science communicators have important implications for epistemic justice: how knowledge is distributed fairly and equitably. This paper presents an overview of issues related to epistemic justice for science communication, and argues that there are two quite distinct ways in which science communicators can be just (or unjust) in the way they distribute knowledge. Both of these paths will be considered before concluding that, at least on one of these accounts, science communication as a field and as a practice is fundamentally epistemically unjust. Possible ways to redress this injustice are suggested.

Keywords Science communication · Epistemic justice · Distributive justice · Ethics

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Introduction

Knowledge is a resource. It is widely regarded as one of the most valuable resources one can possess. But as with any resource, its distribution raises issues of justice and fairness; moral issues. This matters for science communication because it is exactly its core business: distributing knowledge. In this paper, 'science communication' is used as the umbrella term for the research into and the practice of increasing public understanding of and public engagement with science. Indeed, whether we acknowledge it or not, science communication affects both which knowledge is shared (by choosing which topic is communicated), and who gets access to this knowledge (by choosing which audience it is presented to). As a result, how the science communication enterprise evolves from here has important implications for epistemic justice—how knowledge is imparted fairly and equitably.

This paper will present an overview of issues related to epistemic justice for science communication. After defining science communication and some preliminary discussion of the relationship between science, knowledge and justice, this paper follows Coady in distinguishing between two quite distinct ways in which we can be just (or unjust) in the way we impart knowledge (Coady 2010). Focusing particularly on the discussion of epistemic justice that has come out of the social epistemology literature with regard to trust and testimony (Anderson 2012; Fricker 2007; Medina 2011), this paper argues that at least on that account, science communication as a field and as a practice is fundamentally epistemically unjust. This paper closes with suggestions to remedy this injustice.

Background

According to Priest, "The term 'science communication' refers both to a range of related fields of professional practice and to an interdisciplinary field of study." (Priest 2010). This practice and the related field of study are, at one level, about the communication of science to non-experts in an information dissemination mode; what we might think of as science popularization. But there is a growing consensus that simply informing the public is not sufficient, either as a practice, or as a field of study (Bauer et al. 2007; Nisbet and Scheufele 2009). Indeed, the view of science communication as a broader set of concerns is also reflected in the strategies and policies of governments' programmes and of funding agency programmes (Palmer and Schibeci 2014). And as an interdisciplinary field of study, science communication is likewise broader in its concerns than simply informing and disseminating; it draws upon the sciences (bio-physical, social and behavioural sciences) as well as the humanities and other more critical "interdisciplinary fields, in particular from 'STS'" (Science and Technology Studies) (Priest 2010). Given the breadth encompassed by science communication, it is useful to anchor down the term 'science communication'. In this paper, 'science communication' is taken to be more than the "ad-hoc, intuition-driven approaches" taken to inform and educate a non-expert public about science (Nisbet and Scheufele 2009). The term 'science

communication' refers to institutionalised science communication; institutionalised in government policies on the public understanding of and public engagement with the sciences; in the growing numbers of academic journals and departments committed to further the enterprise through research and teaching; in requirements set by funding bodies; and in the growing numbers of associations clustering under the umbrella of science communication across the globe. What sits central to much of science communication is the view of science as a producer and provider of reliable knowledge (Dietz 2013).

Science and knowledge are clearly related (indeed, the Latin word "scientia" means knowledge), but what exactly this relation is and how we should define it is far from settled (Fuller 1987). Science can be viewed as many things. It can be viewed as a social activity, a method, a culture, and many things besides. But fundamentally, science, through research, is a knowledge producing activity (indeed, science is sometimes equated with knowledge, see Chalmers' 1976 classic for a discussion). Importantly, it is the capacity of science to produce more reliable knowledge that has given science the prestige and epistemic dominance it has historically held (Nowotny et al. 2005).

This paper takes as its starting premise that knowledge should be considered a resource, no matter how we understand the term knowledge. But knowledge is strange resource. It is not material like gold or chocolate. While knowledge can be observed, it cannot be physically held and transferred like gold or chocolate. Still, knowledge, or at least the acquisition of knowledge, has all the hallmarks of a resource; acquiring knowledge incurs costs and the acquisition of knowledge is unevenly shared (Boulding 1966). We take the costs of acquiring knowledge seriously. We decide which university to attend and which course we take based, at least in part, because of costs and potential returns (Clotfelter 2014). The same is true with the decisions we make over what we read, listen to, and watch in order to gain further knowledge (should I invest the next half an hour of my life watching a documentary on physics or reading a magazine on finance?) Relatedly, the acquisition of knowledge is uneven. Some people can afford to acquire more knowledge than others. Some have better access to knowledge than others, some have greater capacity for knowledge than others, and some have more thirst for knowledge than others.

Acknowledging science as a knowledge producing activity and that knowledge is an unevenly shared resource makes the allocation and distribution of scientific knowledge an important ethical issue (Medvecky 2016) and makes science communication an inherently moral discipline, raising both ethical issues and issues of epistemic justice (Dahlstrom and Ho 2012; Thompson 2012).

Two Forms of Epistemic Justice

Epistemic justice can be thought of in two quite distinct ways. We can think of epistemic justice in terms of standard distributive justice issues: who gets access to knowledge? And we can think of epistemic justice in terms of justice for the

knower: whose knowledge is considered valuable or worthwhile or reliable? Both of these highlight important moral issues for science communication.

Distributive Justice and Access to Knowledge

As Miranda Fricker states, "the idea of epistemic injustice might first and foremost prompt thoughts about distributive unfairness in the distribution of epistemic goods such as information or education" (2007). Distributive justice is concerned with how scarce resources are distributed or allocated across a population. Put simply, for any scarce resource—a scarce resource being a resource that not everyone can have as much of as they may want or need—distributive justice provides ways of assessing who should get some of that resource and how much of that resource each should get. This assessment is based on number of factors such as the individual's needs and claims (Roemer 1998). There are two flavours of underlying theories that determines what counts as a fair distribution: transactional theories and structural theories (Anderson 2012). Transactional theories take a system to be fair if the rules of exchange (or transactions) are fair, no matter what the final allocations resulting from such transactions happen to be. For example, Nozick's libertarian theory (1974) views any system in which resources are held justly to be fair. Resources are held justly just so long as they are acquired justly (though fair exchange or though one's own labour or such like, but, for example, not stolen), exchanged justly (honestly, willingly, free of fraud or coercion or such like), and any breach of acquisition or exchange is rectified.

Structural theories, on the other hand, take a system to be fair if the pattern or structure that emerges from that system is fair. Most theories of distributive justice are structural, and these nearly always require some form of redistribution (Lamont and Favor 2008). Classic examples of structural theories of distributive justice include strict egalitarianism, luck egalitarianism, and Rawls' Justice as Fairness. Strict egalitarianism is one of the simplest forms of egalitarianism and argues that all members of society should to have the same levels of "benefits and burdens" (Nielsen 1979). Luck egalitarianism argues that inequalities across different members of a society are acceptable if they derive from the choices the individuals have voluntarily made, but inequalities arising from unchosen features of an individual (such as age, gender, race, or socio-economic background; the brute luck of life) are unjust (Duus-Otterström 2012; Dworkin 2003; Scheffler 2003). By contrast, Rawls' Justice as Fairness (1999) views fairness as a system that permits inequalities in resource allocation across a society so long as the outcome maximizes the well-being of the least well-off members of that society. These theories have predominantly been concerned with the distribution of (material) wealth and resources across a population. However, they are equally applicable to and relevant for intangible resources such as knowledge, and have received some attention with regard to science and technology education and communication (Gorski 2005; Hendrix 2005; Medvecky and Leach 2013; Trend 2001).

One of the most obvious ways in which distributive justice has become an area of concern with regard to the STEM disciplines is in regard to science and technology in education (though not always explicitly appealing to a given theory). Some of this

concern is focused on inequalities in the use of and access to technology (Bryson and De Castell 1996; Gorski 2005; Hendrix 2005; Singh 2001). But concerns about distributive justice over knowledge extend beyond the formal education setting. An obvious and regular set of distributive justice concern for science communication is about participation: who is invited and who is left out of engagement efforts, and as a result who is given access to the imparted knowledge and who is left out of such access (Besley 2009). Indeed, discussions of citizenry, representation and participation are a reoccurring theme in science communication and science studies (Kurath and Gisler 2009). Another area of concern for science communication has been the distribution of resources (epistemic or material) *amongst* science communication practitioners and researchers themselves (Medvecky and Leach 2013). And there is much more that could be said about epistemic justice in terms of distributive concerns for science communication, but in this paper, the focus will be on a different form of epistemic justice: justice for the knower.

Epistemic Justice as Justice for the Knower

Epistemic justice as justice for the knower is concerned with testimonies and credibility. This form of injustice arises from the way an agent is treated as a knower, as a source of knowledge. Ideally, the degree of credibility an individual is granted over a specific subject should be commensurate with their degree of knowledge on that subject. A high degree of credibility is bestowed on Jane Goodall's claims about the social interactions of chimpanzees (i.e. we trust her more than we would trust almost anyone else) as she has high level of knowledge on the subject. In this case, Goodall is treated justly as an epistemic agent. Epistemic injustices occur when there is a mismatch between the level of knowledge an individual possesses and the credibility the individual is afforded. Fricker defines epistemic injustice as "prejudicial dysfunction in testimonial practice". The injustice stems from the hearer's action and the inappropriate level of credibility the hearer grants the speaker as a source of knowledge. For example, to dismiss Jane Goodall's claims about the social interactions of chimpanzees on the grounds that she is a woman and that such knowledge is beyond the reach of women would be to treat Jane Goodall unjustly from an epistemic standpoint. Much of the discourse on epistemic injustice has focused on injustices ensuing from negative prejudice against the speaker; Fricker calls this credibility deficit (2007). But prejudice is not always negative—it is not only unjustly dismissive or undermining of some subject's credibility.

Prejudice can also be positive prejudice—it can be unreasonably supportive of some individual's knowledge. This is termed credibility excess. As Fricker explains, such "prejudice results in the speaker's receiving more credibility than she rationally deserves—credibility excess". For example, Jane Goodall may be mistakenly granted expertise on a subject she has no specific knowledge about such as calling upon her as an expert on Byzantine architecture. While Fricker notes that there is such a thing as credibility excess, she claims this positive prejudice should not be considered an instance of epistemic injustice. Indeed, she questions whether there could be "circumstances in which being overly esteemed in one's capacity as

a knower would do one harm of a sort that merits the label 'testimonial injustice'" (2007). However, Anderson notes that there are situations where such credibility excess certainly does matter; namely when credibility judgements are used comparatively, "in contexts where one person's word must be weighed against another's" (Anderson 2012). Not only is credibility excess a form of epistemic injustice when credibility is used comparatively, but as Medina points out, the very notion of credibility is always relative and comparative. He explains, "credibility judgments are implicitly comparative and contrastive […]. Credibility is not assessed one person at a time in complete isolation from all other subjects and their social affiliations." (Medina 2011) So while Fricker might be correct in stating that credibility excess does not harm the speaker, it does not follow that credibility excess is not a form of epistemic injustice. Credibility excess injures a different party or set of parties, namely those whose credibility forms the comparison base to the speaker. By calling on Jane Goodall as an expert on Byzantine architecture (assuming that she is no such expert and that she would accept the mantle of expert on the topic), then actual experts on Byzantine architecture would be denied the voice they seemingly deserve and their expertise would *unjustly* be held as no greater than hers. This would indeed be a form of epistemic injustice, not towards the speaker, but towards the speakers' comparative epistemic cohort. It is this positive prejudice and the epistemic injustice arising from credibility excess that ought to be taken seriously for science communication.

Credibility Excess and Science Communication

Misrepresentation of Expertise

Science communication has a long history of working through the complexities of what counts as experts or what counts as expertise in relations to various types of knowledge (Aitken 2009; Collins and Evans 2002; Jasanoff 2004; Wynne 2003). There are clear connections between the debates around expertise and the discussion on epistemic justice, but they are quite different beasts. While the debate around expertise classically centres on complex boundary issues, the concern over epistemic justice focuses on cases where there is a clear mismatch between knowledge and credibility.

There are a number of ways science communication practice can lead to substantial epistemic injustice. The most obvious case in when undue credibility is granted to an individual or group through misrepresentation of expertise. This is especially likely to be the case when popularizing or reporting science. When putting on a science communication event, writing a popular science article, hosting a *café scientifique*, or designing a science exhibit, a choice has to be made as to who is given a voice, who is interviewed, or who is presented. In such cases, the speaker given a voice is, at the same time, inherently assigned a level of credibility. In most cases, interviewees or invite speakers are not invited because they're wrong or unknowledgeable (though there are occasions when contrarian views are intentionally invited), so in most cases, simply being invited is a sign that the speaker or

interviewee has some above-average level of epistemic credibility. It is assumed that their knowledge is worth listening to. But in many cases, speakers are invited based on convenience or on broad popular appeal even though their knowledge of the topic discussed may be less credible than suggested by the platform given to them. Exemplar cases are celebrity scientists such as Lawrence Krauss or Richard Dawkins, who are given a platform to speak on many topics. These many platforms provide them with a degree of credibility afforded to few others, despite their often less-than-expert degree of knowledge about the topics discussed. Let's take Dawkins as an example.

Dawkins is regularly invited to engage in discussion about religion, often on the evolution/creationism debate which sits at the intersection between religion and biology; the latter being a topic where he is, indeed, uniquely knowledgeable and a credible epistemic agent. As Trench notes, Dawkins' focus is on critiquing "religion and the obstacles he sees it presenting to the spread of science and reason in society." (Trench 2008). In so doing, he is also invited to discuss issues about the history and traditions of religion, and the capacity for science and religion to co-exist; topics that would be substantially better covered by religious studies scholars or social studies scholars than a biologist. As Moritz notes, "Dawkins' method in assessing religion's intellectual mind-set and core values is anything but scientific." (Moritz 2009). In such cases, the voice given to Dawkins leads to credibility excess for him, to the detriment of more knowledgeable others. Those knowledgeable about the history and traditions of religion are unjustly denied the primary voice on the topic, and their knowledge and expertise is unjustly presented as nothing more than equivalent to biologist's hobby. This is not to say that Dawkins should be denied a public voice for his views on non-biology related topics, rather it is to say that views such as his should not be coated with the mantle of expertise or credibility. When science communication practice cloaks a speaker with undue credibility by providing them with an elevated platform, epistemic injustice ensues.

Implications for Science Communication as an Institutionalised Field

Science communication may run the risk of acting epistemically unjustly by granting credibility excess through misrepresentation of expertise, but with awareness, this can be managed. However, there is a more fundamental concern, namely that science communication as an enterprise is inherently unjust. While science communication may not be a major force in the communication landscape, it sits apart from others fields of communication through its relationship to science and the latter's privileged place as a producer of reliable knowledge (Nowotny et al. 2005). While there is much financial and political communication (most clearly in the form of journalism), this is rarely about the knowledge produced by these fields. Only science communication has a set of professionals who specialise in communicating its knowledge. The same can be said about the focus of work done in the numerous university departments around the globe that focus on "communicating science to the general public" (Centre for Science Communication 2016). While there are a few exceptions in the form of isolated centres (such as the Crick Centre for the public understanding of politics at the University of Sheffield)

and a few splatterings of work on public communication of research which will be discussed below (Wilkinson and Weitkamp 2016), no other field has specialized academic journals and conferences that so singularly view it as their mission to impart especially important knowledge. Likewise, there are national strategies for increasing public understanding of and public engagement with science across the globe (Department for Business Innovation and Skills 2010; Department of Innovation Industry Science and Research 2010; Ministry of Business, Innovation and Employment 2014), all commonly appealing to science's special place as a producer of reliable knowledge (Department of Innovation Industry Science and Research 2010; Ministry of Business, Innovation and Employment 2014). Importantly, there are few (if any) such strategies for increasing public understanding of and public engagement with other fields of knowledge, such as the social sciences or the humanities. While there are many well-argued reasons for communicating, popularizing, and engaging with science, these are not necessarily reasons for communicating, popularizing, and engaging *only* with science. Focusing and funding only the communication of science as reliable knowledge represents science as a unique and privileged field; as the *only* reliable field whose knowledge requires such specialised treatment. This uniqueness creates a credibility excess for science as a field. And since science communication creates credibility excess by implying that concerted efforts to communicate non-science disciplines as fields of reliable knowledge is not needed, then science communication, as a practice and as a discipline, is epistemically unjust.

Objections and Responses

When We Say 'Science', We Mean 'Science' Broadly, Inclusive of All Branches of Knowledge

There are a number of ways to object to the above argument and to defend science communication from the charge of being epistemically unjust. The first one is to argue that science communication is not only about "the bio-physical sciences", but about science in its broader meaning; about *scientia*, knowledge generally, including the social sciences, the humanities, and so forth. If 'science' is understood broadly, this objection argues, then science communication is not epistemically unjust. For example, the journal *Science Communication* makes the point that "Science is broadly defined within the context of *Science Communication* to include social science, engineering, medical knowledge, as well as the physical and natural sciences." ("Science Communication: Description," 2016). Still, this leaves out the humanities, fine arts, and law (to name a few). Importantly, while *Science Communication* should be credited for its openness, most national strategies for making science public are less generous in their intentions. For example, the *Inspiring Australia* strategy states that 'the sciences' refers to the biophysical sciences and related fields, and to "the social sciences and humanities, critical to the interface between science and society" (Department of Innovation Industry Science and Research 2010). Moreover, national strategies regularly link the making-public

of science with the need for more STEM majors (Science, Technology, Engineering and Mathematics), such as New Zealand's *Nation of Curious Minds*, which states that one of its three aims is to have "more [people] choosing STEM-related career pathways" (Ministry of Business, Innovation and Employment 2014). Thus any claims that science communication is meant to cover knowledge more broadly than the bio-physical sciences cannot be taken too seriously. Science Communication is first and foremost about the bio-physical sciences and related field and the reliable knowledge they produce. A better objection would be to defend why these fields and the knowledge they produce should be treated differently.

Research Communication and Engaged Research

There is an increasing push towards public communication of research, which may be considered as a way of broadening the scope of science communication (Grand et al. 2015; Wilkinson and Weitkamp 2016). However, communicating research is often largely based on science communication, and sometimes it is used to refer exclusively to science communication, such as Jensen and Buckley's "Why people attend science festivals: Interests, motivations and self-reported benefits of public engagement with research" (Jensen and Buckley 2014). There is also a move towards engaged research, which Holliman and Holti define as "the different ways that researchers meaningfully interact with various stakeholders over any or all stages of a research process, from issue formulation, the production or co-creation of new knowledge, to knowledge evaluation and dissemination" (2014). However, much of what is valued in science communication has little to do with existing research. Much of science communication is about well-established knowledge that is broadly accepted with the scientific community, from explanations of evolutionary theory in museums to describing the big bang in documentaries to explaining the basic workings of vaccinations in medical brochures. These may have once-upon-a-time been topics of research, but they are not now. So while the move to communicate research and to carry out engaged research should be applauded for broadening the content of our public engagement, it does little to overcome the established credibility imbalance between scientific knowledge and other forms of established knowledge.

Objection #2: There's Something About Science that Require Unique Communication

There are many reasons why science is worthy of communication (Stilgoe et al. 2014; Thomas and Durant 1987), but what we are looking for here is more than that. To defend science communication against the charge of being epistemically unjust, there needs to be a reason why scientific knowledge is in need of communication in a way that knowledge from other fields (such as history, religious studies or economics) are not. A number of such arguments have been put forward.

Science is Too Technical

The first argument claims that science is often highly technical, and translating such technicality into understandable language requires specific expertise. This is especially the case when topics are controversial, such as climate change, neuroscience or genetic engineering (Hails and Kinderlerer 2003; Illes et al. 2010). Certainly, science is often highly technical and making complex technical issues understandable requires considerable skills and expertise. But economics is equally technical (indeed, much of econometrics is impenetrable except to a small select audience), and so is much of modern philosophy (formal epistemology, metaphysics or logic are prime examples), and art history, and linguistics, and the list goes on. If the argument is that technically complex reliable knowledge should be made digestible to non-experts, then yes, science should be included in this, but much beyond science should also be made more accessible. This argument does not, on its own, make a case for why science should be treated uniquely.

Science is Especially Important to Our Lives

A more robust defence would argue that while there are other technically complex disciplines, science is important and embedded in our lives in a way other fields are not; science has "a critical role in creating and defining our future" (Ministry of Business, Innovation and Employment 2014). But the same can be said for many non-science fields, such as economics, law or politics. These disciplines are as important and embedded in our lives as science is, from ensuring we have sufficient retirement funds, to dealing with the legal requirements in the workplace, to voting in a referendum. If the argument is that knowledge important to our everyday life should be made more public, then yes, science should be included in this, but again, much beyond science should also be made more public. This argument, as the previous one, does not make a case for why science should be treated uniquely.

Scientific Misinformation is Dangerous

A third argument is based on the danger of scientific misinformation. For example, Schmidt calls for "fundamental changes in how scientists interact with the media because debates over climate change, health, energy, and technology are simply too important to lose to misinformation." (Schmidt 2009). Indeed, scientific misinformation can be a very dangerous thing, but no more dangerous than holocaust denial (a form of historical misinformation), or the view that Islam is a threat and synonymous with terrorism (a form of religious and cultural misinformation) (Revell 2010). If the argument is that where there is a risk of misinformation, the communication of reliable knowledge should be treated with special care, then yes, this would apply to science, but as with the other claims, this would apply much more broadly. This argument, as the previous ones, does not make a case for why science should be treated uniquely.

Science is Important for Democratic Participation

Two arguments turn on the relationship between science and democracy. One side of the argument suggests that science needs to be communicated because it is important for democratic participation. Stocklmayer et al. explain that "[t]he general public is often asked to make decisions about new technologies that could have far reaching effects, both on its own wellbeing and on the rest of the world." (Stocklmayer 2001); we need to communicate science to allow science a place in democracy. The other side of the argument is that science communication has "a normative commitment to the idea of democratic science policy" (Stilgoe et al. 2014); we need to communicate science to allow the public to participate in science and to open a space for the public to have a say in decisions about the directions of science, including the questions science seeks to answer and the ways science goes about answering these. Again, though, the same arguments seem to hold if we were to apply them to, say, economics. Economics (the discipline; not 'the economy', the artefact; nor 'budgeting', the skill) is all-important to democratic participation, and, like science, access to economics is largely limited to experts (Fourcade et al. 2015). Yet, there is no effort to either make policy-relevant economics accessible to non-experts, nor is there any effort to democratise economic research or policy-making. If the argument is that we should actively pursue ways to bridge the gap between experts and non-experts in democratically relevant spheres, then yes this would include science, but as with the three previous claims, there is much beyond science that would also deserve this treatment. This argument, yet again, does not make a case for why science should be treated uniquely. Indeed, the list could go on, and for each argument, a similar counter-example could easily be found to show science is not unique. A more successful line may be to look at what does make science unique.

Scientific Knowledge is the Most Reliable Knowledge We Have

Scientific knowledge is often praised for being especially reliable. From the reproducibility of its results, to the rigorous methods used in its acquisition, to the scrutiny of the peer-review system, science has developed a process for being the most reliable source of knowledge we have. While each of these claims may be disputed (Open Science Collaboration 2015; Lakatos et al. 1999), that is unnecessary here; science is indeed unique in its relationship to knowledge. The problems is that being unique in the sense of being especially reliable does not, on its own, make a case for being treated uniquely in a communication setting. A normative case for communication requires more than 'it's likely to be true'. Indeed, there are good reasons to wish for ignorance and non-communication of many a reliable contention (Henwood et al. 2003; McGoey 2012). What we need is a reason for *why* reliable knowledge ought to be communicated. Why would some highly reliable information about the reproductive habits of a squid be more important to communicate to the public than (possibly less reliable) information about the structure of interest rates or the cultural habits of Sufis? Answering this "why" question requires something like one of the previous arguments about

democracy, misinformation, or relevance to decision making. And as we have seen, these do not provide a justification for why science is in need of special treatment when it comes to communication.

The challenge for science communication is that to defend it against the charge of being epistemically unjust, we need to provide a reason why science is unique in its communication needs. We might be able to show that science is unique, but that uniqueness does not relate to communicative needs. Conversely, we can provide reasons for communicating science, but these are not unique to science.

We Don't Have to Communicate Only Science

A final defence is to accept that, in principle, there is nothing about science that demands a unique form of communication, but still argue that science communication is not epistemically unjust. The suggestion would be that other fields simply should have their own 'public understanding of' or 'public engagement with' movements. As mentioned previously, there is the CRICK Centre for the Public Understanding of Politics a Sheffield University, the Centre for Public Understanding of Finance at the Open University, and the Centre for the Public Understanding of Religion at the University of Birmingham. But these are stand-alone centres, not linked to a cohesive movement with academic journals or national strategies. This latter is especially important as it highlights the resource challenges this approach brings. As things stands, most governments spend considerable funds on public engagement with science, but it would be prohibitive for most governments to additionally dedicate the same amount to 'public engagement with the humanities', and again to 'public engagement with finance and economics', and once more to 'public engagement with the social sciences'. The acquisition and distribution of knowledge comes at a real cost and this underpins the epistemic justice (Medvecky 2016). Suggesting we can redress the epistemic injustice by proliferating movements for 'public engagement with [insert favourite field here]' does not solve the issue; it simply shifts it to an issue of distributive justice about who gets the funding to 'publicly engage'.

Conclusion

Science communication is fundamentally about knowledge distribution. As a result, careful consideration should be given to the potential for epistemic injustice to arise from science communication. After presenting an overview of epistemic injustice, this paper focused on issues pertaining to testimony and credibility, and more specifically, credibility excess. While some concerns over misrepresentation of expertise were discussed, the main concern has been to make explicit that science communication is epistemically unjust in a more fundamental way. Science communication is epistemically unjust in the way it implies (through omission) that concerted efforts to communicate reliable knowledge from non-science disciplines is less worthy or unnecessary. Some possible objections to this concern were

considered, but to no avail. If science communication is epistemically unjust, where can we go from here?

Accepting that science communication is epistemically unjust invites us to look for ways to redress this injustice. While it might be tempting to argue for epistemic justice in some absolute sense, it seems naïve to think knowledge dissemination and exchange can ever be fully fair, but being fairer and more just is something we can and ought to pursue. This paper invites science communicators to reconsider their assumed moral standing and the motivations and justifications put forward for treating science-based reliable knowledge as unique when it comes to communication needs.

Perhaps one possibility is for such communication to shift from focusing on communicating science to focusing on communicating a broader concept (a concept within which science-based reliable knowledge sits alongside that of other disciplines). In many cases, science communication already does something like this, while still positioning science as central to most issues. Communication and engagement about climate change often includes a discussion of associated ethical and economic issues. Still, climate change remains framed as primarily a scientific issue (Kahan et al. 2012; Nisbet 2009). Of course, climate change could also be framed as primarily an ethical issue (Gardiner 2011), or as primarily an economic issue (Nordhaus 2007; Stern 2007; Tol 2006). The suggestion here is it to reframe science communication as something broader; perhaps 'complex issues communications' (with science as part of that complexity), or 'knowledge communication' (with science as one of the branches of knowledge). This would overcome the epistemic injustice stemming from implying science is in need of a unique form of communication. Current 'science communication departments' could morph into something like 'knowledge communication departments'.

The next question is to determine what this overarching concept should be; do we focus on knowledge, on complexity, or on something else? As discussed earlier with regard to 'research communication' and 'engaged research', not all concepts will fill the gap, but a move to a well thought-out, broader, overarching concept would mitigate the existing injustice arising from epistemically privileging science. The key lies in recognising that while there may be something unique about science, that uniqueness does not imply science is in need of a unique form of communication. Some humility and a broader overarching concept for our communication systems would go some way to addressing science communication's epistemic injustices.

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References

Aitken, M. (2009). Wind power planning controversies and the construction of 'expert' and 'lay' knowledges. *Science as Culture, 18*(1), 47–64.

Anderson, E. (2012). Epistemic justice as a virtue of social institutions. *Social Epistemology, 26*(2), 163–173.

Bauer, M. W., Allum, N., & Miller, S. (2007). What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. *Public Understanding of Science, 16*(1), 79–95.
Besley, J. C. (2009). Focusing on fairness in science and risk communication. In L. Kahlor & P. Stout (Eds.), *Communicating science: New agendas in science communication* (pp. 68–87). Thousand Oaks, CA: Sage.
Boulding, K. E. (1966). The economics of knowledge and the knowledge of economics. *The American Economic Review, 56*(1/2), 1–13.
Bryson, M., & De Castell, S. (1996). Learning to make a difference: Gender, new technologies, and in/equity. *Mind, Culture, and Activity, 3*(2), 119–135.
Centre for Science Communication. (2016). *About Us*. Retrieved August 1, 2017, from http://sciencecommunication.info/thecentre/aboutus.html.
Clotfelter, C. T. (2014). *Buying the best: Cost escalation in elite higher education*. Princeton: Princeton University Press.
Coady, D. (2010). Two concepts of epistemic injustice. *Episteme, 7*(02), 101–113.
Collins, H. M., & Evans, R. (2002). The third wave of science studies of expertise and experience. *Social Studies of Science, 32*(2), 235–296.
Dahlstrom, M. F., & Ho, S. S. (2012). Ethical considerations of using narrative to communicate science. *Science Communication, 34*(5), 592–617.
Department for Business Innovation and Skills. (2010). *Science for all: Report and action plan from the science for all expert group (to the Department for Business Innovation & Skills)*. http://www.bis.gov.uk/assets/biscore/corporate/docs/s/science-for-all-report.pdf.
Department of Innovation Industry Science and Research. (2010). *Inspiring Australia: A national strategy for engagement with the sciences*. Canberra: The Minister for Innovation Industry Science and Research.
Dietz, T. (2013). Bringing values and deliberation to science communication. *Proceedings of the National Academy of Sciences, 110*(Supplement 3), 14081–14087. doi:10.1073/pnas.1212740110.
Duus-Otterström, G. (2012). Weak and strong luck egalitarianism. *Contemporary Political Theory, 11*(2), 153–171.
Dworkin, R. (2003). Equality, luck and hierarchy. *Philosophy & Public Affairs, 31*(2), 190–198.
Fourcade, M., Ollion, E., & Algan, Y. (2015). The superiority of economists. *Journal of Economic Perspectives, 29*(1), 89–114.
Fricker, M. (2007). *Epistemic injustice: Power and the ethics of knowing*. Oxford: Oxford University Press.
Fuller, S. (1987). On regulating what is known: A way to social epistemology. *Synthese, 73*(1), 145–183.
Gardiner, S. M. (2011). *A perfect moral storm: The ethical tragedy of climate change*. Oxford: Oxford University Press.
Gorski, P. (2005). Education equity and the digital divide. *AACE Journal, 13*(1), 3–45.
Grand, A., Davies, G., Holliman, R., & Adams, A. (2015). Mapping public engagement with research in a UK university. *PLoS ONE, 10*(4), e0121874.
Hails, R., & Kinderlerer, J. (2003). The GM public debate: Context and communication strategies. *Nature Reviews Genetics, 4*(10), 819–825.
Hendrix, E. (2005). Permanent injustice: Rawls' theory of justice and the digital divide. *Educational Technology & Society, 8*(1), 63–68.
Henwood, F., Wyatt, S., Hart, A., & Smith, J. (2003). 'Ignorance is bliss sometimes': Constraints on the emergence of the 'informed patient' in the changing landscapes of health information. *Sociology of Health & Illness, 25*(6), 589–607.
Holliman, R., & Holti, R. (2014). Defining engaged research at the OU. RC-2014-02-12. Milton Keynes, UK: The Open University. http://www.open.ac.uk/blogs/per/wp-content/uploads/2015/04/RC-2014-02-12-Engaged-Research.pdf (visited on August 3, 2017).
Illes, J., Moser, M., McCormick, J. B., Racine, E., Blakeslee, S., Caplan, A., Hayden, E. C., Ingram, J., Lohwater, T., McKnight, P., Nicholson, C., Phillips, A., Sauvé, K., Snell, E., & Weiss, S. (2010). Neurotalk: Improving the communication of neuroscience research. *Nature Reviews Neuroscience, 11*(1), 61–69.
Jasanoff, S. (2004). Science and citizenship: A new synergy. *Science and Public Policy, 31*(2), 90–94.
Jensen, E., & Buckley, N. (2014). Why people attend science festivals: Interests, motivations and self-reported benefits of public engagement with research. *Public Understanding of Science, 23*(5), 557–573.

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change, 2*(10), 732–735. http://www.nature.com/nclimate/journal/v2/n10/abs/nclimate1547.html - supplementary-information.

Kurath, M., & Gisler, P. (2009). Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. *Public Understanding of Science, 18*(5), 559–573.

Lakatos, I., Feyerabend, P., & Motterlini, M. (1999). *For and against method: Including Lakatos's lectures on scientific method and the Lakatos-Feyerabend correspondence*. Chicago: University of Chicago Press.

Lamont, J., & Favor, C. (2008). Distributive justice. In E. Zalta (Ed.), *Stanford Encyclopedia of Philosophy*. http://plato.stanford.edu/archives/fall2008/entries/justice-distributiv.

McGoey, L. (2012). Strategic unknowns: Towards a sociology of ignorance. *Economy and Society, 41*(1), 1–16.

Medina, J. (2011). The relevance of credibility excess in a proportional view of epistemic injustice: Differential epistemic authority and the social imaginary. *Social Epistemology, 25*(1), 15–35.

Medvecky, F. (2016). The cost of being known: Economics, science communication and epistemic justice. In J. Collier (Ed.), *The future of social epistemology: A collective vision*. Lanham, MD: Rowman & Littlefield.

Medvecky, F., & Leach, J. (2013). The ethics of distributing scientific knowledge: Epistemic and ethical injustices in context. In J. Goodwin, M. Dahlstrom, & S. Priest (Eds.), *Ethical issues in science communication: A theory-based approach*. Ames, Iowa: Science Communication Project.

Ministry of Business, Innovation and Employment. (2014). *A nation of curious minds: A national strategic plan for science in society*. Wellington: New Zealand Government.

Moritz, J. M. (2009). Doubt, deception, and dogma: Science and religion in film. *Theology and Science., 7*(3), 207–212.

Nielsen, K. (1979). Radical egalitarian justice: Justice as equality. *Social Theory and Practice, 5*(2), 209–226.

Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. *Environment: Science and Policy for Sustainable Development, 51*(2), 12–23.

Nisbet, M. C., & Scheufele, D. A. (2009). What's next for science communication? Promising directions and lingering distractions. *American Journal of Botany, 96*(10), 1767–1778.

Nordhaus, W. D. (2007). A review of "the stern review on the economics of climate change". *Journal of Economic Literature, 45*(3), 686–702.

Nowotny, H., Scott, P., & Gibbons, M. (2005). The changing nature of public science. In H. Nowotny, D. Pestre, E. Schmidt-Aßmann, H. Schultze-Fielitz & H.-H. Trutte (Eds.), *The public nature of science under assault* (pp. 1–27). Heidelberg: Springer.

Nozick, Robert. (1974). *Anarchy, state and Utopia*. New York: Basic Books.

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science, 349*(6251), 4716. doi:10.1126/science.aac4716.

Palmer, S. E., & Schibeci, R. A. (2014). What conceptions of science communication are espoused by science research funding bodies? *Public Understanding of Science, 23*(5), 511–527.

Priest, S. H. (2010). Coming of age in the academy? The status of our emerging field. *Journal of Science Communication, 9*(03), C06.

Rawls, J. (1999). *A theory of justice*. Oxford: Oxford University Press.

Revell, L. (2010). Religious education, conflict and diversity: An exploration of young children's perceptions of Islam. *Educational Studies, 36*(2), 207–215. doi:10.1080/03055690903162390.

Roemer, J. E. (1998). *Theories of distributive justice*. Harvard: Harvard University Press.

Scheffler, S. (2003). What is egalitrianism? *Philosophy & Public Affairs, 31*(1), 5–39.

Schmidt, C. W. (2009). Communication gap: The disconnect between what scientists say and what the public hears. *Environmental Health Perspectives, 117*(12), A548–A551.

Science Communication: Description. (2016). Retrieved August 16, 2016, from https://us.sagepub.com/en-us/nam/journal/science-communication.

Singh, S. (2001). Gender and the use of the internet at home. *New Media & Society, 3*(4), 395–415. doi:10.1177/1461444801003004001.

Stern, N. (2007). *The economics of climate change: The Stern review*. Cambridge: Cambridge University Press.

Stilgoe, J., Lock, S. J., & Wilsdon, J. (2014). Why should we promote public engagement with science? *Public Understanding of Science, 23*(1), 4–15. doi:10.1177/0963662513518154.

Stocklmayer, S. M. (2001). *Science communication in theory and practice* (Vol. 14). Dordrecht: Springer.
Thomas, G., & Durant, J. (1987). Why should we promote the public understanding of science. *Scientific Literacy Papers, 1,* 1–14.
Thompson, P. B. (2012). Ethics and risk communication. *Science Communication, 34*(5), 618–641.
Tol, R. (2006). The stern review of the economics of climate change: A comment. *Energy & Environment, 17*(6), 977–981.
Trench, B. (2008). Towards an analytical framework of science communication models. In D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele & S. Shi (Eds.), *Communicating science in social contexts. New models, new practices* (pp. 119–135). New York: Springer.
Trend, D. (2001). *Welcome to cyberschool: Education at the crossroads in the information age*. Lanham, MD: Rowman & Littlefield.
Wilkinson, C., & Weitkamp, E. (2016). *Creative research communication: Theory and practice*. Oxford: Oxford University Press.
Wynne, B. (2003). Seasick on the third wave? Subverting the hegemony of propositionalism: Response to Collins & Evans (2002). *Social Studies of Science, 33*(3), 401–417.