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How institutional solutions meant to increase diversity in science fail

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Abstract:

Philosophers of science have in recent years presented arguments in favour of increasing cognitive diversity, diversity of social locations, and diversity of values and interests in science. Some of these arguments align with important aims in contemporary science policy. The policy aims have led to the development of institutional measures and instruments that are supposed to increase diversity in science and in the governance of science. The links between the philosophical arguments and the institutional measures have not gone unnoticed. Philosophers have even explicitly suggested that institutional measures could be used to increase diversity in science. But philosophical criticisms of the existing institutional instruments have also been presented. Here I review some recent case studies in which philosophers examine actual attempts to increase diversity in science by using institutional measures implemented from the top down – attempts that have failed in one way or another. These studies examine attempts to involve citizens or stakeholders in the governance of science and technology and attempts to increase the number of interdisciplinary collaborations. They draw attention to the limitations of such instruments, calling into question the most optimistic visions of using institutional instruments to increase diversity in science.

Keywords: social diversity, diversity of values and interests, diversity of social locations, cognitive diversity, public participation, interdisciplinarity, science policy, institutional epistemology in practice

1. Introduction

In this paper I review some recent philosophical case studies that tell us about the limitations of institutional instruments that are supposed to increase diversity in science. Philosophers of science have in recent years presented several arguments in favour of increasing cognitive diversity, diversity of social locations, and diversity of values and interests in science and in the governance of science. While I find some of the arguments in favour of increasing diversity in science convincing, here I will not attempt to back them up. Instead, I want to ask what follows, in practice, if we are convinced by some or all of them. Do we know what kind of measures should be taken if the aim is to increase diversity in science?

Some of these philosophical arguments align with important aims in science policy. The latter, in turn, have led to the development of various institutional instruments that are supposed to

increase diversity in science and in the governance of science, and philosophers of science have endorsed some of these. However, it is not clear that they are always very effective. Critical case studies of such instruments are useful when we attempt to understand whether and to what degree they can actually increase diversity in science.

Throughout the paper I will be using a broad notion of science, one that also encompasses the social sciences and the humanities, like the German word *Wissenschaft* and the Latin *scientia*. Moreover, as many of the institutional instruments I examine have been implemented at the porous boundaries between science and technology, the underlying broad account of science I use will also include its many connections to technology.

I focus on instruments implemented from the top down that aim at involving citizens or stakeholders in decisions about the governance of science and technology, and instruments that are meant to increase the number of interdisciplinary collaborations. The first I take to illustrate the possibilities and limitations of using top-down institutional measures to increase social diversity, particularly the diversity of values and interests, in the governance of science and technology. The second I take to illustrate the possibilities and limitations of using top-down institutional measures to increase cognitive diversity in research groups.

I will start by distinguishing three types of diversity, and briefly summarising some arguments that they are beneficial in science. Then I introduce the types of institutional instruments on which I will focus. After this, the bulk of the paper is devoted to the case studies I review. Finally, I draw some conclusions from the case studies reviewed, arguing that philosophers should be wary about endorsing top-down institutional instruments as ways to increase diversity in science, as they may not be particularly effective.

2. Diversities in science

Discussions about diversity abound in contemporary philosophy of science. A plethora of arguments point towards similar conclusions: it is good for research groups and scientific communities to be diverse, it is good if decisions in science and informed by science are made in a way that takes diverse viewpoints into account, and it is good if diverse values and interests influence the governance of science. The term "diversity", however, refers to many different forms of diversity, and the similar conclusions form a cluster of claims. I will now briefly distinguish three forms of diversity that can be meant when talking about diversity in science. After that I turn to some ways in which these different diversities could perhaps be increased by using institutional measures.

I will distinguish between cognitive diversity, diversity of social locations, and diversity of values and interests. A *cognitively diverse* group is one where the members use different problem-solving strategies, have different competences, background beliefs or reasoning styles, or in some comparable way approach the subject of inquiry from clearly different cognitive perspectives. A group that is diverse with respect to *social locations* has members whose social locations, such as class, gender, or ethnic identity, vary. And a group that is diverse with respect to *values and interests* has members with diverse values and interests.

Philosophers of science have presented epistemic, moral, and political arguments that all lead to a similar conclusion: more diversity in science would be desirable.

Cognitive diversity is argued to be beneficial in scientific communities, as it ensures that research efforts are distributed widely, and cognitive labour is divided. This is epistemically valuable when it is unclear which line of inquiry will be successful. A cognitively diverse research community is able to explore research problems in a versatile and therefore more efficient manner than a cognitively more homogenous community. With complex scientific problems this is often required: they should be approached from a wide range of different research approaches (Kitcher 1990; Solomon 2001; Weisberg & Muldoon 2009; Pöyhönen 2017; Rolin forthcoming). Similar arguments have also been presented about groups and not only communities: if the members of a group use different problem-solving methods, their combined efforts can lead to better outcomes than the combined efforts of a cognitively homogenous group. This idea has been backed up particularly with the "diversity trumps ability" hypothesis introduced by Hong and Page (2004; Page 2008; for criticism see Reijula & Kuorikoski 2021). Their modelling approach suggests that a group of diverse problem-solvers could outperform a group of individually more capable but less diverse problem-solvers.

Demands for more diversity of social locations are based both on moral and political arguments, and on epistemic ones. Many social groups are underrepresented in scientific communities, and this is both unjust and potentially epistemically harmful. It is unjust because the results science produces affect so many aspects of contemporary societies; it is wrong if the viewpoints of the powerful influence scientific knowledge production, whereas the perspectives of marginalised groups are not taken into account. Moreover, standpoint epistemologists argue that different social locations can offer epistemically privileged perspectives to different issues, and particularly the viewpoints of members of socially marginalised groups can make an epistemic difference, precisely because these groups are underrepresented in academia. Their inclusion can counteract the harmful effects of social oppression in knowledge production. If a scientific community is too homogenous in the sense of social locations, it risks remaining blind to some issues. (Wylie 2003; Jasanoff 2003; Jaggar 2004; Intemann 2010; Harding 2015; Rolin 2019.)

Demands for more diversity of values and interests are also based on epistemic, moral, and political arguments. Feminist empiricists, most notably Helen Longino (1990, 2002) have argued that well-functioning epistemic communities need members who have diverse values, because this guarantees efficient debates. When research is scrutinised from diverse value perspectives, it is unlikely that some widely shared values could lead to errors that would remain unnoticed. Other arguments emphasising the importance of a diversity of values and interests are more closely linked to the arguments about social diversity in the sense of social location. A socially homogenous research community in the sense of social location is likely to be homogenous also in the sense that its members share similar values and interests. This can be both epistemically and socially harmful if it leads to a situation where researchers pay attention mostly or only on issues that are deemed important and worthy of study by those who share their social location and values – and issues that are important for other groups in society are left understudied (Wylie 2003; Intemann 2010). It is also argued to be politically

questionable. Many philosophers of science today argue that value decisions are unavoidable in all stages of research. If so, in a democratic society these decisions should not be made by researchers whose views by no means represent the society at large. Instead, they should be made democratically. In other words, the values should either be representative of the values of the general population, or they should reflect the values and interests of stakeholder groups who are likely to be somehow affected when the results of research are put into use. (Kitcher 2001; 2011; Douglas 2005, 2009; Elliott 2011.)

3. Institutional solutions for increasing diversity?

Some of the aims summarised in the previous section chime with important aims in contemporary science policy. Today, the importance of some types of diversity in science is emphasised in many countries as well as in many international science policy organisations. This has led to the development of various methods, approaches, programmes, and institutional measures and instruments that are meant to increase diversity in science in different ways. Some of them are typically implemented by researchers who, for instance, conduct community-based or participatory projects because they wish to engage representatives of socially marginalised communities in their research (see e.g. Jordan, Gust, Schemann 2015; Wylie 2015). Also, some measures that are being supported by universities and science policy bodies are fully optional for scientists – think of programmes of voluntary mentoring, for example (Montgomery 2018). Here, however, I am interested in measures that are more formal and implemented from the top down, such as regulations and funding instruments. I will call them institutional solutions, instruments, or measures that are supposed to increase diversity in science. Do we have good reasons for believing that they actually succeed in increasing diversity? If we accept some or all of the arguments summarised in the previous section, should we endorse the use of such institutional instruments?

We can identify at least three clusters of these kinds of measures: ones meant to increase the share of underrepresented groups in scientific communities, ones meant to involve citizens and/or stakeholders in the governance of science and technology, and ones meant to increase the number of interdisciplinary collaborations. In the next section, I will concentrate, in more detail, on cases belonging to the last two of these clusters. But first, let me briefly describe all three.

Firstly, it is a widely accepted aim in science policy to try to increase the share of women and underrepresented minorities in scientific communities. This has led to the development of various institutional instruments that are meant to foster social equity in science. For example, regulating recruitment and hiring practices and tenure and promotion processes is relatively common. Some philosophers of science have endorsed such practices, acknowledging that their use can increase the diversity of social locations in scientific communities. For instance, Anna Leuschner (2015) argues that increasing the representation of members of underrepresented social groups in science requires the use of "mechanical solutions", such as hiring quotas and triple-anonymous review procedures where the identity

of the author of a manuscript is not known even by the editor or the conference organiser. As many of the instruments developed for this purpose are fairly well established, and as their efficacy has already been studied from many perspectives (see e.g. Laursen & Austin 2020), I will not concentrate on them here. I will, however, return to them briefly in section 5.

Secondly, recent decades have witnessed the emergence of many institutional instruments that are meant to "democratise" the governance of science and technology. Citizen panels, programmes of stakeholder hearings, and other similar measures that are supposed to improve the possibilities for members of the general public and stakeholder groups to have their voice heard in the governance of science and technology have been implemented in many countries and endorsed by important science policy bodies (Maassen & Weingart 2005; Jasanoff 2017; Eigi 2017). Sometimes such programmes are initiated by scientists, but as we will see in the next sections, they can also be mandatory. Many philosophers of science have recognised that the use of such instruments can be an effective way to increase diversity in the governance of science both in terms of social locations and in terms of values of and interests. Such programmes of democratisation and engagement chime particularly well with arguments that demand for democracy in the value decisions that are unavoidable in science: they are precisely meant to ensure that many value decisions related to science are made democratically. Recognising this, Heather Douglas (2005) and Kevin Elliott (2011), for instance, have endorsed the use of such instruments.

Thirdly, institutional instruments that are meant to increase the number of interdisciplinary collaborations are very common today. Interdisciplinary research is often seen as indispensable when attempting to find solutions to urgent societal and environmental problems. Science policy bodies, for example, devise funding instruments and targeted calls for interdisciplinary research, and universities create space in their structures for interdisciplinary institutes and research platforms, reallocating research funds so as to create strong incentives for scientists to join them. Typically, advocates of interdisciplinarity argue that only by integrating different disciplinary perspectives scientists can gain a profound enough understanding of many of the complex societal and environmental problems we face today. (Huutoniemi et al. 2009; Pohl et al. 2017; MacLeod & Nagatsu 2018; Salmela, MacLeod & Munk af Rosenschöld 2021; Griffiths 2022.) In practice, when successful, institutional instruments that are supposed to increase the number of interdisciplinary collaborations in academia lead to the creation of research groups that include members from different disciplines. The idea is that they learn from each other and come up with solutions none of them could have reached had they used only the problem-solving strategies of their own disciplines. This, I argue, chimes very well with the main gist of the arguments demanding for more cognitive diversity in research groups: if the members of a group use different problem-solving strategies, their combined efforts can lead to better outcomes than the combined efforts of a cognitively homogenous group.

In the next section I review some recent philosophical case studies that tell us about the limitations of institutional instruments belonging to the last two clusters. In other words, I will peruse some of the ways in which institutional solutions meant to increase diversity in science can fail. This is possible because philosophers interested both in the institutions that

sustain and shape scientific knowledge production, and in the epistemology of practice, have in the recent years produced some illuminating case studies about such instruments. Some of these case studies tell about failures. And this is needed, because if philosophers of science are to endorse the use of such instruments, a thorough understanding of their limitations is valuable.

4. Failures and unexpected outcomes

In this section I will discuss recent case studies that focus on two types of institutional measures. In the first two subsections the focus is on attempts to involve citizens and stakeholders in decisions about the governance of science and technology: participatory programmes, citizen forums, stakeholder hearings, and other similar endeavours. In all of them one of the explicit goals is to take the diverse values and interests of citizens and/or stakeholders into account in the decisions, thus making them more democratic. In the last subsection I will turn to institutional instruments that are meant to increase the number of interdisciplinary collaborations in science. One of the explicit aims in such initiatives is to create research groups and sometimes even larger communities where the members have different disciplinary backgrounds, and thus use different problem-solving strategies and have different competences. I take all of these instruments to be illustrative examples of the ways in which institutional measures are used to increase diversity in science. And I take the case studies below to tell us about the limitations of such measures.

4.1. Against the consensus ideal: adversarial interaction and critical activism

In a recent article, Jeroen Van Bouwel and Michiel Van Oudheusden (2017) examine and criticise some contemporary participatory programmes that seek to democratically intervene in scientific practice. They claim that the programmes they examine, and much of the literature discussing public participation, take for granted an ideal of reaching consensus. According to Van Bouwel and Van Oudheusden this ideal can be harmful, as it can lead to the exclusion of some potential participants from the participatory processes, thus curtailing the potential diversity within programmes that aim at public participation in the governance of science and technology. They therefore examine possible alternatives, based on different models of democracy, particularly emphasising agonistic plurality that questions the consensus ideal and allows for adversarial interaction between parties who respect each others' right to differ. Their criticism draws attention to stakeholders who may be excluded from participatory processes because they question the rules and expectations of the existing processes. I will argue that even processes of public participation that are not built on the consensus ideal may exclude some stakeholders, if they do not trust the organisers. Stakeholder activism and activist research movements can sometimes – but only sometimes – be a more effective way for such stakeholders to have their voices heard in science, technology, and science policy.

Van Bouwel and Van Oudheusden describe and discuss a programme of participatory technology assessment, Nanotechnologies for Tomorrow's Society, that was initiated in

Belgium in 2006. Its aim was to align science and technology innovation with the values of society by instigating several participatory rounds over a five-year period, thus subjecting the "visions and expectations that inform nanoresearch to public debate and streamlining" (Van Bouwel & Van Oudheusden 2017, 499). The participants included researchers and members of technical communities, civil society organisations, and citizens.

While conflict between the participants was expected, Van Bouwel and Van Oudheusden argue that the initiative failed to adequately address the diversity of the values and interests of the different participants, because it did not allow for protracted conflict. The programme was based on a normative commitment that such conflict should be reconciled. The participants were to "learn to locate common ground whilst they reconfigure their identities and interests along the way" (*ibid.*, 500). The aim was to reach at least a mutual understanding and recognition between the participants, and ideally "a common identity and culture" that would provide a basis for future innovation (*ibid.*). However, some of the participants refused to conform to this deliberative, consensus-seeking process:

> For instance, several nanotechnologists refuted the project's aim of involving 'nonexperts,' such as lay citizens, in scientific and technical assessment. Instead, they suggested educating citizens about nanotechnology so as to acquire public support for technology innovation through participation and outreach [...]. As a consequence, the NanoSoc process became impracticable and even undercut the deliberative process, which its initiators sought to sustain. (Van Bouwel & Van Oudheusden 2017, 505.)

The problem, Van Bouwel and Van Oudheusden argue, was that the initiators of the programme had adopted a consensual deliberative model of democracy. In other words, the participants were supposed to engage in a rational debate, build understanding by listening to one another and by questioning their own assumptions, and thus, ideally, end up forming a genuine consensus. The programme was therefore feasible only if all participants agreed with the idea that such consensus was desirable, and that this kind of deliberation was the way it should be reached. The programme was therefore unable to deal with a situation where no such meta-consensus about the deliberative rules of the process or its desirable outcome existed.

Van Bouwel and Van Oudheusden discuss alternative models of democracy and suggest agonistic pluralism as a possibly useful one when planning participatory processes in science and science policy. They follow Chantal Mouffe (1999; 2000; see also Van Bouwel 2009), who has criticised particularly deliberative models of democracy of depoliticising political debates, and of not allowing for genuine, protracted conflict and disagreement about the rules and aims of political negotiations. Instead of consensus, agonistic pluralism seeks to establish interaction, not just antagonism, between parties whose conflicts may be irresolvable, and who can disagree even about the rules of the interaction. By following this model of democracy, Van Bouwel and Van Oudheusden argue, a participatory process could admit that for instance some conflicting group interests and values can be non-negotiable. This would also create space in the process for stakeholders who are wary of the consensus ideal.

A participatory process based on agonistic pluralism will not always reach a decision. In other words, such processes may not produce the kind of clear solutions to problems that are often wanted from participatory processes. If the process is supposed to inform decision-making, the decisions typically cannot be postponed indefinitely, and any decision may well be unacceptable to one or more of the parties involved in the process. However, arguably a decision that is overtly against the views of some stakeholders is at least more transparent than one that claims to be based on a consensus view, but is, in fact, based on an agreement that was reached only because some stakeholder groups were excluded from the decision-making process. Moreover, it can be difficult to predict whether a participatory process could lead to a consensus view. If some stakeholders doubt the possibility, and the process is based on a normative commitment to the consensus ideal, they may decide not to participate. A process that allows for protracted conflict would be more inclusive, and could sometimes enable the formation of agreements that the participants initially thought to be unlikely.

But even a programme of public participation that would allow for protracted conflict would not necessarily be able to reach and engage all relevant stakeholder groups. As Catarina Dutilh Novaes and Silvia Ivani (2022) have pointed out, programmes of public participation or engagement are able to reach only those who already have a certain "modicum of trust" in the organisers of such programmes. There are people and groups who, for various reasons, do not have such trust, and who are therefore unlikely to engage in programmes of public participation. As Dutilh Novaes and Ivani note, this is why it is unlikely that such programmes could build trust in people who actively distrust scientists, even though they can increase already existing trust in science.

Institutional instruments, such as programmes of public participation and engagement, are most likely not an effective way to hear and take into account the values and interests of the most distrustful stakeholder groups. An alternative to such programmes, one that some groups have seized, is to combine social activism with research initiated and even conducted by the activists themselves. Stakeholder activism can sometimes lead to the emergence of movements that also operate within academia and are able to influence science, technology, and science policy. Kristina Rolin and I have recently examined indigenous activism as an example of a movement that has succeeded in influencing research in many fields, challenged dominant academic practices, and made indigenous perspectives and interests heard and taken into account (Koskinen & Rolin 2019). It is easy to think of other similarly successful movements – for instance, disability activism – where stakeholders have not relied on programmes of participation or engagement designed by others, but initiated movements aiming at change, and succeeded at least to some degree. Such movements can function as alternatives to programmes of public participation, and be successful in engaging stakeholders who generally distrust scientists. But because such movements typically originate outside academia, it is very difficult if not entirely impossible to control their emergence by using the kind of institutional instruments discussed here.

Moreover, as we point out, there is no guarantee that even when an activist movement with epistemic aims has emerged, it will choose to operate within academia (Koskinen & Rolin 2019; Koskinen 2021). It can easily also establish an antagonistic relationship to science,

bolstering distrust and sometimes even propagating clearly pseudoscientific views. José Medina (2021) has suggested that avoiding such an outcome requires epistemic activism within the group, that is, collective epistemic action that aims at changing both oppressing institutions that affect the group and potentially harmful epistemic dynamics within the group. This, too, is something that can hardly be controlled by using institutional instruments that only work in academia.

In other words, activist movements can increase diversity in science and its governance if there is a strong enough impetus within the movement itself towards engaging in critical interaction and also operating within academia, rather than towards antagonistic dismissal of science or the existing scientific institutions. It is hard to see how institutional changes within academia or the development of new institutional instruments within academia could much increase the likelihood of this happening.

Van Bouwel and Van Oudheusden (2017) criticise not only the programmes they study, but also much of the STS literature on participation, for relying too strongly on deliberative models of democracy and accepting the consensus ideal too easily. Their criticism is also relevant for philosophy of science. For example, Philip Kitcher's (2001; 2011) influential idea of well-ordered science is explicitly based on a deliberative theory of democracy. He argues that the choice of problems and topics to be studied, ethical constraints on research, and the ways in which scientific results are applied should be decided democratically. When envisioning how this could be done, he describes an idealised group of representative deliberators who are tutored so that they understand the issues at hand, and who then deliberate until they reach common preferences. Ideally, they should reach a consensus view; otherwise, they should vote. Douglas (2005) has similarly endorsed the consensus ideal when examining science shops, citizen planning efforts, and consensus conferences as practical examples of processes in which citizens can take part in the value judgements needed in science. It is important to recognise that while such processes may bring some democratic legitimacy to the decisions, their ability to include diverse values and interests is limited. A procedure that has to produce a consensus view or a result of a vote will exclude some groups. Those who have some non-negotiable values and interests to defend, and who believe that they would lose if the issue were settled by a vote, are unlikely to participate. And if they do not trust the organisers or the other participants, they most certainly will not.

Diversity of values and interests – be it connected to diversity of social locations or not – can bring about genuine, non-negotiable disagreements and protracted conflict. I agree with Van Bouwel and Van Oudheusden in that programmes of public participation based on the consensus ideal risk excluding individuals and groups who doubt the ideal. And I agree with Dutilh Novaes and Ivani in that including such groups is even more difficult if they distrust science or the organisers of the programme. While activist movements can at times offer another avenue through which diverse values and interests are introduced in academia, they can also end up in an antagonistic relationship with science or scientific institutions. Moreover, it is hard to control activist movements with academic institutional instruments.

4.2. Taking advantage: hijacking and diversity washing

Distrust in programmes meant to increase diversity in science or science policy can be warranted. Philosophers and STS scholars have drawn attention to several cases where institutional solutions that were meant to democratise decision-making and increase public participation in science or science policy have not delivered what they promised. Instead of the diverse values, interests, and viewpoints of citizens or stakeholders actually influencing decision-making, the participatory process can be seized by some powerful party, or its results may not actually influence decision-making (Wilholt 2014, Koskinen & Mäki 2016; Kurtulmus 2021; Radder 2021). This can happen more or less intentionally, and the participants can be more or less aware of the flaws in the process.

Hans Radder (2019; 2021) has recently analysed a development of the Dutch National Research Agenda, a programme meant to hear citizens when choosing topics that should be on the research agenda of Dutch scientists. In 2015, members of the general public were invited to submit questions they would like to see scientists addressing. The 11,700 questions received were then processed, mostly by academic juries, after which funding was made available, and research teams could propose projects seeking to answer the questions chosen. However, the institutional design of the programme was problematic in many ways. The coalition that directed the process included representatives of employers' associations and established policy organisations, while representatives of many relevant stakeholder organisations, such as labour unions, NGOs and academic grassroots organisations were not heard – in other words, all relevant stakeholders were not involved. Moreover, the final list of 140 questions was hardly representative of the original questions:

> [T]he process of clustering the 11,700 questions into the 140 overarching ones, which has been carried out exclusively by academics, was by no means a neutral procedure. The following example shows what gets lost in this process. One question reads: "How can we increase the inclusion, resilience and talents of young people with (mental, cognitive, physical) developmental problems and retardations?" According to one of the scientific jury members, the core of this question can be rephrased as: "How can we have children grow up safely?" [...] But of course the original question is not limited to questions of safety. And while the latter question could be used to promote technocratic research about security policies, the former question could entail a rather different set of research projects. (Radder 2021, 121–122.)

Radder argues that the process failed to be democratic. Clearly the process also failed to reflect the diversity of values and interests in the questions the participating citizens originally submitted.

Sometimes the participants in participatory programmes realise that their contributions and concerns are lost in the system and have no real effect. Sara Angeli Aguiton (2018) has studied such a development from an STS perspective. She examines French citizen conferences, participatory technology assessments, and similar administrative and institutional actions meant to increase "technical democracy". Their explicit aim is to increase citizen and stakeholder participation in discussions and decisions about science and

technology and their use in society, and to increase the democratic control of technoscientific development. They are supposed to diminish power inequalities, temper conflicts, and lead to responsible research and innovation.

Aguiton argues that while such policy instruments have been common in France for decades, they have become instrumentalised in ways that go against their democratic premises: in many of the cases she discusses the institutions organising participatory conferences and forums have mainly sought to govern critique raised against new technologies, not to redistribute power. Such instrumentalisation has not escaped the attention of activist groups. As they have become disillusioned with the conferences and forums, they have stopped collaborating, refusing to be "domesticated", and have started to protest against the participatory programmes by disturbing and heckling their public meetings. Aguiton's (2018, 111–122) discussion of the growing tensions between the parties culminates in a detailed description of a protest during a public forum on synthetic biology, held in Paris in 2013. Activists sabotaged the forum by invading it, dressed up as chimpanzees.

However, when something goes wrong in such a participatory process, activists and other participants in the process do not necessarily realise it. Bennett Holman and Sally Geislar (2018) have analysed a case in which a pharmaceutical company successfully captured a participatory process that sought to involve patients in the assessment of a drug developed by the company. The US Food and Drug Administration has developed a concept of patient-focused drug development meetings. The aim is to hear the patients' views especially in situations where it is difficult to weigh the risks and benefits of a new drug. Hearing the patients' viewpoint is supposed to offer the FDA a fuller understanding of the patient's needs, and thus complement expert evaluations.

Holman and Geislar argue that in the case they studied, the pharmaceutical company successfully manipulated the meetings. From the meeting documents, Holman and Geislar were able to identify two distinct patient groups: those who had an affiliation with the company – often, the company had paid their trip to the meeting – and those who did not. The two groups understood their ailment in distinctly different ways, indicating that the company had either successfully manipulated the views of the first group, or succeeded in having patients whose views were already favourable to their interests participate in the meeting, or both. This went unnoticed by the organisers of the meeting, and the result was that the drug was approved, despite expert evaluations suggesting otherwise.

When some powerful parties involved in a participatory process have important interests are at stake, "lobbying, bullying, and bribery" (Wilholt 2014, 171) of the participants must be expected. This of course should be taken into account when designing the policy instruments.

Holman and Geislar (2018) suggest that in programmes such as the patient meetings, the institutional design could be more resistant against attempts to manipulate the results. They argue that such policies should include ongoing reliability assessments, and that they should be designed so as to be robust to foreseeable countermeasures. The best solutions, they claim, would succeed in aligning the interests of the different parties, so that there would be no need for constant countering of new attempts to manipulate the process and its results.

Their suggestions are reasonable in the context they examine – one where it is easy to predict that one party is likely to attempt to manipulate the views of the participants, and this party is not the one that plans and organises the participatory process. But they are not adequate in situations where this is not the case. For instance, the case of the Dutch National Research Agenda that Radder (2021) describes is not one where we could identify two clear parties, the organisers, and the powerful stakeholder, in an arms race of manipulation attempts and countermeasures. In murky cases, it may well be that no one involved in the process is involved first and foremost in order to ensure that the participants' diverse values and interests are genuinely taken into account. And as the examples above illustrate, in such cases the result may be something other than the increase in diversity that the institutional measures were supposed to produce.

4.3. Getting something other than was envisioned: scientific subordination instead of interdisciplinarity

Not only social diversity, but cognitive diversity too is something that is valued in many science policy initiatives today. Interdisciplinary collaboration is often seen as a way – perhaps even the only effective way – to solve many of the urgent problems of our contemporary societies. While "interdisciplinarity" is a complex term that can be and has been defined in numerous ways, it is common to assume that interdisciplinary research is marked by the integration of different disciplinary approaches. In order to solve complex problems, members of genuinely interdisciplinary research groups learn from each others' perspectives and come up with new, integrated approaches capable of addressing all sides of the multifaceted problems they study. (Klein 2010; Huutoniemi & Rafols 2017.) In other words, the idea that it is beneficial if the members of a research group or a larger research community employ different problem-solving strategies is widely shared in contemporary science policy.

This conviction has led to the development of institutional instruments that are meant to incentivise interdisciplinary collaborations. The functioning of such instruments has started to also interest philosophers of science. Two recent articles, reporting on separate studies in different countries, come to surprisingly similar conclusions: rather than increasing the number of interdisciplinary collaborations of the kind sketched above, the studied institutional measures have led to something else.

Daniel J. Hicks (2021) has used bibliometric methods to study publications produced in nondepartmental research units at the University of California, Davis. These units are supposed to support interdisciplinarity, but Hicks's evidence shows that they have mostly succeeded in promoting multidisciplinarity – that is, there is perhaps fruitful interaction across disciplinary boundaries, but the collaboration has not led to the integration of different disciplinary approaches.

A somewhat similar result has emerged from a much larger case study conducted in a project led by Mikko Salmela, where I was part of the research team. The research platforms we studied in this project have mostly not led to the emergence of genuinely interdisciplinary

collaborations marked by the integration of different disciplinary approaches. Instead, the platforms have promoted something else. I will now look at our case more in detail in order to understand what this might mean for attempts to increase cognitive diversity in research groups. The results of the case study that are of interest here have been described and analysed in detail in a recent article by Salmela, Miles MacLeod, and Johan Munck af Rosenschöld (2021), and I will base my discussion on their paper.

Our interdisciplinary team conducted a case study of a structural reorganisation of a small technical university, "BizTech". During the four-year study period, this university, located in a Nordic country, reallocated its internal research funds to temporary research platforms. To be able to apply for funding, a platform had to incorporate researchers from at least two of the university's three schools.

Similar developments as the ones we studied are common in many European universities, and as Hicks' case illustrates, also in many other countries (see also Griffiths 2022). In Europe, an important catalyst for these kinds of structural changes is the Horizon Europe funding programme (and its predecessor Horizon 2020) which aims at interdisciplinary collaborations focusing on topics that are deemed societally important. Universities attempt to increase their researchers' chances of gaining the highly competitively allocated funding by creating structures that would not only support, but strongly incentivise interdisciplinary research collaborations. (Lindvig & Hillersdal 2019; Salmela, MacLeod & Munck af Rosenschöld 2021.)

Our research team included philosophers and STS scholars. We followed the creation and development of the platforms at BizTech, and conducted semi-structured interviews with platform PIs, coordinators, professors, and researchers from three platforms, as well as the university management. The aim of the study was to study tensions arising in interdisciplinary collaborations, and to evaluate the epistemic consequences of such a structural reorganisation of university research. One of our team's findings is of particular interest here: in only one of the three platforms we saw something that might amount to interdisciplinary integration. Instead of the kind of exploratory learning by which "genuine" interdisciplinarity is supposed to be characterised, our team found platforms where some strong groups with established epistemic goals formed the core of the platform, set the research topics, and framed the main problems, and other participating groups had to adjust their research to serve the core. Instead of different disciplinary perspectives being integrated, one perspective would dominate. In other words, the platforms became examples of scientific subordination (MacLeod 2018) rather than genuine interdisciplinarity.

Salmela, MacLeod and Munck af Rosenschöld (2021) suggest that one of the reasons why this happened was that when the platform strategy was planned, the aim of creating interdisciplinary collaborations was conflated with the aim of optimising the ability of researchers to gain external funding. The strategy proved to be quite efficient with regard to the latter aim. But gaining external funding for the platforms did not require genuine interdisciplinary collaborations. Rather than promoting balanced communication and integration, the platforms could pool resources in a way that would reinforce the goals of the central group or laboratory.

This is in line with what has been found in studies concerning the effectivity and impacts of such science policy instruments as targeted funding calls and programmes. It is surprisingly difficult to predict or control how they shape the development of research agendas, ways of conducting research, or its content, particularly in the long run. The contemporary academic environment makes researchers skilful in adapting to their funding conditions, and creative in presenting their own goals in ways that are or appear to be in line with the changing criteria of different funding opportunities. And the long-term, macro-level consequences of such adaptations are not well known. (Shove 2003; Laudel 2006; Gläser & Laudel 2016.)

Our case illustrates how the adaptation and creative reinterpretation of the aims of science policy instruments can happen on multiple levels. First the aim of increasing interdisciplinary collaborations was merged, in the planning of the platform strategy, with other central and well-established aims of the BizTech administration – first and foremost, that of gaining external funding for the university's researchers, regardless of whether interdisciplinarity was stressed in the funding call. Then the researchers who applied for the platform funding found ways in which they could advance their own research goals, while still complying with the criteria of the internal funding call. The result was mostly something other than integrative interdisciplinarity.

As Hicks (2021) points out, getting multidisciplinarity instead of interdisciplinarity is not necessarily a bad thing. This is true also if we think about the possible epistemic benefits of cognitive diversity in research groups. It is possible that gaining such benefits does not require that much or that ambitious integration of the different problem-solving strategies, as long as there is some kind of fruitful interaction (see also MacLeod & Nagatsu 2018). However, it is doubtful whether any of the benefits could be achieved if the collaboration is characterised by scientific subordination (MacLeod 2018), where one disciplinary perspective is dominant, and the work of the participants who have different disciplinary backgrounds is subordinated to the dominating discipline's goals. In such a situation, not all of the different problem-solving strategies of the participants are employed, as some strategies are dominant right from the start of the collaboration. Naturally researchers are still exposed to each others' perspectives more than in monodisciplinary research, and this may have some effect later. But in the collaboration at hand, the possible epistemic benefits of cognitive diversity have been quite effectively curtailed. In other words, the kind of institutional instruments we studied do not reliably lead to epistemically beneficial cognitive diversity in research groups.

5. Limitations of institutional instruments in increasing diversity

What should we make of these case studies? If we philosophers hold that more diversity in science would be beneficial, should we endorse the use of top-down-implemented institutional measures that are meant to increase diversity in science? Do these case studies help us in finding an answer to this question?

I believe that we can draw some relevant conclusions from the case studies. They are examples of critical philosophical scrutiny of the kind of institutional instruments that are often used in contemporary science and science policy, and they draw attention to

vulnerabilities and limitations in the instruments studied. And together they give reasons to question whether and when this kind of top-down institutional instruments are effective in increasing the diversity of values and interests in the governance of science and technology, or in creating more cognitive diversity in research groups. The case studies do not tell us how common the problems identified are, nor do they tell us how effective the instruments could be if they were redesigned, taking the identified problems into account. However, they should give philosophers reason to pause before endorsing the use of top-down institutional measures that are meant to increase diversity in science. This is because they identify features, interdependencies and mechanisms that can reduce an instrument's capability of producing the wanted result, and they show that the problems identified are not just possible in principle, but have at least sometimes materialised.

The philosophical case studies I have just discussed combine two trends in contemporary philosophy of science. Firstly, they are examples of what Elizabeth Anderson (2006, 8) calls institutional epistemology: a branch of social epistemology that investigates the epistemic powers of institutions. Secondly, they approach the institutions that surround and shape science with a "philosophy of science in practice" attitude (Boumans & Leonelli 2013), focusing on the practices of science policy and scientific institutions. To put it briefly, these case studies are examples of what could be called institutional epistemology in practice.

All these case studies draw attention to the limitations and vulnerabilities of the institutional instruments they study.

The programme Van Bouwel and Van Oudheusden (2017) studied was shown to be not quite as inclusive as one could hope. I agree with them in that if a participatory programme is based on the consensus ideal, it risks excluding those who are not willing to share the ideal. And as they point out, the consensus ideal is fairly pervasive in contemporary participatory practices. This can be a problem if the aim is to increase diversity of values and interests in the governance of science, as it can lead to the systematic exclusion of some values and interests. We do not know how often this happens, but the possibility is there. Such exclusion can, in practice, also mean the exclusion of some social minority, so the consensus ideal can be problematic also if the aim is to increase diversity in terms of social locations. The problem can be aggravated if many in the excluded group mistrust science or the organisers of the programme (Dutilh Novaes & Ivani 2022).

The case examples summarised in section 4.2 show that the programmes studied were vulnerable to more or less intentional misuse. Instead of the diverse values and interests of citizens or stakeholders actually influencing decision-making, a participatory process can be seized by some powerful party (Holman & Geislar 2018). Such processes can also be instrumentalised in ways that diminish their actual influence on decision-making. If the aim of increasing diversity is combined with other aims, such as containment of critique against new technologies, a programme that is in principle meant to democratise decision-making, can fail to do so. (Radder 2021; Aguiton 2018.) It may be difficult to prevent particularly the latter kind of failings, ones that result from the aim of democratising the governance of science and technology being but one of the things an institutional instrument is supposed or hoped to do.

A similar problem was observed also in the BizTech case studied by our team (Salmela, MacLeod & Munck af Rosenschöld 2021). When the aim of creating interdisciplinary research teams was but one of the aims built into the platform strategy, the strategy failed to reliably result in interdisciplinary collaborations. But even if it were the only aim, it may be difficult to create top-down institutional instruments that could reliably produce genuine interdisciplinarity, because researchers are quite apt at advancing their own research goals in changing institutional settings. If their goals do not include genuine interdisciplinary collaboration, a funding instrument might not be a very effective way of producing it.

The institutional instruments examined in these case studies could not reliably increase cognitive diversity in research groups or the diversity of values and interests taken into account in the governance of science and technology. As noted, this is in line with what is known about the ability of instruments such as targeted funding calls to influence research agendas, ways of conducting research, or its content: it is difficult to control complex processes with such measures. Institutional instruments like the ones discussed here are not very precise tools. They may be serviceable if the aim is clear-cut enough. For example, if the goal is to raise the share of women in the STEM fields in some university, it may well be, as Leuschner (2015) argues, that institutional solutions implemented by the university administration, such as hiring quotas, could do the trick. But this does not mean that other diversity aims are as easy to reach by using similar measures. If a diversity aim is not easy to measure, the use of an institutional instrument implemented from the top down can lead to something other than what was sought – for instance, scientific subordination instead of interdisciplinarity. Moreover, virtually all institutional instruments are implemented in complex institutional contexts where the aim of increasing some form of diversity in science is but one of many aims. For an instrument to be efficient in increasing diversity, this aim would need to be prioritised throughout its design and implementation. If the instrument is supposed to serve several goals, and some other goal is prioritised – for instance, the ability to handle external critique, or better success rates in the competition for external funding – it is no wonder if the results with regard to diversity are slim. In practice, the efficacy of an instrument that is supposed to increase some form of diversity in science may partly depend on whether the people implementing the instrument, and the ones who are targeted with it, also have this goal. After all, many of the failures described in the previous section were due to the organisers and/or participants having different goals, and advancing them rather than the goal of increasing diversity. In such cases, such instruments might not be any more effective than measures relying purely on voluntariness.

Obviously institutional instruments implemented from the top down can also succeed in increasing some form of diversity in science. Even in some of the cases discussed above, the use of the instruments led to some increase in the type of diversity that was sought. In the BizTech case, for example, the collaboration in one of the platforms involved interdisciplinary integration. But whether such instruments are particularly effective can depend on things like whether the diversity aim can be measured in a way that can be effectively integrated in the intrument's design, or whether the people implementing the instrument and the ones being targeted share the aim, or whether there is some stakeholder group that attempts to

manipulate the process, or whether some stakeholders are not satisfied with the design of the instrument. In other words, the effectiveness of such instruments can be quite context-dependent. A philosopher who believes that more diversity in science would be beneficial should therefore consider whether a top-down-implemented institutional measure would be effective in increasing the type of diversity they seek in the contexts where they think a change is needed.[1] The known limitations and potential vulnerabilities of such instruments should naturally be taken into account when making such assessments. Therefore, I believe the case studies discussed above are useful when we try to decide whether we should endorse the use of some top-down institutional instrument in science.

6. Conclusion

Some important science policy aims today align with philosophical arguments that speak in favour of increasing diversity in science. The science policy aims have led to the creation of various institutional measures and instruments that are supposed to help in reaching those aims. In this paper I have reviewed some recent philosophical case studies that take a critical stance towards such measures.

These case studies focus on two types of institutional measures. First, I discussed case studies of programmes that are meant to democratise the governance of science and technology by involving citizens and/or stakeholders in decision-making processes. These, I have argued, show some limitations that should be taken into account if one wants to suggest using top-down-implemented institutional measures to increase the diversity of values and interests that influence the governance of science and technology. They can also be illuminating when thinking about the possibilities of using such instruments to increase the diversity of social locations represented in such decision-making. Secondly, I discussed two recent case studies focusing on structural changes and reallocations of funding that are meant to increase the number of interdisciplinary collaborations in universities. I take them to demonstrate some limitations of top-down institutional measures if the aim is to increase cognitive diversity in research groups.

The case studies suggest that institutional instruments implemented from the top down are not always an effective way to increase diversity in science. Philosophers ought to take the known risks and limitations of such instruments into account when deciding whether the use of some instrument in some context should be endorsed or not.

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[1] I also believe that we should take into consideration the unwanted but predictable side effects of the implementation of such instruments. Even an effective instrument should be rejected if it causes more harm than good. But this is not the topic of this paper.

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Literature

Aguiton, S. A. (2018). *La démocratie des chimères: Gouverner la biologie synthétique*. Bord de l'eau.

Boumans, M. & Leonelli, S. (2013). Introduction: On the Philosophy of Science in Practice. *Journal for General Philosophy of Science*, 44(2), 259–261.

Douglas, H. (2005). Inserting the Public into Science. In S. Maassen and P. Weingart (eds.), *Democratization of Expertise? Exploring Novel Forms of Scientific Advice in Political Decision-Making*. *Sociology of the Sciences Yearbook* 24, 153–170.

Douglas, H. (2009). *Science, Policy and the Value-Free Ideal*. University of Pittsburgh Press.

Dutilh Novaes, C & Ivani, S. (2022). Public engagement and argumentation in science. *European Journal for Philosophy of Science*. DOI: doi.org/10.1007/s13194-022-00480-y.

Eigi, J. (2017). Different motivations, similar proposals: objectivity in scientific community and democratic science policy. *Synthese*, 194(12), 4657–4669.

Elliott, K. (2011). *Is a Little Pollution Good for You? Incorporating Societal Values in Environmental Research*. Oxford University Press.

Gläser, J., & Laudel, G. (2016). Governing Science: How Science Policy Shapes Research Content. *European Journal of Sociology, 57*(1), 117–168.

Griffiths, P. E. (2022). Why the 'interdisciplinary' push in universities is actually a dangerous antidisciplinary trend. *The Conversation*, 17.2.2022.

Harding, S. (2015). *Objectivity and Diversity: Another Logic of Scientific Research*. University of Chicago Press.

Hicks, D. J. (2021). Productivity and interdisciplinary impacts of Organized Research Units. *Quantitative Science Studies*, 2(3): 990–1022.

Holman, B. and Geislar, S. (2018). Sex Drugs and Corporate Ventriloquism: How to Evaluate Science Policies Intended to Manage Industry-Funded Bias. *Philosophy of Science*, 85(5), 869–881.

Hong, L. & Page, S. E. (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Proceedings of the National Academy of Sciences of the United States of America*, 101(46), 16385–16389.

Huutoniemi, K., Thompson Klein, J., Bruun, H. & Hukkinen, J. (2009). Analyzing interdisciplinarity: Typology and indicators. *Research Policy*, 39(1): 79–88.

Huutoniemi, K. & Rafols, I. (2017). Interdisciplinarity in research evaluation. In R. Frodeman, J. Thompson Klein & R. C. D. S. Pacheco (eds.), *Oxford Handbook of Interdisciplinarity*. 2nd edn., Oxford University Press.

Intemann, K. (2010). 25 Years of Feminist Empiricism and Standpoint Theory: Where Are We Now? *Hypatia*, 25: 778–796.

Jaggar, A. M. (2004). Feminist politics and epistemology: The standpoint of women. In S. Harding (ed.), *The feminist standpoint theory reader: Intellectual and political controversies.* Routledge, 55–66.

Jasanoff, S. (2003). Technologies of Humility: Citizen Participation in Governing Science. *Minerva*, 41(3), 223–244.

Jasanoff, S. (2017). Science and Democracy. In U. Felt et al. (eds.), *The Handbook of Science and Technology Studies*. MIT Press, 259–288.

Jordan, C., Gust, S., and Scheman, N. (2011). The Trustworthiness of Research: The Paradigm of Community-Based Research. In N. Scheman, *Shifting Ground: Knowledge and Reality, Transgression and Trustworthiness*. Oxford University Press, 170–190.

Kitcher, P. (1990). The division of cognitive labor. *The Journal of Philosophy*, 87(1), 5-22.

Kitcher, P. (2001). *Science, Truth, and Democracy*. Oxford University Press.

Kitcher, P. (2011). *Science in a Democratic Society*. Prometheus Books.

Klein, J. T. (2010). A Taxonomy of Interdisciplinarity. In R. Frodeman, J. Thompson Klein & C. Mitcham (eds.), The Oxford Handbook of Interdisciplinarity. Oxford University Press, 15–30.

Koskinen, I. & Mäki, U. (2016). Extra-academic transdisciplinarity and scientific pluralism: What might they learn from one another? *The European Journal of Philosophy of Science*, 6(3), 419–444.

Koskinen, I. & Rolin, K. (2019). Scientific/intellectual movements remedying epistemic injustice: The case of Indigenous studies. *Philosophy of Science*, 86(5), 1052–1063.

Koskinen, I. 2021. Emancipatory Activist Movements Can Build Collective Intellectual Self-Trust—But Not Always in Ways We Would Like. *Social Epistemology Review and Reply Collective*, 10(2): 21–26.

Kurtulmus, F. (2021). The Democratization of Science. In D. Ludwig, I. Koskinen, Z. Mncube, L. Poliseli, & L. Reyes-Galindo (eds.), *Global Epistemologies and Philosophies of Science*. Routledge, 145–154.

Laudel, G. (2006). The art of getting funded: How scientists adapt to their funding conditions. *Science and Public Policy*, 33(7), 489–504.

Laursen, S. & Austin, A. E. (2020). *Building Gender Equity in the Academy: Institutional Strategies for Change*. Johns Hopkins University Press.

Leuschner, A. (2015). Social exclusion in academia through biases in methodological quality evaluation: On the situation of women in science and philosophy. *Studies in History and Philosophy of Science*, 54: 56–63.

Lindvig, K. & Hillersdal, L. (2019). Strategically unclear? Organising interdisciplinarity in an excellence programme of interdisciplinary research in Denmark. *Minerva* 57(1): 23–46.

Longino, H. E. (1990). *Science as social knowledge: Values and objectivity in scientific inquiry*. Princeton University Press.

Longino, Helen E. (2002). *The fate of knowledge*. Princeton University Press.

Maassen, S. and Weingart, P. (2005). What's New in Scientific Advice to Politics? In S. Maassen, and P. Weingart (eds.), *Democratization of Expertise? Exploring Novel Forms of Scientific Advice in Political Decision-Making*. *Sociology of the Sciences Yearbook*, 24, 1–19.

MacLeod, Miles. 2018. Scientific Subordination, Molecular Biology and Systems Biology. In U. Mäki, A. Walsh, & Fernández Pinto, M. (eds.), *Scientific Imperialism: Exploring the Boundaries of Interdisciplinarity*. Routledge.

MacLeod, M. & Nagatsu, M. (2018). What does interdisciplinarity look like in practice: Mapping interdisciplinarity and its limits in the environmental sciences. *Studies in History and Philosophy of Science, Part A*, 67: 74–84.

Medina, J. (2021). Vices of the privileged and virtues of the oppressed in epistemic group dynamics. In M. Hannon & J. de Ridder (Eds.), *The Routledge handbook of political epistemology*. Routledge, 336–346.

Montgomery, B. L. (2018). Building and Sustaining Diverse Functioning Networks Using Social Media and Digital Platforms to Improve Diversity and Inclusivity. *Frontiers in Digital Humanities*, 5, 11.9.2018.

Mouffe, C. (1999). Deliberative Democracy or Agonistic Pluralism? *Social Research*, 66: 745–758.

Mouffe, C. (2000). *The Democratic Paradox*. Verso

Page, S. E. (2008). *The difference: How the power of diversity creates better groups, firms, schools, and societies* (paperback ed.). Princeton, Woodstock: Princeton University Press.

Pohl, C., Truffer, B. & Hirsch-Hadorn, G. 2017. Addressing wicked problems through transdisciplinary research. In R. Frodeman, J. Thompson Klein & R. C. D. S. Pacheco (eds.), *Oxford Handbook of Interdisciplinarity*. 2nd edn., Oxford University Press, 319–331.

Pöyhönen, S. (2017). Value of cognitive diversity in science. *Synthese*, 194, 4519-4540.

Radder, H. (2021). Which science, which democracy, and which freedom? In P. Hartl, & A. T. Tuboly (Eds.), *Science, Freedom,* Democracy. Taylor and Francis, 113–134.

Radder, H. (2019). *From Commodification to the Common Good: Reconstructing Science, Technology, and Society*. University of Pittsburgh Press.

Reijula, S., & Kuorikoski, J. (2021). The Diversity-Ability Trade-Off in Scientific Problem Solving. *Philosophy of Science, 88*(5), 894-905.

Rolin, K. (2019). The Epistemic Significance of Diversity. In M. Fricker, P. J. Graham, D. Henderson & N. J. L. L. Pedersen (eds.) *The Routledge Handbook of Social Epistemology*. Routledge, 158–166.

Rolin, K. (Forthcoming). Epistemic benefits of diversity: A perspective from institutional epistemology.

Salmela, M., MacLeod, M. & Munck af Rosenschöld , J. (2021). Internally Incentivized Interdisciplinarity: Organizational Restructuring of Research and Emerging Tensions. *Minerva*, 59(3), 355–377.

Shove, E. (2003). Principals, agents and research programmes. *Science and Public Policy*, 30(5), 371–381.

Solomon, M. (2001). *Social empiricism*. MIT Press.

Van Bouwel, J. (2009). The Problem with(out) Consensus. The Scientific Consensus, Deliberative Democracy and Agonistic Pluralism. In J. Van Bouwel (ed.), *The Social Sciences and Democracy*. Palgrave Macmillan, 121–142.

Van Bouwel, J. & Van Oudheusden, M. (2017). Participation Beyond Consensus? Technology Assessments, Consensus Conferences and Democratic Modulation. *Social Epistemology*, 31(6): 497–513.

Weisberg, M. & Muldoon, R. (2009). Epistemic landscapes and the division of cognitive labor. *Philosophy of Science*, 76(2), 225-252.

Wilholt, T. (2014). Review of Philip Kitcher: Science in a Democratic Society. *Philosophy of Science*, *81*(1), 165–171.

Wylie, A. (2003). Why Standpoint Matters. In R. Figueroa and S. Harding (eds.), *Science and Other Cultures: Issues in Philosophies of Science and Technology*. Routledge, 26–48.

Wylie, A. (2015). A Plurality of Pluralisms: Collaborative Practice in Archaeology. In F. Padovani, A. Richardson and Y. Tsou (eds.), *Objectivity in Science: New Perspectives from Science and Technology Studies*. Springer, 189–210.