Science and Democracy

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1. Introduction

When considering how values manifest themselves in science, the interplay between scientific and democratic institutions and processes plays a special role. The aim of this chapter is to clarify what this interplay entails in order to develop an account of how science should be organized that is explicitly grounded in political theory (rather than ethics or epistemology). To do so, we will proceed in the following way:

In the next section, we will explore the potential science and democracy have to support each other's values. We quickly leave this perspective on their relation behind to take a more functionalist approach starting with section 3: science provides information that is needed as a basis for democratic decision-making and thus has an important role to fulfil in democracy. In Section 4, we will derive normative consequences of this role of science, which include the independence of science, its responsiveness to citizens' values, preferences and interests, and its commitment to an orientation towards justice. As is customary in the philosophy of science, we first develop these points in accordance with a liberal understanding of democracy. In a section 5, however, we also point out the limitations inherent in this prevailing view and suggest some benefits for a philosophy of science that also takes alternatives to traditional liberal political philosophy, such as non-ideal, communitarian or agonistic approaches, seriously as philosophical resources.

2. Science and democracy: ideas about their kinship

A close affinity and a relationship of mutual dependency has often been asserted between science and democracy. Strong claims in this vein were emphasized in the middle of the last century, often in the spirit of defending science and democracy alike from the threats of

totalitarian systems. For example, American sociologist Bernard Barber (1952) suggested that science and the democratic political order go hand in hand, based on the assertion that both share core values such as individualism, rationality, universalism and progress. Robert Merton's (1938, 327) earlier and more famous reflections that non-democratic systems in their influence on the sciences must inevitably come into conflict with the institutionalized norms of science and its ethos also fit into this general spirit. At many different points in the history of liberal thought, one finds authors who combine the claim of a close association between science and democracy with an enthusiastic partisanship for both—such as when Thomas Jefferson describes freedom itself as the "first-born daughter of science" or when a handbook of the liberal-democratic movement in Germany declares in 1848 that science could only have originated in ancient Greece, since only there the necessary liberal political conditions had obtained (Jefferson 1896, 3; Scheidler 1848, 622).

If the idea of a connection between science and democracy is understood simply as the assertion of a straightforward conditional relationship (in one direction or the other), then it is clearly not credible. Writing at around the same time as Merton, John Dewey had already declared: "It is no longer possible to hold the simple faith of the Enlightenment that assured advance of science will produce free institutions […]" (Dewey 1988, 156). Dewey drew attention to the technical applications of science and their potential to cause great harm to free institutions, for example by bringing about a high concentration of capital or by providing the world's dictators with new, powerful propaganda tools. The conditional in the other direction, i.e. the assertion that democracy is necessary for science, is just as unconvincing. After all, even the celebrated achievements of the Scientific Revolution were accomplished in repressive social and political environments, with liberal democracy nowhere in sight, and the more recent past has only discredited the thesis more. If you think of scientific efforts to develop weapons of mass destruction in National Socialist Germany and other undemocratic systems, what is most frightening about them is not how badly, but how well scientific research can function in totalitarian regimes (cf. Sarewitz 2003, 186–87).

To be convincing today, the claimed connection between science and democracy must therefore be read in a weaker sense. Dewey himself had some noteworthy thoughts on this. According to him, the two are based on common epistemic principles, which he summarizes in a characterization of the "scientific attitude". For him, this explicitly includes the "willingness to hold belief in suspense, ability to doubt until evidence is obtained; willingness to go where evidence points instead of putting first a personally preferred conclusion; ability to hold ideas in solution and use them as hypotheses to be tested instead of as dogmas to be asserted; and (possibly the most distinctive of all) enjoyment of new fields for inquiry and of new problems." (Dewey 1988, 166). Dewey assumes that a functioning democracy requires, among other things, that citizens are sufficiently and independently informed. Since he believes that the necessary knowledge of citizens can only flourish if the epistemic attitude described above is widely disseminated and recognized, democracy is dependent on the scientific attitude. In a discussion that bears similarities to that of Dewey, Bernard Williams attributes to the sciences a particularly striking manifestation of the "virtues of truth" (B. Williams 2002, 144). The preoccupation with science confronts a subject in a particularly striking way with a situation in which truth is not at the disposal of any personal counterpart. Science, Williams suggests, is a practice in which that particular epistemological stance can be learned in an exceptionally straightforward way.

The claim that science can make constructive contributions to a democratic culture in this way should of course not be confused with the naïve idea that mastery of science makes one immune to anti-democratic and authoritarian tendencies. The history of science is rich in depressing counter-examples (cf. Beyerchen 1977; Proctor 1988). Nor is it possible to draw a clear and simple conclusion as to how much the potentially beneficial contributions of the sciences to epistemic culture weigh against the threat to democracy and human life posed by the technological fruits of science that Dewey had so presciently addressed.

3. Science's role in liberal democracies

This is the reason why, in the remainder of this chapter, we will take as our starting point an even weaker link between science and democracy and focus on political philosophers, especially in the liberal tradition, who have considered the relationship between science and democracy primarily in terms of the *function* or *role* that science has in a democracy: to provide knowledge. Let us briefly elaborate on why knowledge is so important from a democratic perspective; in the subsequent section we will see what implications this political role has for science.

Scientific knowledge is needed to improve the ability of citizens to assert their values and interests within the democratic process. If the preferences that citizens form and bring to bear in the political process are supposed to reflect their values and interests, then they must be well-informed, that is, they must be based on reliable belief (including, at the very least, reliable views on how government actions or legislative decisions are likely to affect the lives of citizens; cf. Fuerstein 2008, 76; Goldman 1999, 320–25). As the consequences of political decisions are generally causally delivered via complex natural, technological, social and economic processes, the availability of *scientific* knowledge specifically belongs to the prerequisites for the well-informedness of citizens in modern societies. The importance of knowledge is particularly accentuated in deliberative theories of democracy, which see the political process as public use of reason and an exchange of arguments and consider the formation of citizens' preferences to be an essential part of the democratic process. But even in more parsimonious conceptions of democracy, which focus on voting and elections and regard the democratic process as a means of aggregating existing preferences, citizens' access to knowledge is emphasized as a prerequisite (e.g. Dahl 1989, 112).

The general approach to describing the connection between science and democracy in terms of the relevance of scientific knowledge for the democratic process is embedded in a liberal understanding of the state and politics in the broadest sense. By this we mean the endeavor to develop the justification of state power and the answering of normative questions

about political relations and institutions without relying on a comprehensive understanding of the good (so as not to commit the citizens to such an understanding). This core approach characterizes the liberal tradition from the beginnings of Hobbes' and Locke's reflections on limited government and constitutionalism to more recent attempts, such as those of Rawls and Habermas, to in one way or another find normative foundations of political philosophy in what citizens must minimally agree upon (cf. Heath 2022, chap. 3).

Of course, science has other important potentials besides its role for the democratic process: it can inform not only collective and political decisions, but also individual ones; it can contribute to collective prosperity and the improvement of health and living conditions; and it can promote our understanding of the world and our own position in it. But all these services (as well as the harms and threats it poses) are provided as a collective endeavor shaped and enabled by institutions without which contemporary science would not be possible. These include, above all, many informal and evolved institutions, but also formal ones in some key places, whose rules can ultimately only be enforced by the state (Mantzavinos forthcoming). In democratic states, the collective enterprise of science as a whole is in this sense subject to the democratic order that makes it possible in the first place.

The idea that citizens of a democracy are dependent on scientific knowledge in order to be able to effectively assert their interests does not amount to a glorification of science as the royal road to democracy, nor does it presuppose that science is politically neutral or value-free. It is not assumed that scientific knowledge puts citizens in a perfect epistemic position, but only that they are relevantly better off epistemically with access to scientific knowledge than without it. For this to be the case, the science in question must fulfill certain requirements, which will interest us in detail in the next section.

4. Implications for philosophy of science

Clarifying the role science occupies in and for democratic systems has been productive for philosophers of science because a number of ideals concerning science's institutional structure, scientific norms and value management can be derived from this role. In this way, answers to questions that play a central role in the debates on science and values and on trust in science can be found that have their basis in political theory (rather than ethics or epistemology). The main line of thought that we will follow in this chapter is therefore that the institutional structures, the norms and rules that make up the institutions of science and the way in which values and interests are dealt with in internal scientific decisions ought to be determined by the functions served by science for a just democratic polity.

First of all, considerations about science's political role are crucial in order to specify its proper relation to (other) political institutions. If the knowledge that citizens obtain from scientific sources is to enable them to bring their values and interests to bear in the democratic process, then the production and dissemination of this knowledge must be independent of the political powers. In modern societies, where the results of scientific research are often decisive for the assessment of controversial issues, there are strong incentives for political forces to use their power to influence what science does. Since the inception of modern democratic institutions, the protection of science from political interference has therefore been called for – e.g. by Thomas Jefferson, James Madison and others in America, and in France by Condorcet, who was commissioned by the French National Assembly to make proposals for the institutional foundations for science and education (Wilholt 2010; 2012). The idea was also taken up by German liberal thinkers such as Julius Fröbel, who declared in 1846: "The combination of these two principles, the rule of majorities in the realm of ends, and the rule of freedom and anarchy in the realm of theory, constitutes the only correct method of political life and progress." (Fröbel 1850, 107). Following the 1848 revolution, the constitutional assembly in Frankfurt's Paulskirche, which included Fröbel and many other liberals, included the principle that "Science and its teaching is free" on its list of fundamental rights. Although

the Paulskirche constitution never came into force, its catalog of basic rights influenced later constitutions. Since then, academic freedom has been constitutionally recognized in many continental European countries.

It is worth pointing out that this tradition of justifying the need for freedom and independence of science on democratic grounds is different from epistemological arguments that usually dominate Anglophone discussions about freedom and independence in science. The latter typically start by emphasizing the fallibility of inquiry (often with reference to John Stuart Mill) and the unpredictability of what might later become of a nascent idea or line of research. Building on this, the arguments advise that any epistemic collective enterprise would do best not to suppress any approach or idea altogether, even if it seems false, implausible or unpromising at the moment, but instead to hedge its bets, achieving the required diversity through individual freedom, as this unleashes creative potential and allows individuals to make the most of their local knowledge. Epistemological arguments of this kind have become the dominant narrative in support of the independence of science in the post-war period—following Vannevar Bush's successful promotion of a "New Social Contract for Science" (Guston 2000, chap. 2), Michael Polanyi's fight against J. D. Bernal's plans for socialization and greater planning of scientific research (Fehér 1996), and other Cold War developments.

In contrast, the argumentation outlined above following Condorcet, the American Founding Fathers, the German liberals of the 19th century and others, which can be described as a political argument for the independence of science (Wilholt 2010; 2012), amounts to demanding a separation of powers between science and the (other) political powers (cf. Brown and Guston 2009). While epistemic arguments emphasize individual creativity and the exploitation of individual knowledge and thus call for individual freedoms, an argument based on democratic theory strengthens a corporative independence of science. It must be free from the kind of influence by political powers and similarly powerful actors that would allow it to be steered towards certain outcomes. This strengthens the demand for freedom in the choice

of research questions and for the public nature of the results of scientific research. It may also be taken to strengthen the case for pluralism within the scientific community, in so far as pluralism provides good grounds for optimism that scientific information effectively improves the politically relevant knowledge base of citizens. This is so because admitting a plurality of different approaches both facilitates mechanisms of mutual criticism (and thus improves epistemic quality) and ensures that even in a society with very different value outlooks, as many people as possible have access to the epistemic resources they need to participate effectively in deliberation (Hilligardt 2023; Longino 2002, chap. 6; Rolin 2021; Thoma 2023; Wilholt 2012, 247–52).

A second type of normative consequence that can be derived from the role of science for democracy concerns the responsibilities and duties that scientists have towards the public. They can differ, as S. Andrew Schroeder (2020) has pointed out, from moral responsibilities that apply to all moral agents. Thus, science as an institution arguably has the duty to be responsive to the public's preferences and values. Kitcher famously and influentially spelt out how this can be done in his ideal of "well-ordered science". According to this ideal (Kitcher 2001), the correct answer to the question of which epistemic objectives are classified as significant and thus made the target of scientific research is the one that a collective of idealized, well-informed deliberators would agree on at the end of a discussion in which different points of view have been expressed and weighed against each other. In Kitcher 2011, the same is also extended to the question of what the appropriate standards of evidence are by which scientific outcomes are determined, and questions about which knowledge is applied and in what way. For Kitcher, these are first and foremost purely theoretical scenarios that are intended to show in what sense it is even possible to speak of answers to the above questions that are distinguished as correct. When it comes to approaching this ideal in the real world, Kitcher suggests to rely on participatory approaches. In particular, he discusses the idea of creating "groups of citizen representatives, drawn from diverse segments of different societies", that are subjected to a specific instructional process in which they form a basic

understanding of relevant research processes, and who are allowed to go "behind the scenes" of research (Kitcher 2011, 129). These special efforts are to ensure that science is not subjected to a tyranny of the ignorant. Others, too, have made proposals for how to ensure science's responsiveness to public values, ranging from stakeholder participation procedures, the involvement of randomly selected representative samples of the population to the consultation of social science research on public values (cf. Intemann 2015; Lusk 2021; Schroeder 2021; Rolin 2021; Bozeman and Sarewitz 2011).

A different line of argument emphasizes science's duty to serve the public in a way that takes into account requirements for fairness and equal treatment. At a very fundamental level, equality (equality of opportunity for political participation, equality before the law) is one of the basic building blocks of democracy according to the liberal understanding. For this reason alone the role of science in democracy must also be considered in light of these principles (Kitcher 2011, chap. 3). Liberal theorists have also argued that the sense of equality relevant to democracy must also include the fulfillment of a minimum level of *social* equity, because certain material requirements must be met in order to achieve equal opportunity of political participation (Waldron 1993; Bohman 1997).

And even more specifically, it is compelling that equitable access to *epistemic* resources is required (Thoma 2023). The "epistemic basic structure", Irzik and Kurtulmus argue, "should serve individuals fairly and provide them with an equal opportunity to gain knowledge in order to reason about the common good, their individual good and pursuit thereof" (2024, 4). Specifying the ideal distribution of epistemic resources (Irzik and Kurtulmus draw on a Rawlsian theory of distributive justice) can help identify and criticize unequal and unfair distributions. Kitcher (2001, 128) similarly highlights "the problem of inadequate representation", such as the disproportionate funding for mild diseases affecting a small number of solvent people (e.g., acne) versus deadly diseases like malaria and tuberculosis impacting larger, less affluent populations (Kitcher 2011; Reiss and Kitcher 2010).

The justice-based approach has also been used to evaluate the legitimacy of values in "internal" phases of research such as the management of epistemic risks. Ahmad Elabbar (forthcoming), drawing on Irzik and Kurtulmus, argues that justice considerations can justify varying the evidential thresholds set by the Intergovernmental Panel on Climate Change for inclusion of hypotheses or projections in their reports. Elabbar demonstrates that the pronounced inequality in climate data and research between the global North and South means the IPCC harms the fundamental interests of Global South citizens by applying uniform evidence standards across regions.

In sum, based on the importance of scientific knowledge for effective democratic self-governance, a strong case can be made that science ought to be organized in a way that allows for it to produce independent knowledge that meets the population's interests and addresses justice issues. Of course, achieving this ideal is far from a simple task in societies with deep inequalities in power and opportunity, significant value differences, and widespread opinion manipulation and misinformation. We have offered some ideas in this section – a comprehensive account of the way in which science ought to be organized in a democracy goes beyond the scope of this chapter. Before coming to an end, however, we want to offer some general reflections on the tools that philosophers employ when engaging with the question how science can best fulfil its role.

5. De-idealizing political philosophy of science

Philosophers of science rarely discuss the political philosophy resources themselves and the limitations that might arise from them. Additionally, it is often overlooked how much the perspective is informed by assumptions about the nature of society and politics – a problem that is particularly visible in conflicts between philosophers of science and science and technology scholars. To illustrate this, we will use the rest of this chapter to discuss two prominent critiques of liberal democratic theory and their implications for philosophy of science views on science and democracy.

Liberal theories of democracy, in particular John Rawls' and Jürgen Habermas' versions, which so often find application in philosophy of science, have been debated for decades. One key point of contention is their use of idealisations. Charles Mills (2005) criticises that Rawls does not merely formulate an ideal for society in the sense of a desired state of affairs but draws up an *idealized model of society*. Rawls envisions deliberators to be perfectly rational and disinterested and justifies principles of justice on the grounds of the imagined outcome of their deliberations. Mills argues that these idealisations are "abstracting away from realities crucial to our comprehension of the actual workings of injustice in human interactions and social institutions" (ibid., 170), making them ineffective for addressing real-world injustices.

Most philosophers of science are aware of the debate between ideal and non-ideal theory and those who draw on Rawls' work often acknowledge this in footnotes (see for example Irzik and Kurtulmus 2024, 4; Cabrera 2022, 816). However, it is well worth considering non-ideal theorists' critique in more detail than footnotes permit, as it can have relevant consequences for the characteristics of what we consider well-ordered science. The question is how much the normative guidance from philosophers of science relies on idealized assumptions about scientists and society. Do these idealizations limit the potential to address real-world problems? A key example which highlights the importance of these considerations is the idealization of autonomy.

A common characteristic of many liberal theories of democracy is to imagine individuals as autonomous and independent agents, or to at least posit this as an ideal to strive towards. The so-called communitarian critique (cf. Sandel 1982; Mills 2005) therefore condemned "much liberal political theory for conceptualizing the individual person as prior to and not fundamentally conditioned by commitments and values of particular social groups", as Iris Marion Young (1995, 182) summarizes.

This individualism, arguably, has also carried into philosophy of science, firstly in the way researchers used to be idealized. Feminist scholars have famously argued that research is shaped in crucial ways by the social situatedness of the researchers and have grounded this view explicitly in non-ideal political theories, in particular Marxist theories of the self (see Hartsock 1983; Harding 1992). They have used this argument to critique the notion that science is value-free and by doing so have contributed substantially to the values in science debate we have today.

More importantly for the role of science in democracies, however, it has been argued that the idealization of *citizens* as autonomous agents is also reflected in the way many philosophers of science imagine lay people, especially in the context of scientific advice and science communication. Elabbar (2023, 2) suggests that much of the existing literature on scientific advice "share[s] a common commitment to the principle of decisional autonomy: advisors should resolve value-laden choices in a manner that preserves the decisional autonomy, or self-determination, of advisees", for instance by making their own values transparent. This commitment to autonomy has been questioned from a non-ideal perspective (see especially McKenna 2023). For as empirical research suggests, individuals do not form preferences and judgements independently and autonomously, nor do they incorporate scientific information into their preferences in a context-independent manner. Group affiliations and loyalties – for instance to class, race, religion etc. – are key factors determining lay people's party affiliations, which in turn often determine attitudes towards scientific information (McKenna 2023; D. Williams 2023; Achen and Bartels 2017). In the US, for instance, almost all "liberal Democrats" believe that global warming is real, but less than half of all "conservative Republicans" do (cf. McKenna 2023, 66). This group-based thinking also occurs among those who are highly politically engaged and informed, i.e., those who come closest to the ideal, well-informed citizen (D. Williams 2023, 3).

One conclusion that has been derived from this is that scientists have to take a more pro-active stance in advising and informing public and private decision-making. Norms such as

neutrality and non-partisanship, as well as measures aimed at increasing transparency or using public participation to resolve value disputes in research, do not necessarily lead to autonomous and independent decision-making (Elabbar 2023), but rather to decision-making that conforms with existing beliefs and societal power relations (Rolin 2021; Hilligardt 2023). Scientific information that conflicts with widely held beliefs and vested interests often struggles to be taken seriously. Consequently, methods of persuasion and marketing, as well as outspoken advocacy, may be necessary to ensure that relevant scientific information is not only available but also incorporated into decision-making (McKenna 2023; Oppenheimer et al. 2019).[1]

This critique highlights that philosophical frameworks for well-ordered science must strike a delicate balance between offering normative guidance and avoiding unrealistic idealizations. While there are valid reasons to view citizens as autonomous decision-makers and to model science based on this view, it should not be assumed that this model is always the most suitable (see also Biddle 2009). Political philosophy, with its long history of critically examining various models of society, can offer valuable insights for reflection in this area.

A second non-ideal critique of liberal theories, relevant to science and democracy, addresses how consensus and conflict are managed in democratic decision-making. This so-called "agonistic" critique has been influential in science and technology studies, for instance in the more recent work of Bruno Latour (2018). Based on this perspective not only the characterisation of well-ordered science may be put into question but the very role that is attributed to science in the context of liberal democratic accounts.

[1] It might be objected that respecting others' autonomy is an ethical principle that ought to be upheld independent of the consequences of doing so. Stephen John (2021b) has argued along these lines in a paper on scientific deceit. When looking at individual instances, such argument remains forceful. Many non-ideal approaches, however, prioritize the societal perspective. Upholding a certain principle becomes problematic when it systematically disadvantages or brings about negative consequences for part of society. As Mills (2005, 172) argues, philosophers ought to ask "cui bono?" when assessing an idealisation and ideal theory more broadly.

Agonistic thinkers such as Chantal Mouffe (2000; 2005) argue that conflict is essential for forming and sustaining personal and group identities. Conflict shouldn't be seen as inherently negative or something that must be resolved. Of course, liberal theories, too, allow for disagreement—indeed value pluralism is one of the core tenets of liberalism. But they draw a line between issues open to reasonable disagreement (such as values and religion) and those that every rational person should agree on. Agonistic theorists find this distinction untenable and covertly exclusionary. They argue that those who don't accept what is deemed reasonable are discredited as irrational and excluded from the debate. Mouffe (2000, 756) states that while pluralist democracy requires some consensus on ethical-political principles, these principles are always subject to conflicting interpretations and thus agreement on them can only come in the form of a "conflictual consensus." Therefore, pluralist democracy must accommodate dissent and the institutions that facilitate its expression. In essence, Mouffe contends that nothing should be considered beyond political contestation; we can only temporarily agree not to debate certain issues (Mouffe 2000, 756; see also Schönwitz 2022 for an application of this argument in the context of the values in science debate).

This is relevant to the role ascribed to science because, at least at times, philosophers of science argue that scientific information should ideally not be subject to political debate but instead form the common ground that political debate starts from. Stephen John (2021a, 5), for example, argues that some "factual claims" should be "beyond political contestation" for the sake of fruitful political debate: "For example, even if value-based disagreements might lead to disagreements over climate policy, such disagreements require some epistemic common ground, say, that climate change is occurring at all." The agonistic perspective casts doubt on the notion that science should even aspire to play such a role if it presupposes exclusion from the realm of political contestation.

It is debatable whether it is wise to remove any science-related discourse boundaries in a world where strategic misinformation is so ubiquitous (see Biddle and Leuschner 2015; Melo-Martín and Intemann 2014). Nevertheless, using rationality and expertise as common

ground in political debates can clearly be exclusionary, especially when some groups in society are significantly better trained to prevail in debates on these terms than others (cf. Young 2000, chap. 1) and when scientific information itself is at times biased in favor of specific interests (e.g. Wilholt 2009; Stegenga 2017, chap. 10). Agonistic theories highlight these challenges; even proponents of scientific discourse boundaries must consider them to prevent unjust exclusion in the name of science.

6. Conclusion

We started by reviewing some sweeping claims about the special kinship between science and democracy that have historically been made, to then identify Dewey's thesis of a common epistemic attitude, which is conducive to both democracy and science, as the most plausible, if still somewhat vague, core of this idea. We then moved on to focus on a connection between science and democracy that can be described and substantiated much more precisely: namely, that science plays important epistemic roles within democracy. We have shown that this provides a particular justification for the need for the political independence of science, as well as a derivation of the duties of scientists to be responsive to the needs and interests of the public, and to bring considerations of justice to bear in the production of knowledge. These things can be well explained, especially against the background of a liberal understanding of democracy.

But liberal theories of democracy have been subject of contestation for many decades in political philosophy. In light of these critiques, we have argued that philosophers of science who comment on science's role in democracies need to reflect on assumptions, abstractions and idealizations they adopt from the political resources they use. Concretely, we have considered critiques of two idealizations that are prominent in theories of liberal democracy as well as in philosophy of science: a focus on and appraisal of autonomous individuals and the aspiration of establishing a non-political common ground or consensus that limits the range of legitimate conflict. These critiques are meant to demonstrate the extent to which both

philosophers' account of well-ordered science and the very role that is attributed to science hinges on what is considered a good democratic system and thereby support the view that philosophers of science should pay attention to political philosophy.

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