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### ***Science, Values, and Democracy***

One of the great paradoxes of modern science and politics, going back at least to the seventeenth century, is that the value of science has seemed to depend on it remaining value-free. Whenever science is shaped by values, it has appeared to lose value. To be sure, sociologists like Robert Merton showed how science relies on various *institutional values*, and historians and philosophers in the tradition of Thomas Kuhn have illuminated the *cognitive values* that guide scientists in their work. For many years, however, accepting the presence of cognitive and institutional values in science only strengthened the case for excluding social and political values, which were thus called *extra-scientific values*. This tidy solution to the paradox of science and values has become increasingly unworkable, however, as bearers of extra-scientific values—social movements, interest groups, religious leaders, politicians, biotech companies, etc.—assert themselves in both the application and creation of scientific knowledge. Moreover, innumerable case studies in the history, philosophy, and sociology of science have made clear that so-called extra-scientific values often play a central role in scientific research. What remains unclear is how different types of values relate to each other in different epistemic and institutional contexts, and how democratic societies can best mediate conflicts over competing values in both science and society.

The *general research problem* of the Junior Research Group is to examine historical, sociological, and philosophical dimensions of the relationship between science and values. On the one hand, the group will study the ways that values shape science, e.g. the cognitive values of scientific theories, sociopolitical values that influence the scientific agenda, and historical changes in these values. On the other hand, the group will investigate how scientific knowledge and practices shape the values manifest in diverse social practices and institutions.

The postdoctoral fellows will focus their work on a series of specific projects concerned with the intersection of science, values, and democracy. They will pursue two complementary sets

of topics: one focusing on the way that democracy shapes science, the other on how science shapes democracy.

More specifically, the first postdoctoral project will reconstruct various historical manifestations of the idea that the scientific community has (or ought to have) a democratic structure for epistemic reasons—in other words, that democratic social structure is most likely to promote scientific progress.

The second postdoctoral project will examine historical, conceptual, and institutional aspects of “epistemic democracy”: the notion that democracy is justified not despite its inability to produce substantively correct decisions, as is usually assumed, but because it promises to produce more correct decisions than other modes of governance. This idea has roots in eighteenth-century political thought, and it has acquired new relevance in light of recent work in political science and sociology on public deliberation and science advisory institutions.

### **General Research Problem: Science and Values**

According to the traditional ideal, science is (and ought to be) *value-free*: science is concerned only with objective facts, and matters of fact and matters of value have to be sharply distinguished. This ideal combines two conceptually independent claims: First, it involves the idea that inquiring into matters of fact has no implications for questions of value. This claim goes back to David Hume, who famously argued against inferring “ought” from “is.” Second, the ideal of value-free science asserts that values should not influence scientific research. Francis Bacon, for example, argued in the *Novum Organum* (1620) that scientific progress requires impartiality. From the viewpoint of science, the ideal of value-freedom is tantamount to saying that science is and ought to be autonomous; from the perspective of society, the practical value of science seems to depend on it remaining value-free. The value-free ideal has been applied to scientific theories, scientists, and scientific institutions.

The ideal of value-free science is untenable on both empirical and conceptual grounds. That science is value-laden is first of all an empirical finding. According to Thomas Kuhn, the history of science shows not only theory change but also changes in the standards that good theories have to fulfil; not only experimental tests lead to theory rejection but also the criteria of theory assessment. Among these criteria are extra-scientific values—for instance, an anomaly can cause a scientific crisis only because its solution is of great practical importance (Kuhn 1962, esp. ch. VIII). Further studies have substantiated this claim. Even those criteria Kuhn assumes to be characteristic of science in general like scope and simplicity—criteria which are commonly seen as epistemic—are best understood as values, too (Kuhn 1977).

Despite common misunderstandings (Gross/Levitt 1994), saying that science is shaped by values does not mean that science fails to provide reliable knowledge. Both true and false scientific claims are *necessarily* value-laden. The central point in this regard is the underdetermination of science by logic and experience. As shown by Pierre Duhem, it is just as impossible to falsify a theory conclusively as it is to verify it (Duhem 1906). According to Willard v. O. Quine’s formulation of this argument, for every given amount of data, there are in principle several theories which agree with the data (Quine/Ullian 1970). Thus, *non-empirical values* have to play an important role in theory assessment and theory choice. These philosophical findings are substantiated by historical and sociological research. For instance, numerous studies have shown that alleged *experimenta crucis* took place *post festum*—at a point in time when scientists had already reached agreement about the relative merits of the

respective theories (Kuhn 1977, 108). Thus, these experiments cannot have played the decisive rôle ascribed to them, and non-empirical aspects must have governed theory choice.

Scholars in science studies now widely agree *that* science is essentially shaped by values, and that values not only influence the motivations of scientists but also theory choice itself. However, no agreement has been reached as to *which values* in particular and *which kinds* of values in general are important, how exactly they influence science, and under what conditions they threaten the objectivity and integrity of science.

To consider these issues, we shall distinguish between four kinds of values according to two aspects: firstly, whether a certain value is *epistemic* or *non-epistemic*; secondly, whether a value is *substantive* or *procedural*. Although substantive and epistemic values tend to be associated with science, and non-epistemic and procedural values tend to be associated with society and politics, we intend to examine the role of each type of value in selected scientific and non-scientific contexts, respectively:

(1) *Substantive epistemic values* are values associated with various forms of knowledge. Some social theorists attribute a “cognitive content” or truth-value to certain kinds of moral or political claims (cf. Habermas 1998). From this perspective, for example, it is “true” that racism is wrong. With regard to science, the class of values scientists use to assess theories, generally called *cognitive values*, are also both substantive and epistemic. Thomas Kuhn identified five such values common to all sciences: predictive accuracy, internal and external consistency, scope, simplicity, and fruitfulness. (Kuhn 1977, 103). The debate on this class of values has centered on two issues: first, whether these values are actually epistemic or truth-promoting and not only pragmatic criteria of theory choice (van Fraassen 1980); second, which values actually belong to this class. Historical studies have shown that most of the values mentioned by Kuhn are either specific to certain disciplines or to certain epochs of science or both. Indeed, as Lorraine Daston has argued, even the value of objectivity has a history (Daston 1992; Daston/Galison 1992).

(2) *Procedural epistemic values* underwrite procedures that tend to produce true claims and correct decisions. For example, the legal values of modern constitutional democracies (e.g., habeus corpus, right to an attorney, socially representative juries, etc.) underwrite procedures designed, not only to protect individual rights, but to correctly identify those guilty of crimes. Similarly, within contemporary science studies, the subfield of social epistemology deals with the social processes and institutional arrangements of science. It tries to explain and identify those procedures which promote the discovery and acceptance of true beliefs.

(3) *Substantive non-epistemic values* include various political, religious, economic, and technological goods: human health, economic growth, technological innovation, religious doctrine, etc. Many scholars conceive such values as independent criteria for evaluating social activities, including the activities associated with both science and politics. Substantive non-epistemic values are sometimes products of science, but they need not be; and in either case, they may shape subsequent scientific activity. Such values have long been emphasized by those who argue that science can only be socially useful if it remains value-free. Recent sociological and historical scholarship has shown, however, that social values such as practical utility and moral or religious acceptability have always shaped science (e.g., Elkana 1982; Ruse 1999).

(4) *Procedural non-epistemic values* are those which emphasize the fairness of procedures used to reach decisions, regardless of whether the resulting decisions are correct. According

to what Rawls (1993) calls “pure procedural justice,” for example, the justice of an outcome is reduced to the fairness of the procedure employed: e.g., a coin toss. Similarly, although egalitarian voting rights may be justified on epistemic grounds (e.g., the Condorcet jury theorem), voting rights generally convey a commitment to fairness rather than truth. The value of fairness is often seen as foreign to science, but it plays a key role in social relations among scientists. The attribution of scientific credit, for example, as well as hiring and promotion decisions, are generally assessed according to standards of fairness. And science advisory committees increasingly reach decisions by majority vote rather than consensus.

This four-part framework promises to generate a wide range of fruitful questions regarding the actual and potential role of different kinds of values within and across different epistemic domains. To be sure, these categories are highly artificial, and our research is likely to associate some values with more than one category. For example, democratic procedures require freedom of expression, but historically freedom of expression has been seen as having substantive value beyond its role in democratic procedures. Similarly, consistency is a substantive epistemic value associated with successful scientific theories, but it has also been frequently sought (if rarely found) among political decisionmakers. In light of such considerations, we plan on revising and expanding these conceptual categories as our research progresses. Nonetheless, this initial framework is specific enough to provide a point of orientation for interdisciplinary conversations, yet broad enough to allow all participants in the Junior Research Group, including doctoral candidates, the necessary latitude to define and pursue their own research interests.

### **Postdoctoral Research Problem: Science and Democracy**

In the *Republic*, Plato proposed a government of philosopher kings, whose right to rule rested on their superior knowledge. Plato’s vision has fascinated both admirers and critics ever since, and there is a long history of efforts to understand the relationship between scientific knowledge and political order. During the past fifty years, however, the academic fields of science studies and political theory have usually had little to do with each other. Probably the most important of several causes for this lack of engagement has been the increasing specialisation within both fields. This situation has recently begun to change. On one hand, political scientists have become increasingly interested in the epistemic dimensions of politics, especially with regard to theories of “deliberative democracy.” On the other hand, science studies scholars like Philip Kitcher and Helen Longino have devoted increased attention to the importance of societal conditions for the successful development of science, to issues connected with the increasing technical importance of science for society, and to the social accountability of science.

One structural feature in particular suggests that a renewed connection between science studies and political theory will be beneficial for each. During the last few decades, science studies has focused on explaining theory choice in science in terms of substantive epistemic or cognitive values (*i.e.* the criteria of good theories) involved, and it has paid less attention to the role of procedural justification in science. Most social and political theorists, in contrast, have focused on showing how political decisions can be justified as the outcome of fair democratic procedures. In both fields of research, there is a growing awareness of previously neglected modes of justification, and so one might expect that collaboration will be stimulating for both.

## Democracy in Science (Menke)

The first postdoctoral project shall focus on democratic conceptions of science. Since antiquity, the process of research has been described in terms of social and political categories. Since the Enlightenment, and especially in the nineteenth and early-twentieth centuries, scientists as well as sociologists and philosophers of science have seen close connections between democratic social structures and the organization of science, especially within the natural sciences. The claim has not only been that democratic societies (as opposed to totalitarian societies, for instance) are best suited for the advancement of science, but that science itself is, and ought to be, organized in a democratic manner.

This project aims at reconstructing and assessing these ideas. Firstly, it will reconstruct the history of democratic conceptions of science and their historical contexts. Secondly, it will try to identify what exactly people have supposed to be similar in (natural) science and democracy. Thirdly, it will try to reconstruct the arguments for the alleged similarities and the claim that science *as an epistemic endeavor* ought to be organized that way. Finally, it will consider to what extent these ideas and arguments can contribute to the contemporary debate on “social epistemology.”

*Social epistemology* studies the social dimensions of knowledge and science. It is based on Ludwik Fleck’s and Thomas Kuhn’s insight that science is a social phenomenon and that the constitution of the scientific community is not a contingent fact but is an essential part of the explanation of the progress and success of science. While giving a sociological explanation of scientific phenomena has often been seen as undermining the epistemic value of science, the debate has recently focused on the social *preconditions* of successful science. As Alvin Goldman puts it, “Social epistemology should evaluate . . . social processes and institutional arrangements in terms of their promotion of true rather than false beliefs” (Goldman/Cox 1994, 190). Within this approach, history, philosophy and sociology of science do not compete in explaining science and scientific progress, but work together and rely on each other’s results.

While social epistemology often presents itself as a new field of research, there are precursors of this debate: All those who argued that the social constitution of science is not arbitrary, and that there is a *specific* social structure characteristic of science, made the implicit assumption that this structure promotes science and, thus, is relevant and well-designed for the purposes of science.

The idea that the social structure characteristic of and appropriate for science is *democratic* is an old one; in the early and mid-twentieth century it was “passionately reaffirmed” (Hollinger 1983, 1) by several scientists and scholars. Among them one finds such names as Michael Polanyi, John Dewey, Ludwik Fleck, Karl Popper, Bertrand Russell, and Robert K. Merton. Merton developed his views on the “scientific ethos” in the context of this connection. While all of them share the same main thesis, their specific claims and the arguments they give in support of them differ.

In *Freedom and Culture* (1938), for instance, John Dewey characterizes the scientific method by four elements: freedom of inquiry, toleration of diverse views, freedom of communication, and the free distribution of results (Dewey 1938, 135). These values he regards as virtues, i.e. attributes of individual scientists (not the scientific community). Dewey claims that these values, which constitute the “scientific attitude,” are identical with the democratic attitude, otherwise a democracy would not be able to resolve social problems (ibid., 168). Robert

Merton (1942), on the other hand, regarded the “scientific ethos” as characteristic not of individual scientists but of the scientific community.

Ludwik Fleck, who developed the concept of *Denkkollektiv* in the context of the history of medical research, distinguished in *Das Problem einer Theorie des Erkennens* (1936) between “democratic” and “elitist” *Denkkollektive*, and he regarded natural science as a paradigm of the former. In a democratic *Denkkollektiv*, the highest criterion is the approval of the *whole* community. According to Fleck, the equal status of every member of the scientific community is based on the fact that most scientists are specialized in a narrow field of research, and therefore, they must trust and rely on other scientists specialized in neighboring fields. Thus, the democratic constitution of science is not due to special values characteristic of scientists, and it is the obverse of scientific specialization

A different argument attributes the democratic constitution of science to fallibilism. Only if there were certain knowledge, would a special status of those having this knowledge be justified; but because knowledge is fallible, it is essential not to suppress divergent opinions. This idea is central to Mill’s conception of a “marketplace of ideas” (Mill 1859). It is also central for Karl Popper’s (1945) argument that a society which is open to (evolutionary) change is preferable to a closed one, because—for epistemic reasons—one can never be sure that the current solution to problems is also the best one. (This line of reasoning is directly opposed to Thomas Kuhn view that it is exactly the exclusion of diverse views which makes “normal science” successful.)

As these quotations indicate, there are different *tertia comparationis* between science and politics as well as rationales. Thus, before the historical adequacy and soundness of the idea can be assessed, the history of the idea of democratic science needs to be reconstructed. Given the development of democracy and democratic theory and the variety of different historical forms of democracy, the project will examine whether and, if so, how changing ideas of democracy have shaped changing conceptions of science, and vice versa.

The rationales given for the alleged democratic constitution of science need to be examined with reference to the actual history of science. To find out to which extent the rationales are in accordance with the actual development of science, one has to compare the history of the respective rationale with the history of science and its organization.

One way is to consider the historical development of a particular discipline. The aim is to assess to what extent disciplinary development is correlated with a quasi-democratic social structure. A second way of confronting the democratic ideal and actual history of science is to compare different disciplines to see whether more successful disciplines are in some way more democratic. In considering both questions, one has to take into account the shifting standards of scientific “success.” Thus, one has to consider the relation of substantive and procedural epistemic values.

The comparison of different disciplines is particularly promising for testing the implications of the different rationales. If, for instance, Mill and Popper are right in assuming that the main advantage of a democratic structure of science is due to the uncertainty of knowledge, one might expect that disciplines like mathematics or logic differ noticeably from disciplines like physics or chemistry, since mathematical knowledge is not uncertain in the way empirical theories are. If, however, Fleck is right and the social structure of science is due to its specialisation, mathematics and physics as highly specialist disciplines should resemble each other much more than physics and geology, for example.

Generally, substantive epistemic values differ from discipline to discipline, as well. While, for instance, a theory's capability to make predictions is central for theory choice in disciplines like physics or chemistry, biology or historical linguistics cannot predict the development of species and languages, respectively, and thus they have to use different standards in assessing theories.

Finally, the thesis itself that science is somehow democratic should be reassessed. One of the central features of the social organisation of science highlighted by the current debate in social epistemology is the status of scientific reputation. Scientists' pursuit of reputation has the effect that, as Philip Kitcher argued, scientists inquire not only into the most promising of several promising topics of research, but also into the others, and so they promote the diversity of research. But the claim that scientific reputation is a central feature of scientific social structure seems hardly reconcilable with an equal, democratic status of all members of the scientific community; on the contrary, it seems to fit more with elitist conceptions of science. To bring together the old ideal of democratic science and the recent debate in social epistemology promises to be fruitful for both sides.

### **Science in Democracy (Brown)**

The second area of research complements the first by examining the conceptual and institutional location of science advice in modern democracies. In a context of growing social complexity and emerging forms of network governance, science advisory bodies play an important role in the legitimation of political decisions. However, scientific uncertainty and growing expectations for citizen involvement raise persistent questions about the legitimacy of science advice itself. The planned research addresses this dilemma with reference to two interrelated topics: 1) the institutional design of different kinds of expert advisory bodies, and 2) the historical constitution of different conceptions of "the lay citizen." Each of these topic areas builds on Brown's previous research (e.g., Brown et al. 2006).

#### *Design and Practice of Expert Advisory Bodies*

This part of the project will examine how the institutional design of science advisory bodies affects their capacity to mediate the relationship between science and values in modern democracies. The aim will be to empirically assess the *institutional values* of different advisory bodies, explore their relationship to relevant *social and political values*, and examine their implications for the *cognitive values* commonly associated with scientific advice. The research will address three different kinds of advisory bodies: (a) bodies composed exclusively of technical experts, (b) lay deliberative forums, and (c) bodies that combine experts and lay citizens (cf. Turner 2003, 52-54; Hitzler 1994). The empirical methods will include observation of relevant advisory committee meetings, semi-structured interviews with advisory committee members and other experts, as well as computer-assisted qualitative analysis (NVivo) of meeting transcripts and other documents from selected advisory bodies in each of the three categories. The research will initially focus on the German context, but it may well prove useful to expand the research to include advisory bodies in other countries.

a) Expert advisory bodies: *To what degree do the participants, procedures, problems, and audiences of advisory bodies composed only of technical experts differ from those of the basic sciences? Can one observe any sharp distinctions between the formal procedures and*

substantive outcomes of the basic sciences and those of politically relevant scientific expertise, or is the difference a matter of degree? Does it depend on the type of science? Does it depend on the issue context? Pielke (2007) argues that the design of science advisory bodies should vary with the specific issue context. The key factors are the degree of *consensus* on political values and the degree of *uncertainty* in scientific knowledge. Like Ezrahi (1980), Pielke develops a typology of four ideal modes of relating science to politics, each appropriate to a different type of issue context. Despite the usefulness of their typologies, both authors neglect the potential role of power, conflict, and ideology in procedures for establishing consensus. Taking such considerations into account, the aim of this part of the project will be to illuminate the role of different types of substantive and procedural values in expert advisory bodies, both historically and today.

b) Lay advisory bodies: *How do different types of lay knowledge relate to the cognitive, institutional, and social values of science?* Do participants conceive the involvement of lay citizens in science policy decisions primarily in procedural or substantive terms? Most practical efforts to institutionalize deliberative democracy—citizens’ juries, consensus conferences, deliberative polls, and similar forums—create an institutional division between lay and expert deliberation. In contrast to the intermingling of experts and non-experts on many government advisory committees, such forums usually exclude experts from the lay panel, restricting them to a special session during which lay participants ask the experts specific questions (Brown 2006; Abels/Bora 2004). The aim is to bring a distinctive “lay perspective” into public discourses dominated by politicians, experts, and interest groups. There is growing empirical evidence, however, that certain “pathologies of deliberation”—e.g., irrational behaviors, group dynamics, etc.—often prevent the promised epistemic benefits of deliberation from being realized in practice (Stokes 1998; Sunstein 2002). Similarly, the communicative construction of subject positions such as “expert,” “citizen,” or “administrator” has been shown to create a dynamics of exclusion (Bora/Hausendorf 2006). The goal of this part of the project will be to compare different types of lay forums with respect to their capacity to minimize such problems, while maximizing both political legitimacy and scientific validity.

c) Advisory bodies with both laypeople and experts: *What conceptual and institutional preconditions facilitate the combination of lay and expert perspectives in advisory processes?* Many advisory bodies today include both experts and non-experts; or they include both certified technical experts and experts whose expertise is based on experience. The latter are often expected to represent different *social perspectives*, which in contemporary political theory are conceived as emerging through interaction between structural relations of power (e.g., class, race, gender, etc.) and the self-conceptions of individuals (Young 2000: 92-102). Whereas interests are usually linked to specific political goals, a “perspective” involves particular questions and concerns. Similarly, the *professional perspectives* of scientific experts are shaped by the interaction between professional standards and cultures on the one hand, and individual ideas and goals on the other. Despite important differences, social and professional perspectives share an orientation toward deliberation, in contrast to the decision-making orientation of interest representation. The aim of this part of the project will be to examine the dynamics of expert-lay relations in advisory committee practice.

### *Constituting Experts and Citizens*

Recent studies in the social history of science have shown how modern science has long cultivated an ambiguous relationship to common sense and lay knowledge. Seventeenth-century experimentalists portrayed themselves as engaged in a distinctly public form of

knowledge, while also relying on elite gentlemanly status and rejecting the common sense of non-scientists (Stewart 1992; Shapin 1994, 1996a, 1996b). Today it is commonly acknowledged that democracy requires some sort of epistemic division of labor between experts and lay citizens. Aristotle famously argued that “the diner—not the cook—will be the best judge of a feast,” and liberal thinkers like Montesquieu, Madison, J.S. Mill, and Dewey made similar arguments. The idea of an epistemic division of labor between experts and laypeople has long served to legitimize the role of experts in politics, assuring skeptical publics that experts are “on tap, not on top.” Lay citizens lack time, attentiveness, and knowledge, so they must trust most experts most of the time. This raises two key questions: *Under what empirical conditions do lay citizens tend to trust experts, and when are they justified in doing so?*

Recent efforts to increase the “public understanding of science” build on a long tradition in Western societies of assuming that trust in scientific experts increases with scientific knowledge. From this perspective, expert-lay relations are understood in terms of competing substantive epistemic claims (Collins and Evans 2002). This approach has been widely challenged on both theoretical and empirical grounds, and scholars have shown that lay concerns often focus more on procedures of decisionmaking than on substantive knowledge (Wynne 1996; Saretzki 1997). Building on such research, this part of the project will pursue several alternative conceptions of trust in experts.

One possibility is that trust in scientific experts increases with public understanding, not of substantive scientific knowledge, but of the social processes whereby science is produced and employed. Another possibility is that trust increases with regard to the effective possibility of contesting expert claims and holding experts accountable. This conception of trust has the interesting effect of shifting the grounds of trust from knowledge to action. A third possibility is that, even if laypeople cannot directly assess the relative merits of the arguments offered by two experts, they may be able to use indirect evidence or proxy indicators to make reasonable assessments of expert credibility. They might consider factors such as the experts’ funding sources and potential conflicts of interest, or their proven track-record of making successful predictions, as reasons for believing one expert or the other. That is, even though laypeople do not have access to the experts’ own reasons for their claims, they may have reasons for believing *that* one expert has better reasons than the other (Goldman 2001). Such strategies for assessing expert advice might be conceived as the conversion of objectivity into neutrality. Whereas *objectivity* traditionally refers to the absence of “extra-scientific” values in science, *neutrality* refers to the balancing of such values (Jasanoff 1990; Turner 2003: 52-57). Neutrality may not always provide substantively correct decisions, but neutrality offers a procedural standard for producing decisions potentially acceptable to all parties.

This part of the project will address questions such as the following: What are the various kinds of procedural and substantive values that contribute to trust between scientists and lay citizens? What are the relationships among these factors? What different kinds of trust are at issue in relations between lay people and experts—e.g., blind trust, rational trust, critical trust, etc.? What types of institutions best mediate these relations of trust?

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