27
TRUST IN SCIENCE

Kristina Rolin

27.1 Introduction

Trust plays an important role in research groups, scientific communities, and the relations these communities have with the society. Much of present-day scientific knowledge is possible only by means of teamwork because the process of gathering and analyzing empirical evidence is too time-consuming or expensive for any individual scientist to accomplish independently (Hardwig 1991). Sometimes collaboration is a necessity because a research project requires expertise from different specialties or disciplines (Andersen and Wagenknecht 2013). A research group with a division of labor is capable of carrying out a project that no individual scientist could do on their own. In research groups, trust makes it possible for an individual scientist to rely on other group members, and to have good reasons to believe in the group's joint conclusion (de Ridder 2013). Trust is also needed in scientific communities that control the quality of research by means of training, peer review, and criticism (Longino 1990). While experimental and observational findings are sometimes reproduced or replicated successfully, not all research results are double-checked because excessive reviewing is costly and likely to delay other research projects (Kitcher 1992). Also, scientists may lack incentives to make effort to replicate research results because novelty is valued more than replication. Instead of questioning their colleagues' findings, scientists often refer to them as indirect support for their own results. One could even argue that trust makes it possible for individual scientists and science students to have good reasons to believe in scientific theories that are an outcome of the epistemic activities of an entire scientific community over a long period of time. Moreover, if scientific research is to provide public benefits, scientific communities must be trustworthy in the eyes of lay people (Grasswick 2010; Scheman 2001; Whyte and Crease 2010).

In this chapter, I focus on the question of what can ground rational epistemic trust within and in science. Trust is epistemic when it provides epistemic justification for one's beliefs, and epistemic trust is rational when it is based on evidence of the right kind and amount. I approach the question by dividing it into two sub-questions: (i) What can ground rational epistemic trust in an individual scientist? (ii) What can ground rational trust in (or reliance on) the social practices of scientific communities and the institutions of science?

Before moving on to discuss these questions, I explain how trust and epistemic trust are conceptualized in philosophy of science. The paradigmatic case of trust is a three-place relation involving two persons and a particular action or type of action. In a relation of trust, a person A trusts another person B to perform an action x (or A trusts B with valued good y). When A trusts B to do x, A takes the proposition that B will do x as a premise in her practical reasoning, or A works it into her plans that B will do x (Frost-Arnold 2013:302). Drawing on Annette Baier's seminal analysis of trust (1986), many philosophers stress that trust involves more than A's reliance on B to perform an action x (or to take care of valued good y). It involves an assumption of the goodwill of B towards A (Almassi 2012; Frost-Arnold 2013; Wilholt 2013). If B lets A down, then A is justified in feeling betrayed, and not merely disappointed (Baier 1986:235). Some philosophers extend this analysis of trust to cover relations that involve collective epistemic agents, such as research groups (Wilholt 2016), or impersonal elements, such as the social practices of scientific communities and the institutions of science (Wagenknecht 2015). Some others think that "reliance" is a more appropriate term than "trust" to characterize relations we can have with groups and organizations (Hawley 2017).

Epistemic trust is often distinguished from social trust. In a relation of social trust, a person A trusts another person B to act co-operatively or with A's best interests in mind, and in accordance with the social mores and norms of the society or the situation in which A and B find themselves (McDowell 2002:54). In a relation of epistemic trust, a person A trusts another person B to have good reasons to believe that p, and this is a reason for A to believe that p (Hardwig 1991:697). Many philosophers of science assume a doxastic account of epistemic trust and reductionism about testimony. A doxastic account is the view that A's epistemic trust in B involves A's having beliefs about B, for example, the belief that B is competent in the relevant domain and honest in rendering her testimony (Keren 2014:2593; see also Keren, this volume). Reductionism is the view that A's entitlement to place epistemic trust in B must be earned by her possession of enough evidence to ground the belief that B is a trustworthy testifier (Fricker 2002:379; see also Faulkner, this volume). Given these two assumptions, epistemic trust involves beliefs, and for these beliefs to be rational, they need to be grounded on evidence. Consequently, much of the debate on trust within and in science is concerned with the question: What kind of evidence can ground rational epistemic trust?

In section 27.2, I discuss the view that rational epistemic trust can be grounded on evidence concerning the epistemic and moral character of B. In section 27.3, I discuss the view that rational epistemic trust can also be grounded on evidence of the social practices of the scientific community that B belongs to and the relevant institutions of science. In section 27.4, I discuss rational epistemic trust from the perspective of citizens (including scientists who are lay people with respect to other scientists' expertise).

Throughout the discussion, it should be kept in mind that the question of what can ground rational epistemic trust arises only in a relation of epistemic dependence (see also Miller and Freiman, this volume). A person A is epistemically dependent on another person B when, for example, B possesses the evidence A is interested in, and it is more rational for A to rely on B than to rely on herself, or to spend a significant amount of time and effort to acquire and to fully understand the evidence B has (Hardwig 1985, 1991; Kitcher 1992). Unless A wishes to stay ignorant, she can try to manage the relation of epistemic dependence by considering whether epistemic trust in B is a rational way of grounding her belief. A relation of epistemic dependence can be opaque, translucent or a combination of both. A's epistemic dependence on B is

opaque when A does not possess the expertise necessary to independently gather and analyze the evidence B has. A's epistemic dependence on B is translucent when A possesses the necessary expertise but, due to a division of labor, does not participate in the gathering and analyzing of the evidence (Wagenknecht 2014:483). If A has access to the evidence that B possesses and the expertise necessary for analyzing the evidence on her own, she does not need to rely on B. But when A does not have first-order reasons for believing what B tells her (e.g. A does not understand the evidence or its analysis), she can still have second-order reasons, that is, reasons other than the evidence and its analysis. What these reasons are is the topic of the first section.

27.2 Trust in the Moral and Epistemic Character of the Scientist

John Hardwig (1991:697) argues that when scientists find themselves in a relation of epistemic dependence, they can legitimately appeal to the principle of testimony: If A has good reasons to believe that B has good reasons to believe that p, then A has good reasons to believe that p. The principle of testimony makes it possible for an individual scientist to have knowledge of p even when she is in a relation of epistemic dependence. Thus, the principle of testimony is an alternative to the suspension of judgment concerning p (Hardwig 1991:699). In Hardwig's view, it is needed also to supplement scientific knowledge that is attributed to collective epistemic agents, such as research groups (Hardwig 1991:699).

Having defended the principle of testimony, Hardwig poses the following question: when is it rational for A to believe that B has good reasons to believe that p? In his view, A's belief can be rational when A trusts B in matters concerning p. Also, A's epistemic trust in B can be rational when A has evidence of the intellectual character of B. As Hardwig explains: "The reliability of A's belief depends on the reliability of B's character," which involves "moral and epistemic qualities" (Hardwig 1991:700). According to Hardwig, B is a trustworthy testifier to the extent that B is (i) honest (that is, truthful in claiming both that she believes that p and that she has good reasons to believe that p); (ii) competent in the domain to which p belongs (that is, knowledgeable about what constitutes good reasons for believing that p); (iii) conscientious; and (iv) capable of epistemic self-assessment. Even though competence is not a character trait per se, it depends upon character. As Hardwig explains, "becoming knowledgeable and then remaining current almost always requires habits of self-discipline, focus, and persistence" (Hardwig 1991:700).

Hardwig acknowledges that there is another possible answer to the question of when it is rational for A to believe that B has good reasons to believe that p (Hardwig 1991:702). The alternative answer is that A's epistemic reliance on B can be rational when A has evidence of the incentives and disincentives that guide B's behavior. A does not need to have evidence of B's moral and epistemic character; it is enough for A to assume that B is a self-interested agent. This account is often called a self-interest account of trust because trust is seen merely as a matter of reliance on the self-interests of scientists (Frost-Arnold 2013:302). A self-interest account of trust shifts the focus away from an individual scientist's moral and epistemic character to the social practices of scientific communities and the institutions of science. When the social practices and institutions of science are well-designed, there are incentives for scientists to behave in a trustworthy way, and prudential considerations are likely to ensure that they will actually do so. Also, sanctions for betraying trust are so serious that it is in scientists' self-interest to be trustworthy. In this account, trust is placed in the scientific community's

ability (i) to detect not merely honest bias and error but also intentional attempts to distort the research process (or gross negligence leading to such distortions), and (ii) to effectively impose sanctions on fraudulent scientists.

A self-interest account of trust can be seen as either a replacement or a supplement to Hardwig's moral account of trust. Many philosophers are skeptical of the view that a self-interest account can fully replace a moral account of trust. For example, in Hardwig's view, prudential considerations alone are not sufficient to guarantee that scientists will be trustworthy. As he explains it: "Institutional reforms of science may diminish but cannot obviate the need for reliance upon the character of testifiers" (Hardwig 1991:707). "There are no 'people-proof' institutions" (Hardwig 1991:707).

Torsten Wilholt (2013) advances another argument against the view that a self-interest account of trust can eliminate the need for a moral account of trust. In his view, epistemic trust involves more than mere reliance on the testifier. It involves trust in the testifier's ability to understand her moral responsibility for inductive risks involved in scientific reasoning and make sound moral value judgments concerning these risks. Wilholt appeals to the inductive risk argument according to which accepting or rejecting a hypothesis involves uncertainties, and a moral value judgment is necessary in decisions concerning an acceptable level of uncertainty. When scientists accept or reject hypotheses, they make moral value judgments, either implicitly or explicitly, concerning the potential consequences of errors (e.g. of accepting a false hypothesis or rejecting a true one). According to Wilholt (2013:250), this means that epistemic trust in scientists has to be understood as "trust in the moral sense."

Karen Frost-Arnold (2013) argues that a self-interest account of trust is incomplete because it is based on two idealized assumptions, (i) that untrustworthy behavior will always be detected, and (ii) that untrustworthy behavior will always be punished with effective retaliation. The first assumption is unrealistic because the social practices that are meant to control the quality of research (e.g. peer review) are meant to ensure that published research is, among other things, significant, original, well-argued and clearly presented; they are not designed to audit every stage in the research process. Also, it is not self-evident that detection mechanisms for fraud can be made more effective. Excessive monitoring of scientists' behavior may be counter-productive because some scientists interpret it as a sign of distrust and disrespect, and they do not try to live up to the expectation of those who do not respect them (Frost-Arnold 2013:307; see also Frost-Arnold, this volume). The second assumption is problematic because scientists, university administrators and journal editors are not always in a position to impose sanctions; at best, they can enforce discipline locally. This means that untrustworthy behavior is seldom punished with effective retaliation. Frost-Arnold (2013:302) concludes that the incentives and disincentives recommended by a self-interest account of trust cannot protect scientists from risks involved in collaborations, including the risk that one's collaborators waste valuable time, work in a sloppy way, produce fraudulent data, or take credit for others' ideas and work. For this reason, many scientists, especially junior scientists, attempt to reduce the risks of collaboration by looking for evidence of the moral character of their potential collaborators (Frost-Arnold 2013:306).

Given the criticism of the view that a self-interest account of trust can replace a moral account of trust, a more plausible view is that a self-interest account of trust is needed to supplement a moral account of trust (or vice versa). If a self-interest and a moral account are seen as mutually supplementing each other, then rational epistemic trust can be grounded on evidence of the moral and epistemic character of the testifier, or the social practices of scientific communities and the institutions of science, or both.

This view is supported by empirical findings concerning scientists' behavior in collaborations. Based on her empirical study of research groups, Susann Wagenknecht argues that personal epistemic trust (that is, A's epistemic trust in B with respect to a particular domain) is often supplemented with impersonal trust, that is, A's reliance on the practices and institutions of science (Wagenknecht 2015:174). Moreover, personal epistemic trust is rarely a stand-alone reason for A to believe B's testimony that p. More often it is the case that A's epistemic trust in B comes in degrees, and it is enhanced with strategies that are an alternative to epistemic trust. These strategies aim at understanding the first-order reasons B has for believing that p, for example, by engaging B in question-and-answer type of interactions, or by checking the coherence of B's testimony against background information. Thus, even when A trusts B to have good reasons to believe that p, A's reasons for believing that p are likely to be a mixture of first-order reasons (that is, A has a partial understanding of evidence and its analysis) and second-order reasons (that is, A has reasons to believe that B is trustworthy).

In the next section, I review debates on impersonal trust within and in science. By impersonal trust is meant trust in or reliance on impersonal elements, such as the social practices of scientific communities and the institutions of science. If rational epistemic trust in scientists can be based on evidence of the social practices and institutions of science, then the question is: What aspects in these practices and institutions are of interest and why?

27.3 Social Practices and Institutions as Background Conditions of Trust

The philosophical literature on impersonal trust within and in science is focused on three questions, (i) which social practices of scientific communities are needed to support rational epistemic trust besides formal peer review processes, (ii) which institutional arrangements are needed to ensure that the evaluation of scientists is fair and reliable, and (iii) how scientific communities should interact with lay communities to earn their rational epistemic trust.

As to the first question, I have argued that epistemic trust in scientists involves more than reliance on the scientific community's ability to detect careless, sloppy or fraudulent research; it involves also reliance on the community's ability to facilitate inclusive and responsive dialogue based on shared standards of argumentation (Rolin 2002:100). The requirement for inclusive and responsible dialogue goes beyond the demand for formal peer review processes. What is needed are venues and incentives for criticism and response to criticism taking place after scientific research has passed a formal peer review process. The social practices of scientific communities are of epistemic interest because a relatively high degree of epistemic trust is often placed in scientists' consensus views (Anderson 2011; Goldman 2006). A consensus may not guarantee truth, but it can be seen as the best approximation to objectively justified belief in science. However, not just any consensus will deserve to be called objective. A consensus may be spurious if, for example, the community ignores the scientific work of some of its members. As Helen Longino (1990:76) argues, scientists (as well as non-scientists) should be able to trust that a consensus in the community has been achieved by means of inclusive and responsive dialogue based on shared standards of argumentation. Boaz Miller (2013:1294) argues that a consensus is likely to be knowledge-based when it is supported by varied lines of evidence that all seem to agree with each other, and the parties to the consensus are socially diverse, but nevertheless, committed to using the

same evidential standards, formalism and ontological schemes. Much work remains to be done to understand which consensus formation practices can support rational epistemic trust within and in science. How reliable are such practices as meta-analyses, systematic reviews, expert committees, and the common practice of trusting individual scientists who are in leadership positions in their field?

Epistemic trust in scientists involves also reliance on the institutions' ability to evaluate scientists in a fair and reliable way (Rolin 2002; see also Wray 2007). As to the second question, which institutional arrangements are needed to ensure that the evaluation of scientists is fair and reliable, Stephen Turner (2014:187) suggests that the evaluation of scientists and scientific research can be understood as a kind of market. In the market of evaluations, there is a demand for certifications for both scientists (e.g. degrees and awards) and scientific research (e.g. publications in high profile journals) because certifications, if reliable, reduce the risk of relying on an untrustworthy source. There is a supply for evaluators (e.g. high education institutions, journals, and grant awarding agencies) because reliable certifications are likely to increase the evaluators' credibility. In a well-functioning market, no agent has a monopoly over certifications, and there is a legitimate concern about ranking systems (e.g. of universities, departments and journals) that authorize some agents as dominant players in the market of evaluations, thereby having a significant impact on the standards of evaluation. Also, a well-functioning market for certifications and evaluators is not closed; the rise of new forms of scientific activity may make previously important certifications peripheral or worthless (Turner 2014:192).

Elizabeth Anderson (2012) argues that epistemic trust in scientists involves reliance on the scientific institutions' ability to prevent and counter epistemic injustice. According to one definition of epistemic injustice, it is a wrong done to someone specifically in their capacity as a knower (Fricker 2007:44). While epistemic injustice may come in many forms, one much discussed form is testimonial injustice which occurs when "prejudice causes a hearer to give a deflated level of credibility to a speaker's word" (Fricker 2007:1). An example of testimonial injustice is a situation in which a hearer finds a person's testimony suspicious due to the hearer's racist and/or sexist perception of the testifier. Testimonial injustice is of concern to any theory of rational epistemic trust because it can generate a systematic mismatch between trustworthiness and credibility (that is, perceived trustworthiness). When there is such a mismatch, some people are assigned credibility in spite of the lack of trustworthiness, and some others are denied credibility in spite of trustworthiness (Fricker 1998; Rolin 2002; see also D'Cruz as well as Scheman, this volume). Epistemic trust can hardly be rational under social conditions in which the institutional markers of credibility (e.g. titles and positions in formal organizations) fail to track trustworthiness (see also Medina, this volume). For this reason, Anderson (2012) argues, the institutions of science have an obligation to advance epistemic justice. When epistemic justice is realized, the institutional markers of credibility can function as proxies for trustworthiness. While Anderson acknowledges that individual remedies are needed to combat testimonial injustice (e.g. attempts to identify and correct one's cognitive biases), she emphasizes that such remedies are insufficient. In her view, testimonial injustice calls for structural remedies. The institutions of science are responsible for designing peer review and other gate keeping practices so that they prevent cognitive biases from being triggered and facilitate the conscious exercise of counteracting procedures to ensure a fair assessment of scientists (Anderson 2012:168).

Let me turn to the third question, how scientific communities ought to interact with lay communities to earn their rational epistemic trust. Naomi Scheman (2001) argues that epistemic trust in scientists involves reliance on the scientific institutions' ability to take responsibility not merely for epistemic justice but more broadly for social justice. When the trustworthiness of scientists is understood to require goodwill towards those who are epistemically dependent on the scientists, scientists may lack trustworthiness in the eyes of marginal social groups even when they are honest and competent. The lack of trustworthiness may be due to historical connections between science and social injustices (e.g. past uses of science against the interests of particular social groups, the unjust underrepresentation of particular social groups within the ranks of scientists, and the abuse of members of particular social groups in scientific research). As Scheman (2001:43) argues: "It is, in short, irrational to expect people to place their trust in the results of practices about which they know little and that emerge from institutions – universities, corporations, government agencies – which they know to be inequitable."

Scheman's argument gives rise to the question of what scientific communities and institutions need to do to earn the rational epistemic trust of citizens, and especially marginal social groups (e.g. indigenous communities). In response to this question, Heidi Grasswick argues that rational epistemic trust in scientists requires more than good scientific practices as philosophers of science often understand them; it requires sharing significant knowledge with lay communities (Grasswick 2010:401). Failures of knowledge sharing with lay communities can legitimately erode epistemic trust in scientific communities. As Grasswick (2010:392) explains: "If we want scientific practices to be epistemically praiseworthy, scientific communities will need the rationally grounded trust of lay communities, unless it can be shown that such rationally grounded trust of a particular community is unnecessary."

To summarize, impersonal trust is often seen as a supplement to personal epistemic trust (that is, the epistemic trust one person places in another person), because impersonal trust functions as a background condition that makes it more rational to place epistemic trust in a person than otherwise. Without impersonal trust in the social practices and institutions of science, in every knowledge transaction between scientists (or between scientists and non-scientists), each party would have to spend a significant amount of time and effort to scan the trustworthiness of the other party. But when impersonal trust functions as a background condition supporting personal epistemic trust, the cost of examining the trustworthiness of the other party is reduced, and knowledge transactions between individuals are smoothened.

Thus far we have seen that rational epistemic trust can be based on evidence concerning the epistemic and moral character of the testifier, the social practices of the scientific community the testifier belongs to, or the relevant institutions of science. While this seems to be a plausible view, it gives rise to yet another problem. If rational epistemic trust needs to be grounded on evidence of individual scientists or the social practices and institutions of science, the task of gathering and synthesizing such evidence is likely to be demanding. The requirement for evidence seems to undermine the very idea of why epistemic trust has been introduced into the social epistemology of scientific knowledge in the first place. The idea is that epistemic trust makes it possible for individual scientists (as well as non-scientists) to know more than they could know otherwise. Epistemic trust broadens the category of good reasons so that even those persons who do not have first-order reasons for believing in the results of scientific research, can still have second-order reasons for doing so. However, if rational epistemic trust requires gathering and synthesizing a wide range of evidence, then it seems to be no less demanding than the task of acquiring and understanding the first-order reasons.

Thus, the challenge is to strike a balance between the demand for evidence and the feasibility of rational epistemic trust. In response to the challenge, I suggest that the requirement for evidence is modified so that rational epistemic trust does not always need to be grounded on evidence. Sometimes it can be grounded on default assumptions concerning the trustworthiness of testifiers or the reliability of social practices and institutions. That default assumptions can legitimately ground rational epistemic trust is easy to see especially in the case of personal epistemic trust. As we have seen in section 27.2, trustworthy character is thought to include two major components: competence and honesty. However, there is an asymmetry between these two components (Andersen 2014; Rolin 2014). While scientists can examine their collaborator's track record for evidence of the collaborator's competence in a particular domain, the moral character of the collaborator is to a large extent taken for granted. This is because evidence of moral character is necessarily incomplete. When group leaders recruit scientists into their teams, they may seek evidence of the moral character of the candidate in letters of recommendation. Or when scientists work in relatively small teams, they are likely to gain some evidence of the moral character of other team members by means of an extended experience of collaboration. But even when there is evidence of good moral character, trust in the moral character of other team members is underdetermined by evidence. This is because the notion of character refers to a disposition to behave in certain ways across a range of social situations. Consequently, trust in the moral character of other scientists is based at least partly on a principle of charity (Rolin 2015:171).

The example of trust in the moral character of a scientist is meant to illustrate a more general position concerning rational epistemic trust. In order to ensure that rational epistemic trust is feasible for scientists and non-scientists, we can weaken the demand for evidence by allowing that trustworthiness can sometimes be treated as a default entitlement. This view is consistent with a position Martin Kusch (2002) calls quietism and contextualism about testimony. Quietism means that we give up the search for global justifications of testimony, and contextualism means that we accept local and contextual justifications of testimony as the best we can have (Kusch 2002:37). Quietism combined with contextualism is an alternative to both reductionism and irreductionism about testimony. Reductionism is the view that A's entitlement to trust B must always be based on evidence. Irreductionism is the view that A enjoys an a priori epistemic right to believe what B tells her (an a priori right to trust is defeated only when A possesses evidence of B's untrustworthiness) (Fricker 2002:379, see also Faulkner, this volume). Quietism combined with contextualism gives rise to the alternative view that sometimes epistemic trust needs to be based on evidence for it to be rational; at other times it is rational to treat trustworthiness as a default assumption. When trustworthiness is treated as a default assumption, a testifier is assumed to be trustworthy unless one has a reason to doubt it. By relaxing the demand for evidence, quietism and contextualism pave the way for a discussion of citizens' ability to assess the trustworthiness of scientists. This is the topic of the next section.

27.4 The Trustworthiness of Scientists with Respect to Lay People

In technologically complex and interdependent societies, responsible public policy making needs to make use of scientific knowledge. But due to the unequal distribution of expertise in society, the majority of citizens cannot directly assess the trustworthiness of scientists. The relation of epistemic dependence between citizens and scientists gives

rise to the question of how citizens can make reliable second-order assessments of the trustworthiness of scientists. The question is especially pressing when citizens are faced with disagreement among scientists. The challenge is to understand what kind of evidence citizens with ordinary education and access to the Internet and the library can obtain, at relatively low cost, so that they will be able to make informed decisions regarding whom to trust. In what follows, I will use the term "expert" rather than the term "scientist" to indicate that the challenge arises when scientists act as experts in the society. In the role of an expert, a scientist is expected to speak as an expert rather than as an interested party in a social or political controversy (Turner 2014:9). While the term "expert" can be understood in many ways (Collins and Evans 2007), I take an expert to be a person who has a relatively high level of knowledge in a particular domain, an ability to deploy her knowledge in answering questions, and an ability to generate new knowledge (Goldman 2006:19–20).

According to Alvin Goldman (2006), citizens can use five kinds of evidence when they assess the trustworthiness of competing experts. Each of these five types of evidence gives rise to further problems waiting for solutions. First, citizens can attempt to ground their epistemic trust on arguments the contending experts present in support of their own views and in criticism of their rivals' views (Goldman 2006:21). Even when citizens are not in a position to evaluate the arguments directly, they can evaluate them indirectly by focusing on the experts' dialectical performance. Assessing a (putative) expert's dialectical performance includes such things as assessing how well she responds to criticism coming from the competing expert. When an expert fails to offer a rebuttal or a defeater to the evidence advanced by the other expert, she has to concede the other expert's dialectical superiority (Goldman 2006:22–23). Thus, the first strategy for assessing experts is based on the assumption that dialectical performance is a reliable indicator of expertise. However, this assumption can be questioned on grounds that dialectical performance can easily be manipulated with the intention of misleading citizens. As Ben Almassi (2012:35) argues, when there is a market for certain kinds of rhetoric in business, law and politics, it is not self-evident that the supposed expert's ability to respond to counter-arguments quickly and smoothly is an indicator of her expertise.

Second, Goldman (2006:24) suggests that citizens can attempt to ground their epistemic trust on the relative numbers of (putative) experts on each side of the dispute. This strategy faces two challenges. For one thing, it is not self-evident that citizens are capable of delineating the relevant pool of experts in which the numbers of experts are counted. For another, it is far from obvious that citizens are capable of understanding how the experts have achieved a consensus. As Goldman himself admits, the simple idea of "using the numbers" to judge experts fails if the presumed experts form a community in which a guru's views are slavishly accepted by followers (Goldman 2006:25). Thus, the second strategy will take us back to the question raised in the last section: Under what conditions is consensus likely to be knowledge-based?

Goldman's third suggestion is an extension of the second one. The third proposal is that citizens can attempt to ground their epistemic trust on the appraisals by "meta-experts" of the experts' expertise (Goldman 2006:21). Whereas the second strategy involves finding evidence about agreement among experts, the third strategy involves finding evidence about other experts' evaluations of the competing experts, including their academic merits (e.g. degrees, positions, awards and high profile publications). The third strategy gives rise to the question of how citizens can identify "meta-experts." Against Goldman's view, one could argue that the appeal to "meta-experts" does not

solve the problem of assessing the trustworthiness of experts; instead, it merely moves the problem from one citizen-expert relation to another citizen-expert relation.

Fourth, Goldman (2006:30) suggests that citizens can attempt to take into account the competing experts' interests and biases. However, it is not clear that citizens are capable of doing so. Identifying interests and biases in scientific research is a demanding task requiring a high degree of expertise. Goldman's proposal may be interpreted as a recommendation to seek evidence of the experts' financial ties. Given this interpretation, the fourth strategy relies on the assumption that a funding source is potentially also a source of interests and biases in scientific research. Kevin Elliott (2014) examines further the question of whether the presence of financial conflicts of interest should count as a reason for treating experts with suspicion. By a financial conflict of interest is meant a set of conditions in which professional judgment concerning a primary interest (the epistemic interests of science) tends to be unduly influenced by a secondary interest (the financial interests of scientists and their paymasters). In Elliott's view, citizens should take financial ties into account when they attempt to assess the trustworthiness of experts. The funding sources of scientific research are relevant especially when scientific findings are ambiguous, or require a good deal of interpretation, or are difficult to establish in an obvious and straightforward manner (Elliott 2014:935). There is a reason to be suspicious of experts also when funding agencies have strong incentives to influence research findings in ways that damage the credibility of research, and they have also opportunities to do so (Elliott 2014:935).

Fifth, Goldman (2006:31) suggests that citizens can attempt to ground their judgments on the competing experts' past track records. By track record Goldman refers to the experts' past rate of success in various epistemic tasks. Again, it is not easy to see how citizens can obtain evidence of the experts' past success rate if they are not in a position to judge directly what counts as an epistemic success. Also, citizens can be misled by an expert's strong track record in one domain to trust the expert in matters that lie outside that domain (Martini 2014:13). Goldman's fifth proposal may be interpreted as an advice to seek evidence of the experts' curriculum vitae and list of publications. This is precisely what is recommended by Anderson (2011). She claims that ordinary citizens who have access to the Internet should be capable of assessing the competing experts' expertise on the basis of the biographical and bibliographical information available online. Laypersons can weigh various experts depending on their education, specialization, number and quality of publications, citations, awards, and leadership positions in the field (Anderson 2011:146–147).

None of the five criteria introduced by Goldman mentions explicitly what many other philosophers see as an irreducible component of trustworthiness: the moral integrity of the expert. In Anderson's (2011) view, honesty is one of the main criteria citizens should use when they judge the trustworthiness of experts. Citizens can look for evidence of factors that may cast doubt on experts' honesty, including conflicts of interest, previous scientific dishonesty (such as plagiarism), misleading statements, and misrepresenting the arguments and the evidence of the rival experts (2011:147). Drawing on Karen Jones's (2012) analysis of trustworthiness, Almassi (2012) argues that trustworthiness requires not merely honesty but also goodwill towards those people who are epistemically dependent on experts. This means that trustworthiness is a relational property. An expert is trustworthy with respect to citizens only when the expert recognizes the citizens' epistemic dependence on her and takes the fact that they count on her as a compelling reason for striving to be trustworthy (Almassi 2012:46). Given this analysis of trustworthiness, citizens should look for evidence of the goodwill of experts toward them.

Anderson (2011) argues that citizens can also search for evidence of the competing experts' epistemic responsibility. An expert is epistemically responsible for her knowledge claims when she is responsive to evidence, reasoning and arguments others raise against her view. As Anderson explains (2011:146):

> To persist in making certain claims, while ignoring counterevidence and counterarguments raised by others with relevant expertise, is to be dogmatic. To advance those claims as things others should believe on one's say-so, while refusing accountability, is to be arrogant. Dogmatists are not trustworthy, because there is no reason to believe that their claims are based on a rational assessment of evidence and arguments. The arrogant are not trustworthy, because there is reason to believe they are usurping claims to epistemic authority.

In Anderson's view, the crucial question is whether experts are epistemically responsible for their claims toward their own scientific communities (2011:146). Thus, the criterion of epistemic responsibility is different from the criterion of dialectical performance since the latter applies merely to the performance of experts in confrontations with rival experts. Regarding epistemic responsibility, Anderson suggests that citizens look for evidence of the evasion of peer review, refusal to share data, and dialogic irrationality (e.g. continuing to repeat claims even after others have refuted the claims) (2011:147). All of these factors can discredit an expert by suggesting that she is not epistemically responsible.

In sum, there is no algorithm citizens can use when they attempt to assess the trustworthiness of experts. Yet, the philosophical literature offers tools that can be used to probe the trustworthiness of experts. The literature suggests also topics that are in need of further exploration. Instead of discussing trust in experts in general, the analysis of rational epistemic trust would benefit from studies that focus more specifically on particular sciences. For example, trust in the experts of the social sciences (e.g. economics) may be different from trust in the experts of the natural sciences. In the former case, citizens' epistemic trust is weakened by failures to predict financial crises, whereas in the latter case, citizens' epistemic trust is bolstered by technologies on which they rely in their everyday lives. Also, analyses of rational epistemic trust in experts would benefit from case studies aiming to understand why citizens sometimes distrust science or fail to defer to scientific experts (see e.g. de Melo-Martín and Intemann 2018; Goldenberg 2016; Grasswick 2014; John 2011; Whyte and Crease 2010).

27.5 Conclusion

When we rely on the results of scientific research, our epistemic trust is directed not only to individual scientists and research groups but also to the social practices and institutions of science. While epistemic trust in collective epistemic agents is an understudied topic in philosophy of science (Wilholt 2016), there is a significant amount of literature on epistemic trust in individual epistemic agents. Rational epistemic trust in an individual epistemic agent can be based on evidence of the agent's competence, honesty, goodwill and epistemic responsibility. Reliance on the social practices and institutions of science is thought to be a background condition that makes it more rational to place epistemic trust in an individual epistemic agent than otherwise. Ideally, the social practices and institutions of science are designed so that they are capable

of exposing scientific misconduct and imposing retribution for it. Moreover, the social practices of scientific communities should ensure that scientific consensus is formed in an appropriate way, and the institutions of science should ensure that scientists are evaluated in a fair and reliable manner. Both scientists and citizens are expected to demonstrate goodwill to support relations of trust between scientific communities and lay communities.

Acknowledgments

I am grateful to Ori Freiman, Gernot Rieder and Judith Simon for their comments on earlier versions of the manuscript. I also wish to thank the participants of the workshop on Trust and Disagreement at the University of Copenhagen in November 24–25, 2016, and the workshop on Current Trends in the Philosophy of the Social Sciences at the University of Helsinki in December 15, 2017.

References

Almassi, B. (2012) "Climate Change, Epistemic Trust, and Expert Trustworthiness," *Ethics and the Environment* 17(2): 29–49.

Andersen, H. (2014) "Co-Author Responsibility: Distinguishing between the Moral and Epistemic Aspects of Trust," *EMBO Reports* 15(9): 914–918.

Andersen, H. and Wagenknecht, S. (2013) "Epistemic Dependence in Interdisciplinary Groups," *Synthese* 190(11): 1881–1898.

Anderson, E. (2011) "Democracy, Public Policy, and Lay Assessment of Scientific Testimony," *Episteme* 8(2): 144–164.

Anderson, E. (2012) "Epistemic Justice as a Virtue of Social Institutions," *Social Epistemology* 26 (2): 163–173.

Baier, A. (1986) "Trust and Antitrust," *Ethics* 96(2): 231–260.

Collins, H. and Evans, R. (2007) *Rethinking Expertise*, Chicago and London: The University of Chicago Press.

de Melo-Martín, I. and Intemann, K. (2018) *The Fight against Doubt: How to Bridge the Gap Between Scientists and the Public*, New York: Oxford University Press.

de Ridder, J. (2013) "Epistemic Dependence and Collective Scientific Knowledge," *Synthese* 191: 37–53.

Elliott, K. (2014) "Financial Conflicts of Interest and Criteria for Research Credibility," *Erkenntnis* 79: 917–937.

Fricker, E. (2002) "Trusting Others in the Sciences: A Priori or Empirical Warrant?" *Studies in History and Philosophy of Science* 33: 373–383.

Fricker, M. (1998) "Rational Authority and Social Power: Towards a Truly Social Epistemology," *Proceedings of the Aristotelian Society* 98(1): 156–177.

Fricker, M. (2007) *Epistemic Injustice: Power & the Ethics of Knowing*, New York and Oxford: Oxford University Press.

Frost-Arnold, K. (2013) "Moral Trust & Scientific Collaboration," *Studies in History and Philosophy of Science Part A* 44: 301–310.

Goldenberg, M.J. (2016) "Public Misunderstanding of Science? Reframing the Problem of Vaccine Hesitancy," *Perspectives on Science* 24(5): 552–581.

Goldman, A. (2006) "Experts: Which Ones Should You Trust?" in E. Selinger and R.P. Crease (eds.), *The Philosophy of Expertise*, New York: Columbia University Press.

Grasswick, H. (2010) "Scientific and Lay Communities: Earning Epistemic Trust through Knowledge Sharing," *Synthese* 177: 387–409.

Grasswick, H. (2014) "Climate Change Science and Responsible Trust: A Situated Approach," *Hypatia* 29(3): 541–557.

Hardwig, J. (1985) "Epistemic Dependence," *Journal of Philosophy* 82(7): 335–349.

Hardwig, J. (1991) "The Role of Trust in Knowledge," *Journal of Philosophy* 88(12): 693–708.

Hawley, K. (2017) "Trustworthy Groups and Organizations," in P. Faulkner and T. Simpson (eds.), *The Philosophy of Trust*, Oxford: Oxford University Press.
John, S. (2011) "Expert Testimony and Epistemological Free-Riding: The MMR Controversy," *The Philosophical Quarterly* 61(244): 498–517.
Jones, K. (2012) "Trustworthiness," *Ethics* 123(1): 61–85.
Keren, A. (2014) "Trust and Belief: A Preemptive Reasons Account," *Synthese* 191: 2593–2615.
Kitcher, P. (1992) "Authority, Deference, and the Role of Individual Reasoning in Science," in E. McMullin (ed.), *The Social Dimensions of Science*, Notre Dame, IN: University of Notre Dame Press.
Kusch, M. (2002) *Knowledge by Agreement*, Oxford and New York: Oxford University Press.
Longino, H.E. (1990) *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*, Princeton, NJ: Princeton University Press.
Martini, C. (2014) "Experts in Science: A View from the Trenches," *Synthese* 191: 3–15.
McDowell, A. (2002) "Trust and Information: The Role of Trust in the Social Epistemology of Information Science," *Social Epistemology* 16(1): 51–63.
Miller, B. (2013) "When Is Consensus Knowledge Based? Distinguishing Shared Knowledge from Mere Agreement," *Synthese* 190: 1293–1316.
Rolin, K. (2002) "Gender and Trust in Science," *Hypatia* 17(4): 95–118.
Rolin, K. (2014) "'Facing the Incompleteness of Epistemic Trust': A Critical Reply," *Social Epistemology Review and Reply Collective* 3(5): 74–78.
Rolin, K. (2015) "Values in Science: The Case of Scientific Collaboration," *Philosophy of Science* 82 (2): 157–177.
Scheman, N. (2001) "Epistemology Resuscitated: Objectivity as Trustworthiness," in N. Tuana and S. Morgen (eds.), *Engendering rationalities*, Albany: State University of New York Press.
Turner, S. (2014) *The Politics of Expertise*, New York and London: Routledge.
Wagenknecht, S. (2014) "Opaque and Translucent Epistemic Dependence in Collaborative Scientific Practice," *Episteme* 11(4): 475–492.
Wagenknecht, S. (2015) "Facing the Incompleteness of Epistemic Trust: Managing Dependence in Scientific Practice," *Social Epistemology* 29(2): 160–184.
Whyte, K.P. and Crease, R.P. (2010) "Trust, Expertise, and the Philosophy of Science," *Synthese* 177: 411–425.
Wilholt, T. (2013) "Epistemic Trust in Science," *British Journal for Philosophy of Science* 64: 233–253.
Wilholt, T. (2016) "Collaborative Research, Scientific Communities, and the Social Diffusion of Trustworthiness," in M.S. Brady and M. Fricker (eds.), *The Epistemic Life of Groups: Essays in the Epistemology of Collectives*, New York and Oxford: Oxford University Press.
Wray, K.B. (2007) "Evaluating Scientists: Examining the Effects of Sexism and Nepotism," in H. Kincaid*et al.* (eds.), *Value-Free Science? Ideals and Illusions*, Oxford and New York: Oxford University Press.