Do Collaborators in Science Need to Agree?

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I argue that collaborators do not need to reach broad agreement over the justification of a consensus claim. This is because maintaining a diversity of justifiers within a scientific collaboration has important epistemic value. I develop a view of collective justification that depends on the diversity of epistemic perspectives present in a group. I argue that a group can be collectively justified in asserting that P as long as the disagreement among collaborators over the reasons for P is itself justified. In conclusion, I make a case for multimethod collaborative research and work through an example in the social sciences.

1. Introduction. A coauthored scientific article asserts that P as the conclusion of collaborative research. In support of P, the article also asserts two independent reasons: Q and R. Every collaborator has agreed that P is the conclusion of their study. In order for the collaboration to be collectively justified in asserting that P, must all members of the collaboration reach broad agreement on both the reasons Q and R in addition to the conclusion P?

I argue in this article that collaborators do not, in fact, need to reach broad agreement over the justification of a consensus claim. This is because maintaining a diversity of justifiers within a scientific collaboration has important epistemic value. Existing views of collective justification overemphasize consensus and agreement among epistemic agents. I develop a view of collective justification that depends on the diversity of epistemic perspectives present in a scientific group. I argue that a group can be collectively justified in asserting that P as long as the disagreement among collaborators over the reasons is *itself* justified. I outline two epistemic "mechanisms" that are sources of diversity of justifiers in a scientific collaboration. Both of these

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mechanisms lead to a diversity of reasons among collaborators that should be maintained and not minimized. This diversity itself then is of epistemic value to the collaboration. In conclusion, I make a case for multimethod collaborative research and work through a case study in the social sciences.

2. Motivating the Problem: Balancing Consensus and Epistemic Diversity. Successful collective inquiry requires some degree of broad agreement or consensus. By "broad agreement" and "consensus" I mean unanimity or near unanimity—the exact degree of agreement is often dependent on context. In order for a group of scientists to successfully work together, there ought to be some agreement over their background theories and methodological choices. Consensus plays an important role in collaborations: the aim of the collaboration is to reach consensus concerning the results of the group's chosen research project. Collaborators are expected to have reached agreement over what is asserted in a published paper. This is the expressed policy at many scientific journals (see ICMJE 2017).

In fact, there exists a body of literature in social epistemology that concerns itself with the role of and importance of consensus in epistemic communities. For example, it has been claimed that consensus, when formed in certain ways, can be a mark of knowledge (Miller 2013). It is the ultimate goal of various kinds of deliberation (Beatty and Moore 2010). Among scientists, consensus appear to have particular value. We have been told that we ought to defer to the 97% consensus among climate scientists that global temperature rises are due to human activity. Consensus expert panels have been convened by the National Institutes of Health to make recommendations for screening or treatment of various illnesses (Solomon 2015).

I call this general attitude the *value of consensus thesis*: broad agreement among epistemic agents of a community has instrumental value—a mark of knowledge, or a sign of successful reasoning, and so on. It also has important social value as a resource for public policy making.

Consensus and the formation of agreement have been the focus of most theorizing about the epistemology of scientific groups. For example, Wray (2014) explicitly writes that "research teams need to deliberate in order to reach a consensus about what view will stand as the view of the group" (292). Consensus is a crucial component of philosophical analyses that use the concept of joint commitment. The role of consensus and agreement in collaborative scientific work has been well studied (see also Wray 2002, 2006, 2007; Rolin 2008, 2010, 2015; Andersen and Wagenknecht 2013).

But, it is often claimed that diversity is an epistemic good. A diversity of epistemic perspectives in a community, for example, has been said to better expose problematic background assumptions and, thus, results in better knowledge generated by the community (see Longino 1990, 2002). Different epistemic viewpoints may be associated with independent sources of

error, so diverse communities will be more likely to discover and fix errors. Diversity of methodologies has also been theorized to more likely lead communities to converge on true claims (see Zollman 2010; Heesen, Bright, and Zucker 2019). Epistemic communities function better when cognitive labor is divided among its members, who pursue scientific problems by employing a variety of research programs.

I call this common viewpoint among social epistemologists the *value of diversity thesis*: the maintenance of a plurality of methodologies, background theories, perspectives, and so on, in a community has positive epistemic value. Such a diverse community is better at "getting at the truth," more likely to discover and fix errors, and so on.

Can diversity be of value to scientific collaborations as well as communities? It may be tempting to think that epistemic diversity ought to be maintained at the community level only—where different individual collaborations are epistemically different from each other—and then leave collaborations for when scientists ought to reach consensus. The case can be made that disagreement would be of little value to collaborations because sustained disagreement can be detrimental to the functioning of collaborative groups. The value of diversity then does not conflict with the value of consensus, as they are valued at different levels of social organization. Diversity ought to be valued at the level of the scientific community only and consensus valued at the level of the collaboration.

This would be overly simple. Collaborations are also epistemic groups that would benefit from a diversity of epistemic perspectives and methodologies. First, as a matter of practicality, collaborations are often organized to bring together scientists with different sets of expertise and background theories. Scientists would lose incentive to collaborate if they may only collaborate with people very epistemically similar to themselves. Why would one collaborate if one can do all the work oneself and thus not need to share any of the credit? Epistemic diversity is often the exact reason why scientists collaborate, to fill in gaps in expertise and bring in new resources and skills.

Second, the reasons why diversity has positive epistemic value for communities can be "projected down" for collaborations. Individual collaborators have their own sets of background theories and preferred methodologies, which may be associated with independent sources of error. Collaborators who are epistemically diverse from one another will be better at identifying sources of error and problems in one another's assumptions and methodologies. Collaborators who use different methods can use a plurality of methods to investigate the same problem. The collaboration itself will then produce more reliable results because of the epistemic diversity of its members.

To sum up: First, consensus is the aim of most scientific collaborations. Second, it would seem to be epistemically good for the collaboration if there were a plurality of methods and viewpoints among its members. How ought

we balance these two values? This is the key question when we evaluate how we ought to determine how a group comes to be collectively justified.

Let us return to the example at the beginning of the article: in order for the collaboration to be collectively justified in asserting that P as the conclusion, must all members of the collaboration reach broad agreement on both reasons Q and R in addition to P? If we were to promote the value of consensus over the value of diversity, then collective justification would require that group members come to broad agreement over both the conclusion and the justifiers of that conclusion. At the beginning of inquiry, it may be fine to have a plurality of reasons held by different members of the group. However, at the end of inquiry, every member of the collaboration ought to reach broad agreement on both the conclusions and the justifiers of that conclusion. This is how a collaboration can be collectively justified in asserting that P as its conclusion.

In the remainder of this article, I argue against this view. Instead, I make a case for why we ought to integrate the value of diversity and the value of consensus in a more complete account of collective justification.

3. Consensus-Promoting Views of Collective Justification. The value of diversity thesis and the value of consensus thesis pull the epistemology of collaborations in two different directions. The form that collective justification would take would be very different, depending on which value is promoted over the other. If we were to promote consensus as the ultimate goal of collective justification, then collective justification would require that group members come to broad agreement over both the conclusion and the justifiers of that conclusion. This view of collective justification has been defended by several philosophers (Schmitt 1994; Wray 2007; Rolin 2010; Goldman 2014; Lackey 2016). In fact, so far, all existing accounts of collective justification roughly fall in this category. These consensus-promoting views of collective justification have two forms: (1) joint commitment-based collective justification and (2) aggregation-based collective justification. Both forms of collective justification give the same result: collaborators ought to agree on both the conclusion and the reasons in support of that conclusion.

First, the value of consensus is preferred in all joint commitment accounts of collective justification. Several philosophers (Schmitt 1994; Wray 2007; Rolin 2010) have defended joint commitment-based accounts of collective justification: a group G is justified in believing that P if and only if G has good reasons to believe that P. A group G has a reason R to believe that P just in case all members of G would properly express openly a willingness to accept R jointly as the group's reason to believe that P. That is, the justification for a group conclusion depends on individual members agreeing to let a reason stand as the group's justification. The group would fail to be justified if any members cannot come to agree on what to let stand as the reasons

of the group. Collective justification by joint commitment straightforwardly promotes the value of consensus over the value of diversity. It requires individuals to suppress their individual preferences for the sake of the group view. Any disagreement would be detrimental to the formation of a joint commitment—every member of the group must jointly commit to the same set of reasons.

Second, aggregation-based accounts of collective justification require that a group belief in P, as defined by an aggregation procedure, is justified only if all members' beliefs in P are themselves justified. An aggregation procedure takes member beliefs as inputs and group beliefs as outputs with respect to the same proposition. An example of such a procedure would be unanimity: if every member believes P, the aggregation generates a group belief in P as well. We can have an aggregative account of justification if the justifiers possessed by individual members can be properly added up. Aggregation would fail if the justifiers possessed by individual members of a group are too different from one another because this would result in an incoherent aggregation of collective reasons. Both Goldman (2014) and Lackey (2016) defend versions of this view. The diversity of justifiers among members would mean that the conclusion of the group would then fail to be justified if the reasons failed to aggregate. The "base" from which we aggregate must be coherent. That is, in order for a collaboration to be justified in P, the individual reasons why each member supports P must also be able to be consistently aggregated. Thus, aggregation-based collective justification promotes the value of consensus over the value of diversity. At the end of inquiry, we ought to be able to add up coherently the reasons from individual members in order for the conclusion to be justified. If individual reasons are too diverse or cannot be added up, then the group fails to be collectively justified.

Both of these two existing forms of collective justification depend on sufficient agreement among group members. Members of the group must either successfully aggregate their reasons by minimizing their differences or suppress their individual differences in order to jointly commit to a group justification. Consensus-promoting views of collective justification emphasize agreement over diversity. The diversity of justifiers possessed by members of the group can be detrimental to the formation of a group justification.

We should reject these accounts of collective justification. First, these consensus-promoting views of collective justification have been based on bad assumptions about the sources of diversity or disagreement among epistemic groups. Disagreement is assumed to be coming from an irrational or incoherent source. Most of the time, disagreement itself is taken to be irrational. When members of an epistemic group disagree about their respective reasons, Q and R, it must be because Q and R are mutually exclusive—at least one must be wrong. Disagreement or heterogeneity among members is taken as a negative feature of collective justification that must be eliminated.

Aggregation-based accounts do this by fiat: if the aggregation results in an incoherent set of reasons among group members, then the group simply fails to be collectively justified. Joint commitment-based accounts require individuals to suppress their individual preferences for the sake of the group view. However, not all disagreement is bad. If the disagreement is itself justified, then disagreement is actually of epistemic value to the group and not a negative feature of the group.

Second, consensus-promoting views of collective justification are not descriptively adequate. They do not capture real epistemic processes in successful scientific collaborations. Disagreement is an inherent characteristic of social groups that are composed of people who are dissimilar to one another. In scientific collaborations, collaborators differ from one another in their epistemic backgrounds, expertise, and cognitive styles. Collaborators may also hold different epistemic and nonepistemic values that inform how they make methodological choices. Beatty (2006) argues that often scientists choose to mask their disagreement in order to protect their expert status and their authority. That is to say, scientists disagree all the time. An account of collective justification that works for science must take into serious account the role of disagreement in how scientists come to be justified in their claims.

Therefore, we ought to turn to a form of collective justification that promotes the value of diversity in addition to the value of consensus. Diversity can be of epistemic value when disagreement and heterogeneity among collaborators is justified. Diversity of epistemic viewpoints is also a fact of scientific practice that should not be taken as a negative feature of social groups.

4. Justified Disagreement. I will argue that diversity has epistemic value in collaborative groups because this diversity makes the group and its members better epistemic agents. Here, I outline two epistemic "mechanisms" that are sources of diversity of justifiers in scientific collaborations. Both of these mechanisms lead to a diversity of reasons among collaborators that should be maintained and not minimized. This diversity itself then is of epistemic value to the collaboration.

Multiple Sources of Evidence. There often exists a diversity of justifiers in a scientific group because collaborators have sought out different lines of evidence toward their conclusion. Some collaborations are designed to employ different methods, and these methods are employed by different people. Methodological pluralism within a group will lead to a diversity of justifiers. Seeking out different sources of evidence may lead individual collaborators to disagree about the relative merits of one another's evidence (see Munafò and Smith 2018). If the evidence requires different sets of expertise to evaluate, collaborators may not understand or even misunderstand other pieces of evidence. Seeking out different lines of evidence toward one discovery

claim results in more robust conclusions. Different methods may be associated with independent sources of errors, which can be controlled for by employing different methods.

Different Background Theories. Collaborators have different epistemic viewpoints, whether due to training or expertise. Collaborators will enter collaborations with different sets of background theories, which is common in multidisciplinary collaborations. A diversity of reasons in a collaborative group can result when collaborators are evaluating evidence using different background theories. Differences in expertise may be associated with erroneous assumptions, which can be better exposed by people from different backgrounds.

The diversity resulting from these two epistemic mechanisms makes members of a group better epistemic agents and the group itself more reliable. When collaborators seek out multiple sources of evidence, it makes their conclusion more robust and well supported. By having collaborators with different background theories, collaborators are better able to interrogate and hold one another responsible for their reasoning processes. Philosophers of science have long argued that a diversity of scientists with different background theories will be better at exposing problems with one another's assumptions, reasoning, and justifications (see Longino 1990, 2002).

When members of an epistemic group disagree over the reasons for their claim, this disagreement is not immediately bad. If this disagreement is a result of negotiating different background theories or resolving multiple sources of evidence, then the epistemic group ought to be nonetheless justified in its conclusion. Diversity in these cases is epistemically valuable and should be maintained, not eliminated.

Consensus still has important instrumental value in the practice of science. After all, there would be no disciplinary unity if scientists never came to broad agreement over some things. However, consensus does not have instrumental value in every stage of science. The proper places for consensus for scientific collaborations are at the beginning and end. That is, first, members ought to reach broad agreement over defining the research question, because a group requires a coherent research question and goal in order to function. And, second, members ought to reach broad agreement over the results or conclusions, because successful collaboration requires some collective end product.

The justification of a consensus claim does not necessarily require broad agreement among members. In fact, Bright, Dang, and Heesen (2018) showed that proposition-wise majority rule is the minimal level of agreement required for a group of coauthors that can be supported by formal models of judgment aggregation. There are other reasons for why the research questions and conclusions may require a higher level of agreement, but there

are no formal requirements for broad agreement on both reasons and conclusions.

Thus, we arrive at a new account of collective justification. In order for the collaboration to be collectively justified in asserting that P, (1) members of the collaborations must be in consensus about P, but reasons in support of P do not require consensus. Instead, for a group to have justified reasons for P, the reasons must be held by some members of the group (not necessarily all), and (2) any disagreement among the group members over the reasons for P must be itself justified. Disagreement among the group members over the reasons for P is justified disagreement, so long as there are epistemically valuable reasons for the disagreement, such as when the disagreement is the result of multiple sources of evidence or a result of different background theories.

5. Application: Multimethod Research in the Social Sciences. The discussion presented so far has been fairly abstract. In conclusion, I show how my account of collective justification may better suit scientific practice, by running through a concrete case of multimethod research in the social sciences.

Methodological divides in the social sciences are deep and entrenched. Mahoney and Goertz (2006) have studied how proponents of qualitative and quantitative research methods have clashed over background assumptions, values, and evidentiary standards. For example, qualitative and quantitative research take very different approaches to what counts as an explanation. A core goal of qualitative research is the explanation of outcomes in individual cases, so qualitative researchers start with individual specific cases (i.e., the end of the Cold War) and their outcomes and then move backward toward the causes. Mahoney and Goertz call this a "causes-of-effects" approach to explanation. But, quantitative research follows an "effects-of-causes" approach to explanations. Quantitative researchers prefer controlled experiments or observational studies, and the point of the study is to observe the effect of the treatment. How researchers from these two traditions tackle the same problem will be very different. Take a general research question like "What causes democracy?" The qualitative researcher will ask instead, "What causes democracy in one or more particular cases?" while the quantitative researcher will ask, "What is the average causal effect of one or more independent variables on democracy?" (231).

Mahoney and Goertz summarize the major divisions as follows: case oriented versus population oriented, outcome explanation versus effect estimations, logic versus statistics. They write: "Given the different assumptions and research goals underlying the two traditions, it necessarily follows that what is good advice and good practice in statistical research might be bad advice and bad practice in qualitative research and vice versa" (Mahoney and Goertz 2006, 246). Nobel-winning political economist Elinor Ostrom

(2006) has lamented that, as a result, social science debates about methods involve frequent misunderstandings, with proponents of different approaches talking past one another. One of major barriers is that researchers are trained to specialize in one particular method and are strongly incentivized during their careers to stay within their methodological boundaries.

Despite methodological differences and disciplinary hostility, there is still much value in pursuing multimethod research. Poteete, Janssen, and Ostrom (2010) in particular advocate for collaborations that combine qualitative and quantitative methods. Such integration is not easy, however:

> No single method overcomes all challenges. Case studies and small-N comparative research designs offer advantages for concept and theory development as well as evaluation of hypothesized causal sequences and mechanisms. Rich explanations of particular cases are often valuable substantively and theoretically. . . . Yet, as is widely recognized, small-N studies offer an uncertain foundation for positing or evaluating general relationships. . . . Small-N qualitative studies can suggest the plausibility of formal models but provide little leverage in assessing the generality of relationships. The broad comparisons required to evaluate the generality of hypothesized relationships demand some form of quantitative analysis. (11–12)

Given the divisive state of social science methodology, collaborative work involves pulling together researchers who have already been trained in one methodology to pursue the same research questions along with other researchers trained in another methodology. Thus, researchers bring their own set of expertise and theoretical assumptions into the collaboration. These social science collaborations that employ the multimethod will result in different lines of evidence gained through different methods, which each collaborator may not agree with.

Here, I will focus on one particular collaboration reported in Poteete et al. (2010). Janssen was trained as an applied mathematician, and his research mainly uses computational methods to study complex systems. Janssen has been a major proponent of agent-based modeling, which is a relatively new type of quantitative methodology for social science research. In brief, "agent-based models explicitly define boundedly rational agents who are interacting with subsets of a whole population. The main aim of such models is to identify the set of micro-level mechanisms within which broader-level patterns evolve, such as cooperation in commons dilemmas. The models can be used to compare alternative explanations that are derived from the field and experimental studies" (171). Janssen has developed several models studying a classic social science problem, the tragedy of the commons, where each individual actor's acting in accordance to his or her short-term self-interest

is at odds with the long-term interests of groups. This is of particular interest to social scientists who study how common resources are managed and used. The results of the agent-based models, while suggestive, have to be empirically confirmed in order to be meaningful. Empirical information is needed to help confirm patterns observed in the models (Janssen and Ostrom 2006).

Janssen reports a collaboration in which he and his collaborators pursue a series of experiments to derive empirical observations, in order to develop formal models of governing the commons. The study included laboratory experiments with undergraduate students, field experiments, and role-playing games with villagers in Colombia and Thailand. His collaborators included an experimental economist, ecologist, cognitive scientist, computer scientist, and a political scientist. The collaborators reported that "all investigators were familiar with the details of some of the methods, but not with all. During the beginning of the project, the investigators needed to get familiar enough with each other's method to start designing experiments" (Poteete et al. 2010, 256). A series of experiments were designed using many different methods including laboratory experiments, field experiments, role-playing games, along with formal modeling. The work results in many papers published by the subsets of collaborators in the group.

This type of multimethod work was not without challenges. For example, in researching shared natural resources, tensions between proponents of protected areas and advocates of decentralized management by natural resource users can be highly contested. Some conservation biologists and ecologists see strict protection as the only solution, while many political scientists advocate for management that involves local populations. These types of disagreements over the goal of social science research are real and difficult to navigate.

These types of multimethod collaborative research in the social sciences exemplify exactly the type of justificatory relationship I have advocated for earlier in this article. In the social sciences, methodological divisions are ubiquitous and lead to many deep disagreements. This should not stop us from collaborating and seeking ways to use different methodologies in pursuit of the same research questions and conclusions.

Consensus-promoting views of collective justification would make these kinds of collaborations extremely difficult. Scientists enter the collaboration from different backgrounds, with different values, and trained in different methods. If they can reach consensus about a discovery claim (i.e., this dynamic derived from an agent-based model has been confirmed by a set of empirical data), the consensus is reached through multiple lines of evidence employing different methods (i.e., computational models and high-resolution experimental data). The applied mathematician will not be able to justify how the experimental data were collected, coded, and analyzed. The experimenter,

however, will not be able to justify how the agent-based model came to be. The experimental economists do not have the expertise to justify formal mathematical modeling. But this difference in justification between the modeler and experiment is justified. These are two different lines of evidence generated by two different methods, which are independent from each other. The consensus result is more reliable and perhaps only possible because of the multiple methods used.

Collaborations, thus, benefit epistemically from a diversity of methods and epistemic viewpoints. Collaborations do not need to agree with one another in every stage of research. When they are justified in having different reasons, like in pursuit of multiple methods, it is a positive feature of epistemic groups, not a negative one.

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