Feminism, Underdetermination, and Values in Science

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Several feminist philosophers of science have tried to open up the possibility that feminist ethical or political commitments could play a positive role in good science by appealing to the Duhem-Quine thesis and underdetermination of theories by observation. I examine several different interpretations of the claim that feminist values could play a legitimate role in theory justification and show that none of them follow from a logical gap between theory and observation. Finally, I sketch an alternative approach for defending the possibility that feminist political commitments could play a legitimate role in science.

1. Introduction. Feminist literature in philosophy of science reflects two ongoing projects. First, there is a critical project of exposing ways in which scientific practices or research programs have perpetuated or maintained systems of oppression, including how sexism and androcentrism have operated in scientific reasoning and specific research contexts. Second, there is a positive, normative, project of showing how feminist ethical and political commitments can legitimately play a role in good science. This normative project has been met with skepticism as it is taken to conflict with the traditional view that science ought to be 'value-free', or the view that moral, political, and other social values have no legitimate role in the justification of scientific theories.

In order to open up conceptual space for this project, several feminist theorists, including Helen Longino (1990, 2002), Lynn Hankinson Nelson (1990), and Elizabeth Anderson (1995a, 1995b, 2004), have relied on some

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version of the underdetermination thesis to argue against the value-free view. Underdetermination and the Duhem-Quine thesis show that there is a gap between theory and observation that may be filled by political or social values. I will refer to this as *the gap argument*.

In this paper I will distinguish three interpretations of the gap argument. While under certain interpretations the argument reveals limitations of traditional epistemological views about science, I will argue that no interpretation successfully undermines the view that science ought to be 'value-free'. Moreover, I will show that certain interpretations of the gap argument undermine, rather than advance, the feminist normative and critical projects. The last section of the paper offers an alternative strategy for arguing against the value-free view that would better support feminist aims.

2. Holism, Underdetermination, and the Gap Argument. Proponents of the gap argument begin by endorsing the Duhem-Quine thesis and Quine's related thesis of underdetermination. Each of these theses is taken to give rise to a 'gap' that needs to be filled in order to be justified in accepting one theory over its competitors. The Duhem-Quine thesis is that no hypothesis, taken by itself, has any observational consequences (Duhem 1954, Quine 1953). So,

> **G1**. There is a gap between theory and observation such that auxiliary hypotheses, or background assumptions, are needed to derive testable predictions and interpret observations. In other words, background assumptions are needed to generate evidential relations between a theory and observations.

A second way of thinking about the gap between theory and observation arises from Quine's underdetermination thesis that there will always be multiple hypotheses (inconsistent with each other) that are consistent with all of the evidence we have at any point in time.[1] So,

> **G2**. There is a gap between theory and evidence. Justification cannot simply be a logical relation between theory and evidence. There must

1. Sometimes Quine is taken to be making a stronger claim. That is, one might hold that theories are underdetermined, not just by the evidence that we have so far, but also by all the possible evidence that we could ever have. This version of underdetermination is more controversial and many have doubted whether there are any such cases in the history of science (e.g., Haack 1998). Yet proponents of the gap argument need not rely on this strong sense of underdetermination (nor is it clear that they intend to). As it would not clearly strengthen their argument, I will assume they are relying on the more modest form of underdetermination.

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> be other characteristics of theories that make us justified in believing or rejecting a hypothesis.

Proponents of the gap argument, then, argue that ethical or political values, or values Longino (1990, 4) has referred to as *contextual* values, can sometimes fill either the G1 or G2 gap. Anderson states:

> Since various background assumptions could be legitimately selected for any reason, no logical or methodological principles prevent scientists from choosing some on account of their congruence with their moral or political values. (Anderson 2004, 2)

According to Longino, contextual values are "not an obstacle to knowledge, but can be understood as a rich pool of varied resources, constraints, and incentives to help close the gap left by logic" (Longino 2002, 128).

Proponents of the value-free view of science claim that both the G1 and G2 gap can be filled without appealing to contextual values. The G1 gap, it is argued, can be filled by descriptive auxiliary hypotheses, such as other highly confirmed scientific theories. They also claim the G2 gap is filled by appealing to values that further the goals of science, or what have been referred to as *constitutive* values (Longino 1990, 4) or *cognitive* values (Lacey 1999; Laudan 2003).[2] Such values have traditionally been thought to include explanatory power, consistency, scope, and simplicity. Empirically adequate theories that have these characteristics will be more justified than their competitors. Thus there is no need to appeal to contextual values in order to fill the gap between theory and evidence.

Proponents of the gap argument claim that this account of how the gap is filled is overly simplistic. They argue that, with respect to G1, there is no way to rule out the possibility that contextual value judgments sometimes operate as auxiliary hypotheses. Scientists rely on a host of background assumptions that they are not even aware of in taking data to be evidence for or against a theory. Longino argues, "one can't give an a priori specification of confirmation that effectively eliminates the role of value-laden assumptions in legitimate scientific inquiry without eliminating auxiliary hypotheses (assumptions) altogether" (Longino 1987, 207). Hankinson Nelson claims that in considering which theories or common-sense beliefs might operate as auxiliary hypotheses "there are no grounds for deciding that social and political beliefs and theories are not within the network of going theories that includes evolutionary theory, biology, physics" (Hankinson Nelson 1990, 248).

Proponents of the gap argument also argue that there is no universal set of constitutive values that can fill the G2 gap. Longino argues that

2. This is a line of argument that Ernan McMullin has made (McMullin 1983).

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which characteristics we take to be virtuous in scientific theories depends on the research context, and may also be a function of the social and political values of research communities (Longino 1995). For example, whether theories consistent with other accepted theories should be preferred to novel theories may turn on whether we are suspicious of the status quo. Feminists who aim to change theoretical frameworks that reinforce gender stereotypes or power relations may value novel theories over externally consistent ones (Longino 1995, 393).

Even if the values traditionally endorsed by philosophers of science (consistency, simplicity, etc.) are the correct criteria for theory choice, there is no algorithm in using them to judge whether particular theories should be accepted or rejected. As Kuhn argued, constitutive values are imprecise, so there can be rational disagreement as to how to apply them in particular cases (Kuhn 1977, 193). Similarly, there are no formal rules that help us to adjudicate between constitutive values when they conflict. For example, there may be contexts in which the simplest theory is not consistent with other highly confirmed theories. There are no formal guidelines as to whether simplicity should weigh more than consistency. For these reasons, according to the gap argument, it is logically possible for contextual values to play a role in the interpretation and adjudication of constitutive values.

Yet even if it is true that the logic of justification does not exclude the possibility that contextual value judgments operate as background beliefs, this alone is not enough to undermine the value-free view of science. The value-free view of science rests on the claim that contextual value judgments play no *legitimate* role in theory justification. Thus, proponents of the gap argument must show not only that it is conceptually possible that contextual values play a role as background beliefs in theory choice, but also that it is possible for them to play a legitimate role, or to contribute to good science. In order to see whether some version of the gap argument can do this work, I will distinguish three interpretations of how contextual values might operate to fill the gap between theory and observation. I will argue that for each interpretation, the gap argument does not successfully establish that it would ever be legitimate for contextual values to operate as background assumptions in theory justification. More importantly, two of the interpretations actually *undermine* the coherence of a normative project that seeks to explore how feminist political commitments might contribute to good science.

3. The Causal Interpretation. One interpretation of the claim that contextual value judgments fill the gap between theory and observation is that contextual values operate as *causal influences* in scientific reasoning. Contextual values may cause scientists or scientific communities to interpret data in certain ways, or to rely on certain background assumptions

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as opposed to others. Such values might cause scientists to give more weight to one constitutive value over another, or to prefer certain ways of applying or adjudicating constitutive value judgments. At times, this appears to be Longino's view. In describing how contextual values shape scientific knowledge, Longino talks about how "contextual values can *affect* practices" "may *influence* the selection of data," or can "motivate the acceptance" of background beliefs or framework assumptions (Longino 1990, 86, emphasis mine).

This interpretation is also supported by Longino's examples of how sexist or androcentric values can influence scientific theorizing. For example, Longino draws on the work of Carol Korenbrot (1979) who critically examined Gregory Pincus' research developing birth control pills. Korenbrot argues that Pincus' political commitment to limiting population growth—particularly in third world countries—led him to report on tests that demonstrated the potential that oral contraceptives have for improving or preventing other diseases, such as breast cancer (Longino 1990, 89). His political concern to reduce population growth caused him to emphasize what he thought would be taken to be benefits and to downplay any risks or negative side effects for women using oral contraception.

At first, this interpretation might suggest that contextual value judgments can only have *negative* causal roles. However, Longino argues that they can have positive roles as well (Longino 2002, 51). While the contextual values of *individuals* can negatively cause scientists to misrepresent data or ignore evidence, the different contextual values within a *community* of inquirers can counteract these negative causal effects (Longino 1990, 73–74). Longino argues that a scientific community with diverse contextual values will be more likely to successfully identify when the contextual values of an individual scientist have had negative causal influence on scientific research. Since contextual values are often deeply held, and since a scientist cannot be aware of all of the background assumptions she is relying on in testing theories, it will be very difficult for individual scientists to recognize when their work is being influenced by their own contextual values. But, by structuring science such that a diverse scientific community is able to publicly scrutinize research, it is more likely that any such influences will be caught (Longino 1990, 80). If Pincus, for example, had been part of a research community with scientists who were as concerned with women's health as with reducing overpopulation, someone would have been more likely to notice that Pincus was down-playing potential risks to women. It is easier to identify problematic assumptions when one does not hold the values in question. Thus, contextual values can play a positive role in scientific practices by causing communities of scientists to

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recognize negative influences of contextual values, or "screen out" the values of individual scientists.

Even though the causal interpretation attempts to establish a positive role for contextual values in science, the role they play on this account is not one that undermines the value-free view. On this account, contextual values of scientific communities play a causal role in enabling them to detect the presence of other contextual values in theories, models, or interpretations of evidence. But, they do not provide *reasons* for accepting or rejecting a theory. They do not legitimately operate as background assumptions in generating evidential relations or in decisions about how to apply constitutive values. This is consistent with the view that the justification of theories ought to be value-free. The causal interpretation upholds the view that background assumptions and descriptions of evidence should not include references to contextual values.

This interpretation is even more problematic for feminists seeking to establish a legitimate role for feminist political commitments in science. On the causal interpretation, contextual values are treated as non-rational causes in scientific reasoning. A consequence of this view seems to be that all contextual values are equally dangerous in their potential to negatively influence scientists. Similarly, all contextual values have a positive role to play in contributing to a diverse research community. A diverse community with different contextual values represented will have a greater chance of catching any contextual values influencing scientific theorizing. But, feminist political commitments will be no more important in contributing to this diversity than anti-feminist commitments. It is the *diversity* of the contextual values represented and not the content of any particular contextual value judgments that makes for good science. Thus, the causal interpretation undermines the claim that feminist political commitments (as opposed to anti-feminist ones) make a uniquely positive contribution to science.

The causal interpretation limits the feminist critical project as well. On this interpretation, feminists can criticize research that is negatively influenced by sexist values, but not the content of the values. Consider the Pincus example. On the causal interpretation, Pincus allowed his political values to influence methodological decisions about which tests were relevant to his hypothesis, and a scientific community with more diverse political commitments may have prevented that. On this account, what is objectionable is that contextual values influenced Pincus' reasoning—not that his values were sexist or unjustified. But we want to be able to say that the problem with Pincus' research was that he misjudged the importance of risks to women. Research on birth control ought to minimize the risks to women in addition to promoting the goal of decreasing overpopulation. This would have been a *better* value judgment to endorse.

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Sexist values are bad for science not because they are values, but because they are unjustified. The causal interpretation does not allow us to make this sort of criticism.

4. The Tie-Breaker Interpretation. Susan Haack (1998) interprets Longino and Hankinson Nelson as claiming that contextual values fill the gap between theory and observation by acting as 'tie breakers' in cases where two hypotheses are equally supported by the evidence. On this interpretation, there will be hypotheses that are equally well supported by what we have observed, other bodies of scientific theories, and constitutive values. In other words, there will be cases where multiple hypotheses are supported by all of the evidence we have so far. In these cases, contextual values can 'break the tie' and give us reason to prefer one hypothesis to another. For example, the 'man-the-hunter' and 'woman-the-gatherer' theories both attempt to tell a story of human development that explains how certain traits and behaviors were favored by evolutionary processes of selection.[3] Longino suggests that both theories are equally supported by the evidence, and there is no other evidence that could give us reason to choose one over the other (Longino 1990, 108). Neither the data nor evolutionary theory can determine which theory is more justified. On the tiebreaker interpretation, we might say that having more women-centered theories is politically important, or furthers feminist goals, and should therefore accept the 'woman-the-gatherer' hypothesis.

According to this interpretation, contextual values operate as reasons (rather than causes of reasons) for taking one theory to be justified over another. However, proponents of the value-free view will argue that contextual values do not provide the right kind of reason to accept a theory. Susan Haack argues that the 'tie-breaker view' is untenable because it allows something other than evidence or constitutive values to determine which hypothesis to accept (Haack 1998, 128). Although contextual values might, in some sense, give us a reason to believe one hypothesis over the other, such values cannot make it *epistemically or scientifically* rational to believe one hypothesis over the other. On this interpretation, the political reasons for preferring one theory to another do not provide epistemic reasons to do so.

The tie-breaker interpretation invites this criticism by framing political commitments as independent from our cognitive or scientific goals. They come into play only when epistemic or cognitive considerations have run out. Again, this hinders our ability to defend a feminist normative project

3. Longino gives a thorough analysis of these two accounts. See Longino 1990, 106–108, 130.

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in science. If contextual values only properly enter into decisions about theory acceptance after all scientific considerations have been exhausted, then it is difficult to make the case that feminist values could contribute towards our scientific or epistemic endeavors.

Yet while Longino's discussion of the man-the-hunter and woman-the-gatherer hypotheses supports the tie-breaker interpretation, it is not supported by the rest of Longino's work. Both Longino and Hankinson Nelson argue that contextual value judgments can play a role as background assumptions in determining *what we take to be evidence* for or against a theory. On their view, it is not that contextual value judgments are relied on to choose between hypotheses that are equally supported by the data, rather they somehow play a role in determining whether a hypothesis (or multiple hypotheses) *are* supported by evidence or not. Longino states:

> Background assumptions are the means by which contextual values and ideology are incorporated into scientific inquiry. While not all such assumptions encode social values, *their necessity to evidential reasoning* means that the basic components of methodologies—logic and observation—are not sufficient to exclude values from proper inquiry. (Longino 1990, 216, emphasis mine)

5. The Normative Interpretation. The final interpretation is that contextual value judgments can fill the gap by operating as background beliefs in theory justification. On this view, they can operate as auxiliary hypotheses in generating evidence for or against a theory, and they can provide us with reasons for justifying, interpreting, applying, and adjudicating constitutive values. Unlike the causal interpretation, contextual values do not merely cause scientists to identify the negative influences of contextual values in scientific reasoning. Rather, on the normative interpretation, contextual value judgments can (at least in some contexts) *give us good reason* to interpret observations in a particular way, to rely on or reject a particular framework, to give more weight to some constitutive value over another, or to adopt a certain standard of evidence. Unlike the tie-breaker interpretation, this view seeks to establish that contextual value judgments can provide legitimate epistemic or cognitive reasons for accepting one theory over another. They can be necessarily involved in helping to generate evidence, as well as applying and adjudicating constitutive values.

This interpretation better represents the claims made by Longino, Hankinson Nelson and Anderson. Hankinson Nelson argues that evidence should be construed holistically to include other scientific theories and common-sense experiences and beliefs—including common sense expe-

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riences and beliefs about sex/gender and politics (Hankinson Nelson 1990, 247–249). It is also the kind of argument that is needed to seriously undermine the value-free view of science and to provide a basis for the feminist normative project. If it were the case that contextual value judgments were sometimes necessary to giving us epistemic reasons for judging a theory to be justified, then that would show that the value-free view is false.

The claim that contextual values can legitimately operate as background beliefs in generating evidential relations or applying constitutive values, however, does not follow from a 'gap' between theory and observation. It may be that the gap between theory and evidence shows that *some* auxiliary hypotheses are necessary (including assumptions about how to interpret and apply constitutive values), but it does not establish that any contextually value-laden assumptions are ever necessary. In fact, it would at least *prima facie* seem more plausible that any necessary auxiliary hypotheses would be descriptive claims. The background assumptions necessary to generating evidence for or against a hypothesis would be related to the content of the hypothesis. Auxiliary hypotheses help give us reason to take something to be relevant to the justification of a hypothesis given the content of that hypothesis. If the content of scientific hypotheses is always descriptive, then it is not clear how the content of contextual value judgments would ever be relevant to generating evidential relations.

Yet, this points to one way that contextual values could, in principle, play a legitimate role in theory justification. If it could be shown that scientific claims are not always purely descriptive, or that they sometimes have contextually normative content, then contextual value judgments will be necessary and legitimate background assumptions in testing those hypotheses. The important thing to note, however, is that this would be a consequence of the *content* of scientific theories and not the result of a logical gap between theories and observation. Whether it would be legitimate to rely on a contextual value judgment as an auxiliary hypothesis would depend on whether the judgment is relevant to generating evidential relations given the content of the theory. The legitimacy of relying on such a value judgment would never be a consequence of the logical structure of justification.

Similarly, whether contextual values could legitimately operate in justifying or applying constitutive values (or cognitive criteria for theory choice) will not turn solely on the truth of the logical claim that theories are underdetermined by evidence or that there is no algorithm for applying constitutive values. The traditional view is that constitutive values are justified (at least partly) in relation to the aims of science (Hempel 1965; Laudan 1984). Thus, a proponent of the value-free view can admit that there is no algorithm for applying criteria for theory choice but insist that

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we ought to appeal to the aims of science rather than any political values in interpreting, applying, or adjudicating between constitutive values. Insofar as the aims of science are free of contextual values, it is not clear why it would be legitimate to appeal to such values in justifying or applying constitutive values. Contextual values do not (at least at first glance) appear to promote the goals of science.

Again, this illustrates another strategy for attempting to argue that the value-free view is false. If one could show that the aims of science did, at least in some research contexts, presuppose or depend on contextual values, then the justification or application of constitutive values might also depend on contextual values. My claim is that whether contextual values could play a legitimate role in justifying or applying constitutive values will depend on the *content* of the goals of science, or on whether contextual values can promote the aims of science, and not as a consequence of underdetermination.

6. Conclusion: An Alternative Strategy. I have argued that the gap argument under any interpretation fails as an argument against the value-free view and hinders prospects for the feminist normative project. The causal interpretation also limits how we can conceive of the critical project of exposing sexism and androcentrism in science. We are unable to argue that science that relies on oppressive values is bad because such value judgments are *unjustified*.

Seeing the ways in which the gap argument fails to support a feminist normative project, however, helps show how one might successfully argue that the value-free view is false. If contextual values can play a legitimate role in theory justification, then they are likely to do so in one of two main ways. First, if the content of a particular scientific theory contains ethical or political content, then contextual value judgments will be relevant and necessary as auxiliary hypotheses in determining whether the theory is supported by evidence. There may be cases where the content of certain scientific concepts involves ethical and political values. For example, some have argued that the concept of 'disease' as employed in clinical psychology and biomedicine involves irreducibly normative content (Reznek 1991). Some feminists have argued that categories such as 'sex' or 'head of household' (as applied in economics) presuppose certain political commitments (Fausto Sterling 2000; Anderson 1995b). Thus, we should examine whether the content of scientific theories is always truly free of contextual values.

A second way that contextual values might legitimately play a role in theory justification would be if such values were somehow inextricably connected to the aims of (at least some) scientific research contexts. If there are cases where the goals of a research context presuppose or depend

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on endorsing certain contextual values, then such values will play a legitimate role in applying and adjudicating between constitutive values. In those cases, it will be scientifically rational to appeal to contextual values insofar as doing so will promote the aims of the research. Phillip Kitcher (2001), for example, has argued that the ethical and political aims of some research contexts cannot be distinguished easily from the scientific aims of those contexts. Longino, in her 1995 article "Gender, Politics, and the Theoretical Virtues," also argues that the aims of some research contexts depend on contextual values in ways that have implications for constitutive values, or criteria for theory choice. Yet this line of argument is absent in the rest of her work.

This approach has a stronger chance of providing us with resources for advancing both the feminist normative and critical projects. It provides a framework for determining whether there are cases where feminist values could play a role in good science. Furthermore, if we find cases where contextual value judgments provide us with good reasons for believing scientific theories, it will make sense to discuss *which* contextual value judgments are themselves justified. This opens up a framework where oppressive values in scientific reasoning can be evaluated as bad, not because they are values, but because they are unjustified values.

In conclusion, it may turn out that proponents of the gap argument have correctly identified ways in which contextual values can play a role in theory justification. However, the gap argument misdiagnoses *why* contextual values play a *legitimate* role in science (if they do). It will be because there are contexts where the content of the theories or the goals of the research contain contextually normative content, and not because there is a logical gap between theory and observation.

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