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ARTICLE

From Anti-Exceptionalism to Feminist Logic

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Abstract

Anti-exceptionalists about formal logic think that logic is continuous with the sciences. Many philosophers of science think that there is feminist science. Putting these together: *can anti-exceptionalism make space for feminist logic*? The answer depends on the details of the ways logic is like science and the ways science can be feminist. This paper wades into these details, examines five different approaches, and ultimately argues that anti-exceptionalism makes space for feminist logic in several different ways.

Anti-exceptionalism in the philosophy of logic is the view that formal logic is continuous with the empirical sciences. Although logic has sometimes been thought to be special—a priori instead of a posteriori, deductive rather than abductive, normative as opposed to descriptive, subjectless or linguistic rather than about the world—anti-exceptionalists argue that this is a mistake: logic is, in various ways, much more like ordinary science than we generally think.[1]

Suppose the anti-exceptionalists are right. Some science is feminist science—or so many have argued.[2] So, if anti-exceptionalism is true, *could some logic be feminist logic*? The answer will depend on the details of the ways logic is similar to science and in which science is feminist. This paper wades into these details by identifying five ways science can be feminist and looking at whether anti-exceptionalism permits there to be feminist logic in any of these ways.

Some of the possibilities turn out, on investigation, to be underwhelming. Others hold promise. In particular, anti-exceptionalism about the *subject matter* of logic—according to which logic studies general but worldly truths—makes room for logic whose subject matter is feminist: perhaps social hierarchies, or social norms and permissions, are sufficiently general features that they merit a logic. Such logics would be concerned with feminist topics the way alethic modal logics are concerned with the topic of necessity. Another promising conduit is *epistemic* anti-exceptionalism, according to which the epistemology of logic is abductive. It can make room for work in logic which is free of, or corrects for, gender bias.

After some needed preliminaries, anti-exceptionalism is introduced and several exceptionalist assumptions are identified that seem to rule feminist logic out, including

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the theses that logic has no subject matter, and that the methodology of logic is proof. The main work then takes place as five conceptions of feminist science are articulated, and we consider whether logic could be feminist in any of these ways. The conclusions are summarized on the final page.

It is hoped that this work will be of interest to several groups. For anti-exceptionalists, this is a new continuity between logic and science, and hence grist for their mill. For feminist philosophers, this paper provides a novel approach to feminist logic and contributes to the project of reclaiming—as opposed to excising—formal tools for feminist thought. And for those with an interest in finding social applications for the core areas of analytic philosophy, logic is offered as an addition to the list of subdisciplines—such as metaphysics, epistemology, and the philosophy of language—which have feminist applications.

Preliminaries: logic, feminism, feminist logic

It's useful to begin with some idea of what success would look like, that is, what would count as *logic*, and what would be required for it to count as *feminist*. The kind of logic the present paper focuses on concerns the entailment relation: patterns of truth-preservation over sentences in a language in virtue of their form.[3] Elsewhere in philosophy, *logic* can be used more broadly and applied to theories of reasoning, confirmation, formal semantics and pragmatics, or other mathematically-informed subdisciplines. On the present, narrower, understanding, these won't count, though standard classical, non-classical, modal, and higher-order logics—the kind of thing that is studied in logic classes in philosophy departments at universities across the world—will.[4] At times *logic* has been interpreted more narrowly still, so that there can be a genuine question about whether modal or second-order logics are *really* logic.[5] I assume no such additional restrictions here; if modal logic turns out to be feminist, I will take that to answer the question of whether there can be feminist logic—I won't turn around and ask whether modal logic is *really* logic.

Feminism, as understood here, is the ethical and political movement for gender equality, according to which a person's status, power, and opportunities in life should not be determined by their gender or lack of it. Often, gender inequality harms women but others can also be so harmed. This paper assumes a conception of feminism on which it fights the inequality that leads to such harm.

When *feminist* modifies the name of a discipline—as in *feminist history*, *feminist ethics*, or *feminist logic*—the compound denotes a subdiscipline that bears some special relationship to feminism, but the substance of that relationship can vary a great deal. *Feminist history* could mean the history of the feminist movement, history of women, or any history pursued in a distinctively non-gender biased way. These are different projects, but each could reasonably be called *feminist* history. For logic to be feminist then, I will require only *some* appropriate special relationship between it and the movement for gender equality. Some relationships will naturally be more interesting and controversial than others, but as we'll see in the next section, one well entrenched view in the philosophy of logic might support the view that feminist logic is simply *impossible*, and so I want to be careful not to dismiss promising possibilities too easily.[6]

Exceptionalism and the impossibility of feminist logic

Anti-exceptionalists in the philosophy of logic emphasize continuity between logic and the sciences:

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> Logic isn't special. Its theories are continuous with science; its method continuous with scientific method. Logic isn't a priori, nor are its truths analytic truths. Logical theories are revisable, and if they are revised, they are revised on the same grounds as scientific theories. These are the tenets of anti-exceptionalism about logic. (Hjortland 2017, 631)

The opposing view is *exceptionalism*, according to which logic is special. Philosophers have held that logic is a priori, necessary, analytic, and/or immune from rational revision or revision in response to experience. They have thought that its *subject matter* is special: it is said to be topic neutral or perhaps to have no subject matter, to be free of ontological commitment, or to be about language rather than the world. Logic has been said to be distinctive because it is formal, or normative, or because its method is proof, whereas the sciences formulate theories, gather data, and select the theory that explains the data best; in short: logic is deductive, science abductive. Clearly then, anti-exceptionalism about logic is said in many ways.

Some kinds of exceptionalism make it hard to see how there could be feminist logic. In pursuing the abductive method, scientists formulate theories, collect data, and make judgments about which theory is best supported. At some stages in this process there is potential for bias, including gender bias, to corrupt the epistemic process. It might interfere with the design of experiments, or with judgments about theories. One task for feminist science then, is to uncover and correct for gender bias. But if logic's method is deductive proof, it is harder to see how gender bias can make any difference, and so harder to see how there is space for feminist reform. The proof succeeds, or it doesn't; the bias of the evaluator would seem to play no role.

A different kind of exceptionalism also makes it hard to see how logic can be feminist. According to it, logic's subject matter is exceptional, perhaps because it is topic neutral, or even because it has none at all. One way science can be feminist is by taking gender as its subject matter (Anderson 1995, 57). But if logic has no subject matter, it cannot do the same.

We've seen that some kinds of exceptionalism close down the prospects for feminist logic. Is anti-exceptionalism any different? The next section looks at five ways science can be feminist and considers whether anti-exceptionalism allows logic to be feminist in those ways.

Five approaches to feminist science and logic

Serving feminist ends

Science

Science is sometimes called *feminist* when it aids in the achievement of feminist ends.[7] If our goal is to, say, increase the proportion of women lawmakers in a society, then work done in sociology, psychology, economics, or anthropology can help by providing models for understanding the status quo, countering common myths, or predicting the consequences of interventions.

Even mathematics can be useful in achieving feminist ends and a mathematics course could be taught on feminist applications of game theory,[8] statistics, or even accounting.

Logic

The thought that logic might be able to serve feminist ends is not new. L. S. Stebbing's book *Thinking to some purpose* (1939) aimed to teach its readers to use logic in the service of politics and in two places she criticizes powerful men for their views on

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women. The first concerns an argument against women's suffrage (159) and the second —on which I'll focus here—is a passage by Bertrand Russell from *The conquest of happiness*:

> If you are sitting in the Underground and a well-dressed women happens to walk along the car, watch the eyes of the other women. You will see that every one of them, with the possible exception of those who are even better dressed, will watch the woman with malevolent glances, and will be struggling to draw inferences derogatory to her. (Stebbing 1939, 100)

Stebbing dryly takes Russell's passage apart. She questions his premise and points out that the transition to such a general conclusion is not valid:

> However that may be, it does not justify the inference that whenever you see a well-dressed woman enter a car on the Underground you will see *every* one of the less well-dressed women turn malevolent glances at her.

This is a use of logic since it uses facts about *entailment* to critique Russell's text; she is saying that his conclusion does not follow logically from his premises. And though Stebbing never uses the word *feminist* herself, her criticisms fight inequality of the basis of gender, and so count as feminist on the present definition. Hence her work is an example of feminist logic.

Still, this first step is unambitious. The observation that a general claim doesn't follow from a more restricted one is apt, but it is not exciting news *qua logic*. We don't need any new *logical* work to explain the fallacy.

Moreover, feminist ends is just one among many applications for logic— we could use it for religious ends, environmental ends, even evil ends. Perhaps that means there is religious logic, environmental logic, and—my favorite—evil logic, but this very openness highlights the fact that this conception of *feminist logic* is both easy and unambitious. In addition, no anti-exceptionalist moves were needed. So let's look further.

Correcting for gender bias in methodology

Science

A second—more substantial—way to see that science can be feminist is to note that sexism is a kind of bias—bias on the basis of gender—and biases can lead us to misinterpret evidence, to fail to consider salient possibilities, to place our thumbs on the scale for favored ideas, or to fail to investigate further when we ought to. Feminist science, then, can be science that uncovers and corrects for gender bias in scientific work.

Sherif (1979) provides examples from the history of psychology. In one case, experiments were performed to test the hypothesis that women are *easier to persuade* than men, but experimenters failed to notice that the topics used in the experiments were in domains of traditional male interest and authority. Subsequent research by Tittler undermined the conclusion that persuadability varied with gender and "showed that both men and women were more suggestible when the topic at hand was of very little concern to them (e.g. the reputation of General von Hindenburg) than when the topic was deeply and personally involving (e.g. the appropriate personal qualities for men and women.)" (Sherif, 1979, 71) Tittler's work was science that uncovered and corrected for gender bias in experimental design, so it is feminist science in this sense.

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Science and gender symbolism

One might think that gender bias could only undermine sciences which study gendered things—people. If so, then there could be feminist psychology, feminist economics, and feminist biology—but no feminist astrophysics, or mathematics. But thanks to the mechanism of *gender symbolism*, gender bias has a much broader reach than one might expect.

Gender symbolism is the phenomenon of things being socially encoded as masculine or feminine, regardless of their own gender or absence of it (Anderson 1995, 57). In an orchestra, conducting is coded masculine, and playing the harp feminine. Among colors, pink is feminine, blue masculine. Or alcoholic drinks: whiskey vs sparkling rose. The phenomenon extends into academic subjects. Computer science is masculine, nutrition science feminine. Logic is masculine, applied ethics feminine. Metametaphyiscs is masculine, social metaphysics feminine.

These are contingent, social connections which require no basis in the phenomena themselves. They are community-relative and may change over time: pink is currently feminine, but used to be masculine (Paoletti 2012; Fine 2011, 208–9), and computing is now masculine but used to be feminine. (Hayes 2014) The fact that philosophy is coded masculine is no bar to the subfield of ethics being coded feminine; within an area, subareas can form a further spectrum—metaethics is masculine, applied ethics feminine—with higher status versions of the same activity often attracting a masculine coding and lower status ones, feminine.

This affects the way subdisciplines are treated. Sherif (1979) describes the veneration of the "hard" sciences that led to a hierarchy of subdisciplines in psychology in the 1970s:

> it was the experimentalists at the top, the testers and statistictians next, then the developmentalists, and finally the social psychologists … It is my contention that each of the fields and specialties in psychology sought to improve its status by adopting (as well and as closely as stomachs permitted) the perspectives, theories and methodologies as high on the hierarchy as possible. … Certain of its dominant beliefs about the proper way to pursue knowledge have made psychological research peculiarly prone to bias in its conception, execution and interpretation. (62–64)

Sherif holds that the hard sciences were higher status and this resulted in bias toward kinds of psychology that could be made to resemble them and unjustified bias against developmental and social psychology. The high-status "hard" approaches are coded masculine and developmental and social psychology were coded feminine.[9] This hierarchy was not a mere static ranking, but an engine of change in the discipline.[10]

Hierarchies also exist in the hard sciences, and even within mathematics. Within computer science, theory and programing have been gendered masculine, with application-focused work regarded as more feminine (Fine 2011, 46–47).

Gender symbolism forges a connection between gender and arbitrary things and gives gender bias a grip on disciplines that don't study gender—like logic. There is a professional cost to engaging with things coded female, and a status bump for engaging with those coded male. Human decision-making is sensitive to status, and such a social environment will, in the words of Sherif, make "research peculiarly prone to bias in its conception, execution and interpretation" (64).

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Logic

Could feminist logic be work that corrects for gender bias in logical methods? We should note that there can only be correction for gender bias in logical methods if there is gender bias in logical methods. And if logic proceeds by deductive proof alone—as the methodological exceptionalist claims—it may seem as if there is nowhere for bias to intrude. But anti-exceptionalists hold that the correct logical theory is selected by abduction and just as this leaves room for bias in science, so can it in logic.

Logicians have their virtues, but lack of bias towards their preferred logics isn't one of them. We all have our favorites, often for contingent reasons connected to educational background and familiarity. Is it likely though, that such preferences have their roots specifically in *gender* bias? Through gender symbolism, it is just possible. One logic could be coded feminine, another masculine, and then gender bias could influence our judgments of relative explanatory power. ("I don't know" we find ourselves saying, "this one just seems more reasonable/austere/elegant.") Moreover, there is *some* gender symbolism in logic, as seems inevitable.

My own view, however, is that there isn't very much of it. The most elementary point is that logic is mostly coded male. Within academic philosophy, that is reinforced by links to abstraction, Aristotle, rationality, formalism, and mathematics. Outside of academia, the contrast between logic and emotion is emphasized, with logic male and emotion female. (Burgis 2019, 6) But beyond these elementary points, it seems to me that there is remarkably little *variation* within logic, for example, attaching to certain logics —classical, second-order logic, or dynamic—subareas of logic—say, model theory, mediaeval logic, or proof techniques—or philosophical views, i.e. normativism, conventionalism, or pluralism. If we were to ask logicians to divide such things into those coded "masculine" and those coded "feminine," I think they would struggle with the task, and especially to find anything not coded masculine. Such lack of variation leaves little room for gender bias.[11]

But there *is* one important example of a logician who claims that one logic has been preferred to another as a result of gender bias. Val Plumwood—in whose work in logic there has been a recent surge of interest[12]—argues that gender bias has led to the widespread acceptance of classical over relevant logics:

> the structure of negation given by classical propositional logic—the dominant formal logical theory of our time—in particular has been privileged and selected over rivals on account of features which also make it appropriate to describe it as a logic of domination, features giving an account of the other in dualistic terms which naturalise their subordination. (1993, 441)

A central feature of Plumwood's view is the account of *dualisms*. Dualisms are hierarchical distinctions—pairs of expressions (such as *master*/*slave*, *reason*/*emotion,* or *male*/*female*)—exhibiting a list of distinctive properties:

1. **backgrounding**—the inferior side is characterized as *inessential*
2. **hyper-separation**—differences are exaggerated, borderline cases suppressed, and features of both sides are essentialized
3. **relational identity**—the inferior side is defined in terms of the other
4. **instrumentalization**—the values of the superior side dominate; their interests are taken as ends in themselves, whereas the inferior side is assessed in terms of virtues that make it useful to the superior

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5. **homogenization**—both sides, but especially the inferior, are treated as "all the same."

Plumwood's case that *male*/*female* is such a dualism is compelling. Making the full case in support of her point is more than I can do here, but to at least sketch a few thoughts in support:

1. **backgrounding**: traditional male work outside the home is characterized as necessary to support the family, and women are regarded as dependent on it—even though the ability to leave the house for work depends on having someone to take care of one's house and children.
2. **hyper-separation**: differences between men and women are taken to be due to their essential natures, even when there are social or historical explanations available (e.g., interest in computer science, or pure mathematics).
3. **relational identity**: women are "co-eds" and "spouses."
4. **instrumentalization**: women are assessed in terms of their value to men
5. **homogenization**: when a man is bad at something, it is just someone being bad, when a women is, inferences are drawn about all women.

So let me grant Plumwood her premise that *male*/*female* is a dualism. The dualism is clearly pernicious, both epistemically and morally. A more difficult issue is what this has to do with logic.

Plumwood argues that classical logic supports and encodes dualisms, whereas relevant logic does not, and this is why classical logic been favored. If this is right, exposing this, and showing how to replace classical with relevant logic, would be doing feminist logic in this second sense we are discussing. But *is* it right?

Plumwood writes: "classical logic is the closest approximation to the dualistic structure I have outlined." And goes on:

> In classical logic, negation, ($\sim p$), is interpreted as the universe without p, everything in the universe other than what p covers, as represented in the usual Venn diagram representing p as a figure surrounded by a square which represents the universe, with $\sim p$ as the difference. … what is important for the issue we are considering here is that $\sim p$ can then not be independently or positively identified, but is entirely dependent on p for its specification. Not-p has no independent role, but is introduced as merely alien to the primary notion p. (Plumwood 1993, 454)

This is where Plumwood and I disagree: there is no special relationship between dualisms and classical logic. While standard classical model theory builds in some questionable assumptions—e.g., that domains of quantification should be non-empty—these fall far short of dualisms. More specifically, the $p/\sim p$ distinction, where $\sim$ is classical negation, *needn't* be a dualism. If we take the set of natural numbers as our domain, we can interpret the non-logical one-place predicate E as the set of even numbers, and the odd numbers will then be those of which $\sim Ex$ is true. But this doesn't result in a pernicious *even*/*odd*, or *even*/*not even* dualism, because there are no consequences in terms of homogeneity, backgrounding, hierarchy, or instrumentalization—the odd numbers are not being oppressed.

One aspect of Plumwood's critique rings true: the interpretation of $\sim Ex$ depends on that of Ex. The truth-conditions of complex symbols depend on the truth-conditions of

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their parts. But it is one thing to say that the interpretation of a predicate depends on the interpretation of one of its parts, and another to say that the odd numbers are dependent on the even—we can have the former without the later. Moreover, this feature of classical negation is *shared* with relevant negation, so that this cannot be Plumwood's reason to favor relevant over classical logics. Finally, we *can* identify the odd numbers independently with a simple predicate, O and note that the even numbers are those satisfying $\sim Ox$. It is not true that "$\sim p$ can then not be independently or positively identified" (454).

Suppose we combine classical negation with predicates that already have the dualistic baggage built in, for example, *male/not male*. The result may well be a dualism. But since classical negation can also be used without these consequences, as in *even/not even*, we know that it isn't the classical negation that is responsible for the pernicious features.

Still, Plumwood's general approach remains the best example of work *in logic* that is designed to counter gender bias in logic's methodology, and so it illustrates feminist logic in this second sense.

Studying feminist subject matters

Science

Some science is feminist because of *what* it studies. A study by Goldin and Rouse (2000, 716) found that the likelihood a woman would be advanced to the next stage of the hiring process for an orchestra was significantly increased if auditions did not reveal the applicant's gender. In Norton et al. (2004)'s CV studies, subjects were asked to evaluate the CVs of job candidates. In one version, there are two candidates for a senior job with a construction company. One of their CVs shows lots of industry experience, but little formal education. The other shows less experience but more education. When the candidate's gender wasn't available, 76 percent of male subjects strongly preferred the better-educated candidate to more-experienced one. Similarly, if the better-educated candidate was male and the more-experienced candidate female, about three-quarters of the subjects favored the better-educated candidate. One might expect then, that if the genders are reversed, three-quarters would now favor the better-educated female candidate. But only 46 percent do. The experiment is designed so that gender is the clear reason for the difference, but when asked why they made chose as they did, subjects did not mention gender, but rather cited the importance of experience. Norton et al. (2004, 817) write: "We suggest that individuals engage in *casuistry* to mask biased decision making, by recruiting more acceptable criteria to justify such decisions."

The studies above are examples of science that studies subject matters that are of especial interest to feminists. Sometimes such work counts as serving feminist ends as well (and so could also fit into category 1) but it needn't be motivated by this. It could be *blue sky* research into gender, motivated by intellectual curiosity and the desire to understand, even if—somewhere down the line—it might also help to redress gender-based injustice.

Logic

Could logic study subjects of interest to feminists? This looks unpromising from an exceptionalist perspective; if logic has no subject matter, must be so general as to be topic-neutral, or is essentially metalinguistic (three different varieties of subject matter exceptionalism) then it is hard to see how it could study, say, gender or injustice.

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But anti-exceptionalism can help here. As we saw earlier, one strain of anti-exceptionalism holds that the subject matter of logic is as worldly as that of the other sciences. Anti-exceptionalism can study modal logic *as* an especially systematic way to theorize about modality, tense logic as a way of theorizing about time, or epistemic logics to study issues in the theory of knowledge, such as the consequences of the KK-principle.

Is there any prospect for feminist logic here? In fact I think this is the most exciting of the conceptions of feminist logic and I'm going to sketch three different development possibilities below, concerning i) gender-based social hierarchies, ii) gender-based norms and permissions, and iii) intuitionistic logic to study socially constructed categories.

So first, consider gender-based social hierarchies. These are hierarchies, defined on people, and a hierarchy is an ordering-relation. Logic has a long track record of studying ordering-relations. In mathematical logic, it has been used to study hierarchies of numbers and sets (Enderton 2001). In counterfactual logics, hierarchies of possible worlds—this time ordered in terms of similarity—have been used to give truth-conditions for counterfactual conditionals (Lewis 1973). In tense logics, orderings of times using the *earlier than* relation have been used to explore the logic of tense-operators (Prior 1967). If we can order numbers, worlds, and times, then why not people?

Taking the above as inspiration, there are at least two promising ways to proceed. On one, we could formulate axioms concerning gender hierarchies, and explore their consequences using familiar first- or second-order logics. On another, we could add an ordering-relation on individuals to first-order models, (just as Lewis adds an ordering-relation on worlds to modal models) and explore the idea of logical constants whose truth-conditions are sensitive to these hierarchies, much as Lewis' counterfactuals have truth-conditions sensitive to hierarchies of possible worlds.

A second idea—that could be combined with the first or explored independently—is to use logic to study *social norms and permissions*. Consider that, on the theory of social subordination given in Langton (1993), one aspect of subordination concerns people's rights to perform actions, and the rights of others to act *on them*. Rights are sometimes thought of as legal permissions, but there is a more general conception of social permissions granted one by social groups, either explicitly by a formal rule or more tacitly by an implicit social norm. We could use tools like deontic-modal logics—which contain explicit logical *permissibility* operators—to study norms and permissibility on the basis of gender.

A third possibility is to note that, historically, distinctive views about the metaphysics of mathematical objects have motivated distinctive approaches to mathematical logic. In particular, the metaphysical view on which mathematical objects are mental constructions has been taken to be grounds for accepting the correctness of intuitionist logic and the failure of classical logic. Then consider that philosophers also hold competing theories of the metaphysics of *social groups* and their properties, including gender groups. Some hold that social groups are natural kinds, perhaps with distinctive essential properties, others that they are social constructions, and others still that they don't really exist at all. If the metaphysics of mathematics can influence the correct mathematical logic, why shouldn't the metaphysics of social groups influence the correct logic for this area of discourse?[13]

The three suggestions above are tentative ideas about how we might use logic to study gender, and how well they can be developed and how fruitful the results would be remains to be seen. My point here is just that anti-exceptionalism about logic's subject matter opens up these possibilities for development, and several of these projects

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promise or threaten interesting consequences *in* logic—not mere applications of familiar logic to feminist issues among many others. With subject matter anti-exceptionalism, and the idea of feminist science as science that studies topics relevant to feminism, we finally have an approach that transfers from science to logic in a way that might allow interesting logic.

Gendered epistemic capacities

Science

A fourth conception of feminist science is: science that employs distinctively feminine epistemic abilities. This approach is controversial. Anderson writes:

> Some people claim that women have gender-typical "ways of knowing," styles of thinking, methodologies, and ontologies that globally govern or characterize their cognitive activities across all subject matters. For instance, various feminist epistemologists have claimed that women think more intuitively and contextually, concern themselves more with particulars than abstractions, emotionally engage themselves more with individual subjects of study, and frame their thoughts in terms of relational rather than an atomistic ontology. There is little persuasive evidence for such global claims. (Anderson 1995, 61–62)

Some have rejected feminist epistemology largely because they reject this conception of it:

> This reversion to the notion of "thinking like a woman" is disquietingly reminiscent of old, sexist stereotypes. … I am not convinced that there are any distinctively female "ways of knowing." … differences in cognitive style, like differences in handwriting, seem more individual than gender- determined. (Haack 1996, 32–33)

I have sympathy with Anderson and Haack's skepticism, but there is more to this approach to feminist science than one might initially think.

Consider first that there is surely variation among humans (and other creatures) in something that we might broadly call *epistemic capacities*. Some of that is perceptual. Standard human variation encompasses color-blindness, supertasting, and prefect pitch. Some is cognitive: memory skills, mental arithmetic, ability to learn languages and complete spatial rotation tasks. Many blend both perceptual and cognitive elements.

Capacities might be as Haack suggests, "more individual than gender determined," but this is an empirical hypothesis. Some capacities do appear to correlate with gender, for example, color-blindness is more common in men.

That said, there is a strong and mistaken tendency to essentialize such gender-correlated differences, that is, to overestimate the role played in their development by genetics, and underestimate the role played by contingent social factors (Fine 2011). Variations in epistemic capacities frequently have social causes. An obvious case: inhabitants of Montreal tend to be much better at learning from the testimony of French-speakers than inhabitants of Edinburgh, but the difference isn't genetic, but the result of growing up in a French-speaking culture. Even broadly perceptual variations—such as susceptibility to the Müller-Lyer illusion—are thought to vary with the subject's history (McCauley and Henrich, 2006).

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Some feminist epistemologists understand gendered epistemic capacities in these contingent, socially caused ways, so that the claim is that *as a result of the social positions women have found themselves in*, they have tended to acquire distinctive epistemic capacities. Put this way the claim is of a piece with studies that say that wealthy people have more trouble reading the emotions of others than poor people do. Kukla and Ruetsche (2002) use the expression "second nature rationalities" since these qualities are not a product of nature alone. Here I will call them "second nature epistemic capacities" because I want to explicitly include both cognitive and *perceptual* variations.

I don't know whether there are distinctively feminine second nature epistemic capacities, but there is suggestive research: some studies that say that women cite other women more than men do and cite themselves less (Dion et al. 2018). This suggests that there might be a gender-correlated impairment related to testimony—a crucial epistemic mechanism in science. Some studies of journal articles have concluded that women write more clearly than men and improve more over time in the clarity of their writing—suggesting variation in gender with respect to explaining oneself and in capacity to improve that skill. Such results are—if accurate—quite plausibly linked to "second nature" epistemic capacities, such as the ability to imagine what it is like for someone else to read one's work. But for these to be genuine gender-based *epistemic* capacities we would need to establish not just that they really exist, and that they vary with gender, but also that they result in new beliefs and provide justifications for the beliefs they result in. That is, they have to i) *be*, ii) be *gendered*, and iii) be gendered *epistemic capacities*.

Still, suppose they exist. How do we get from these to feminist science? Perhaps feminist science would employ more people with these capacities, or just reward the capacities on straightforward epistemic grounds. The former might result in research teams that employed more women but it could also just stress the ability to write an unbiased literature review and cite responsibly. Promoting people who are strong in such capacities would be like promoting people who are good at using an electron microscope or good at mathematics; their learned skills—whatever the explanation for their existence—make them better scientists.

So there are two ways to understand the gendered epistemic capacities approach. One imputes essential epistemic capacities to women. Here, with Anderson and Haack, I am skeptical as to whether there are any. The other interprets gendered epistemic capacities as contingent, socially inculcated, and "second nature." Here it is an intriguing empirical hypothesis that there are any, but if there are, they would be similar to other second nature epistemic capacities—such as the capacity to read an x-ray and or identify solutions to Einstein's field equations. These are things that could justify both the hiring of someone with the capacities and the encouragement of their development generally, regardless of gender. We might call science that emphasized these capacities "feminist"—at least as long as the capacities remain gender-correlated.

Logic

A philosopher who brings a feminine-ways-of-knowing approach to logic is Andrea Nye (1990). Her critique of logic is radical: she holds that logic itself is a *masculine* way of knowing—abstract, general, and formal—and says that, rather than study logic, women should abandon it completely in favor of more detail and context-oriented methods, such as literary analysis: "If men have been the masters of logic, women may be the masters of reading." (Nye 1990, 184).

Unsurprisingly, women logicians have disagreed.[14]

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> The area of intellectual activity potentially destroyed by such a program to eliminate abstraction and anything which departs from "normal" language begins to look alarmingly large—not only mathematics … and large areas of science, but "computer programming, statistics, economic models …" and no doubt a great deal more we might not want to lose. Such total rejection of abstraction would involve a program highly restrictive of thought. (Plumwood 1993, 439)

Plumwood's point is that the cost of giving logic up is too high. Even if there were gendered ways of knowing, a male gendered way of knowing would still be a way of *knowing*, and hence epistemically desirable. I think Plumwood is right about this. But could there be other "ways of knowing" approaches to logic?

On reflection, it can seem strange to talk about logic as a single "way of knowing," just as it might seem strange to describe science that way. Although we can talk in very general terms about all sciences as collecting data, formulating hypotheses, and testing them, in practice the epistemic capacities required to be a good epidemologist differ from those required to be a good archeologist, linguist, or astrophysicist. Similarly, while the anti-exceptionalist sees logic as justified by abduction, the skills required to do, say, Turing's work on abstract automata, Kripke's work on model theories for modal logic, Frege's work on quantification, or Brouwer's work on intuitionism are very different. Did Lewis and Langford, or Barcan Marcus, use the same "way of knowing" as Kripke? What about A. N. Whitehead and A. N. Prior? It's true that there is a high level at which all these logicians have many skills and methods in common—but if we zoom in it is also clear that logicians employ and get good at various different techniques: informal reductio, axiomatic proof, proof by induction on complexity, truth-value analysis, programing and computer-assisted proofs, model-construction, set theory, algebraic techniques, natural deduction proofs, sequent calculus, truth-tables, etc. Some of the most striking and influential work has involved dreaming up creative new theories that provide both marked improvements in explanatory power—think Frege's account of quantification or Kripke's work on modal model theory—as well as new methods for subsequent logicians to use.

But whether we "zoom out" and call logic one epistemic capacity, or "zoom in" and call it many, it seems clear that these will be paradigmatically second nature capacities. Whatever one's natural potential, it takes the right education to develop it, which requires a stable nexus of consistent effort, support, and access to extant work to develop and react to. There could have been no Bertrand Russell without Cambridge, no Wittgenstein without Russell, no Carnap without the Vienna Circle. Even if we had reason to think that some logical epistemic capacities were gender-correlated, we could have little support for the hypothesis that the correlation is essential under present conditions—the thesis that the capacities are socially determined is always going to be a confounding factor.

Are there feminine epistemic capacities in logic, that could perhaps be encouraged to the benefit of both logic and those in oppressed gender-categories (much as using supertasters or supercomputers in science could benefit both science and the supes themselves)? Suppose, for example, that women logicians are better at learning from the work of other women logicians. This is an epistemic capacity that is useful in logic—reading and learning from the work of women *is* a way of coming to have new justified beliefs, after all. But it is plausible that this correlation is socially determined—it has to do with gendered tendencies to dismiss women or take them seriously—and thus the feminist response would be twofold: to train and hire more

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women in logic, but also to ensure that this erstwhile gendered epistemic ability loses its correlation with gender, since the connection is contingent and limits the epistemic capacities of men *because* they are men.[15]

Such a project would be a feminist approach to logic that benefitted both logic and the feminist cause, and moreover, did so without the dubious assumption that there are ways of knowing that are inevitably and essentially gendered.

Guided by feminist values

Science

On the fifth and final interpretation, feminist science is science "guided by feminist values" (Anderson 2004, 1). This is another controversial idea, because it is often thought that science should be *value-free*.[16]

But some epistemologists have argued that there are legitimate uses of feminist values in science. One approach exploits the idea that theories are always underdetermined by the evidence. Since we need *something* beyond the evidence in order to arrive at the correct theory, some have argued that there is nothing wrong with using feminist values (Crasnow et al. 2018).

But there are several problems with that approach. One is that there might be better ways to bridge the gap between evidence and theory, such as appeal to simplicity or unity. Another is that one might think that scientists should suspend judgment in such cases.[17] Anderson (2004) makes two further relevant points. The first is that when we worry about scientists making value judgments, our underlying concern is often that that these judgments have somehow predetermined their conclusion, making the work *insensitive to evidence*.

> When feminist scientists are suspected of "wishful thinking," they are suspected of thinking, for example, that the paucity of women among political leaders is not due to any innate inferiority of women in leadership ability, and wishing away evidence to the contrary. (Anderson 2004, 8)

Anderson's second point is that value judgments can themselves be sensitive to evidence. On her view emotional experiences—such as finding a movie boring, a hobby fulfilling, or the redwoods awe-inspiring—are evidence for value judgments:

> Value judgments are not inherently dogmatic. "Disillusionment" is another name for learning from experience that one's deepest value judgments were mistaken. Millions of people in Eastern Europe, once dedicated communists, were disillusioned of it when they found out what living under communism was like. "Growing up" is another name for learning from experience that one's childish and adolescent values weren't what one had chalked them up to be, an experience that most people undergo. (Anderson, 2004, 8)

If that's right, then value judgments need not be an evidence-independent tool resulting in dogmatism. Rather, some are supported by the evidence, and the use of *these* is as legitimate as other uses of evidence-supported judgments.

Anderson thinks it is dogmatism, not value, which is problematic, and so to distinguish legitimate and illegitimate uses of values we should consider whether they result in dogmatism: "We need to ensure that value judgments do not operate to drive inquiry

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to a predetermined conclusion. This is our fundamental criterion for distinguishing legitimate from illegitimate uses of values in science." (Anderson 2004, 11). She takes research on divorce as a case study and identifies several legitimate uses of values in the research. For example, values can influence which hypotheses get tested, without predetermining the results of the testing.

Logic

Could there be logic guided by feminist values? Exceptionalism makes it hard to see how; if logic proceeds by proof from indubitable premises, there would seem to be no room for values to make a difference. In suggesting that logic proceeds abductively, anti-exceptionalism makes room for logic to be a posteriori, about worldly things, and not conclusively deduced from the evidence. However, we also saw above that the abductive method alone wasn't enough to justify the use of feminist values in science.

Suppose we follow Anderson and hold that use of feminist values in logic is illegitimate iff it predetermines the results. And then imagine if—rather implausibly, and for reasons independent of its truth-preservation—we thought *reductio ad absurdum* was anti-feminist and used this to rule out all logics which contain it. That would be letting our values predetermine the logical results, and so illegitimate.

On the other hand, if we let our feminist values guide what research in logic we pursue—*without predetermining the results*—that would be ok. The history of logic bears out the view that judgments about whether or not an idea is *worth* pursuing have practical consequences for the development and speed of research. Frege seems to have regarded modal logic as unpromising (Frege 1952, §4) and Quine thought it misconceived. C. I. Lewis and Langford were more optimistic, and Barcan Marcus, Carnap, Kripke, D. K. Lewis, and Williamson all pursued work in these areas in the face of skepticism from other researchers.

What motivates one to develop new theories in logic, in the face of high-status skepticism? Sometimes it's curiosity, sometimes a hunch that there is fruitful work to be done, contrariness, desire to impress, anxiety about a deadline, the need to solve a related problem, or admiration for earlier logicians and the desire to do work that is relevantly *like theirs*. Of course, wanting and trying is not enough. But it is a prerequisite. Values drive progress in logic and mathematics as much as they drive progress in anything difficult.

Some of the values described above are intensely personal, but values are often social as well—whom one desires to impress is *both* an expression of one's values *and* highly socially determined—and political; contributing work in the areas of modal, paraconsistent, or intuitionistic logic was itself a signal that the author did not share the (in some times and places) widespread view that such logics lacked worth.

One might work on a project in feminist logic—say, developing a logic of gender hierarchies—for multiple reasons: to impress an advisor, out of one's love of logic, or love of feminism, to annoy family, to establish feminist credentials, or to have a project that can be motivated to non-logicians. Philosophers might also approach feminist logic with more critical goals: to show it foundationally confused, or poorly motivated, or unhelpful to feminist work. And they might pursue such critical work out of their esteem for the value of truth, or as an expression of their political values, feminist or anti-feminist. Such motivations will guide which questions a thinker regards as worth focusing on and which aspects of a theory they put time into developing or critiquing. But to the extent that the work is motivated and guided by feminist values, both the positive and the critical work counts as work on feminist logic in this fifth sense.

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Connections between the different approaches

This paper has considered five kinds of feminist science, and asked whether logical anti-exceptionalism permits analogous kinds of feminist logic: logic which

i) is for feminist ends,
ii) corrects for gender bias in logic,
iii) studies feminist topics,
iv) exploits gender-correlated epistemic capacities, and
v) is guided by feminist values.

Type iii) was especially promising. Here anti-exceptionalism about subject matter made space for logics that study feminist topics, including social hierarchies of gender, norms and permissions, and the metaphysics of social kinds. This was promising for two reasons: a) because there are natural connections to other subject matters where logic already has a successful history—mathematics, counterfactuals, and logics of permissibility—and b) because the exploration looks like it might be fruitful *for logic*. Just as modal logic uses logic to study modality, and this feeds back into insights about logical consequence, so logics of social hierarchy can study subordination, and this too might teach us new things about logic. By contrast we saw that feminist logic on interpretation i)—where we took Susan Stebbing's *Thinking to some purpose* as a model—is legitimate, but less exciting: it has no need of anti-exceptionalism and doesn't feed back into insights about logical consequence. Approach ii) was exemplified by Plumwood's pioneering work, but here I rejected her specific thesis that relevant logic had been counted for less than classical on account of *gender* bias, and though her more general idea of logical theory selection being corrupted by gender bias makes sense—and could happen—we saw that one obstacle to locating it in the history of logic is the lack of association between any logical theories and the feminine. If there were a social logic, or a developmental logic—the way there are social and developmental psychologies—and these were seen as feminine, this would become a way for gender bias in theory selection to get a hold, which would in turn create a role for work redressing the error. Approach iv) sketched ways to understand the idea that there are gender-correlated epistemic capacities, and the ways these might affect logic. The prospects depend critically on the empirical facts but if, say, learning from the published work of women turned out to be an epistemic capacity correlated with being a woman, feminists might well recommend that logicians read the work of women logicians more, and more attentively. This would not be so much *a* feminist formal logic, as feminists pointing out ways in which the discipline of logic could be improved epistemically. And finally, category v) was that of logic guided (non-dogmatically) by legitimate feminist values, and here we saw that the viability of this category might be parasitic on the others: if there is a logic of gender hierarchies, then feminist values might motivate one to pursue it. If there is gender bias in the methodology of logic, then feminist values might motivate one to expose and correct for it, much as Plumwood worked to do.

From the above we can see that, while our taxonomy was useful for exploring possibilities, it elided some connections between those possibilities. Once we have i) logic for feminist ends or iii) logic with feminist subject matters, the possibility of such work being avoided or underdeveloped as a result of ii) gender bias or iv) values, is immediately salient, and so the existence of categories i) and iii) further supports feminist logic in the senses of ii) and iv). In particular, even if relevant logic isn't the One True Feminist Logic, Plumwood's general thesis that gender bias leads to one logic being

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favored over another could still be correct, since logics of gender hierarchies and norms, or constructive logics for social categories, might never have been developed *because* of bias against the social—as opposed to say the mathematical, or modal—in logic. (Much as some logics used to be underdeveloped due to a bias against modality.)

Similarly, one might pursue feminist logic in one of the first four senses for various reasons, including sheer curiosity, intellectual excitement, or the desire to work on something new. But one could *also* do it as an expression of feminist values: to counter a sexist argument, to redress epistemically corrupting gender bias, or to better understand gender phenomena, such as social hierarchies, norms and permissions, or the metaphysics of social kinds.

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Notes

1 Priest 2006; Beall 2017; Williamson 2017, 2020; Hjortland 2017; Read 2019; Russell 2019, Martin and Hjortland 2021. One of the more exceptionalist movements historically was early twentieth-century logical empiricism, as inspired by Wittgenstein's *Tractatus Logico-Philosophicus* and further developed in Carnap 1937, 1950, and Ayer 1936. This movement—and its associated division of truths into two kinds, scientific and logical—has such a long shadow that people are sometimes surprised to learn that anti-exceptionalism is not a purely twenty-first-century phenomenon. But Bertrand Russell was an anti-exceptionalist in the sense that he held that logic was "about the world" ("logic is concerned with the real world just as truly as zoology, though with its more abstract and general features": Russell 1919) and Frege's view that the laws of logic concern truth the way physical and chemical laws concern mass, heat, and acidity, suggests that he recognized important continuities between logic and the empirical sciences (Frege 1918).
2 Sherif 1979; Longino 1987; Anderson 1995; Kukla and Ruetsche 2002.
3 It is common in philosophy to say "necessary truth-preservation," but I avoid this phrase intentionally because of the counterexamples discussed in Kaplan 1989; Russell 2012; Williamson 2013. Logical consequence is more accurately glossed in terms of truth-preservation over models than over possible worlds.
4 On this definition, relevant and intuitionist logics are an interesting case: they count to the extent that they aim to capture truth-preservation. Model-theoretic approaches allow them to be so construed, though not all their supporters welcome this. Similarly with substructural logics: since structural rules are sometimes dropped on the grounds that they don't preserve truth, but sometimes for other reasons. See, e.g., French 2016, 118.
5 Quine famously suggested that second-order logic was just "set-theory in sheep's clothing." (Quine 1986, 66).
6 This approach contrasts, I think, with that of Haack (1993), who I see as rejecting feminist science by insisting on a particularly contentious interpretation of *feminist science* and then arguing against *that*.
7 Haack (1993).
8 O'Connor (2019) is a recent example.
9 Sherif herself is more cautious about the connection with gender than I am here, noting that those who have used the hard/soft terminology "have almost always been men trying to put down other men and their work, attempting to enhance their own status by associating their own effort with the more prestigious physical or natural sciences" and that "after all, in the physical sciences there have been a few women, and some of the women minority in the 'soft' disciplines follow the hard line" (46–47). However these points don't actually undermine the claim that the hard sciences are coded masculine and the soft sciences feminine.
10 It bears comparison with Espeland and Sauder (2016)'s research into the effects of law school rankings.
11 There is, unsurprisingly, some variation in status between logics, subdisciplines, and views in logic, which varies over time and social grouping. Thanks to the influence of Quine, in the late twentieth century

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first-order classical logic was higher status (especially in US and British philosophy) than second-order, though this has recently changed for various reasons, including interest in second-order logic in the philosophy of mathematics, and Williamson (2013). Similarly, *conventionalism* about logic received a status boost through its association with theoretical physics in the early twentieth century (Sober 2000, 246), much as Sherif describes experimental psychology as receiving a boost through its connection to the hard sciences. But does that make conventionalism more masculine than realism? That feels like a stretch to me.

12 See, e.g., Eckert and Donahue 2020; Russell 2020, as well as recent unpublished work by Dave Ripley and an upcoming special issue of the *Australasian Journal of Logic*, to be edited by Andrew Tedder and Guillermo Badia.

13 I am grateful to reviewer 2 for suggesting the link between intuitionism in mathematics and social constructivism about social groups.

14 See also Joan Weiner's scathing review in the *Journal of Symbolic Logic* (Weiner 1994, 681).

15 It is plausible that it also counts as an epistemic injustice against the women as well, in the sense of Fricker (2009), since the women are not being respected in their capacity as knowers.

16 See e.g. Haack 1993, 34.

17 See Haack, 1993, 35.

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