Hypatia (2026), 1–21
doi:10.1017/hyp.2026.10100

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Math Proofs, Gender Proofs

Franci Mangraviti

ETH Zurich Department of Humanities Social and Political Sciences, Switzerland
Email: legallyfranci@gmail.com

(Received 15 September 2025 UTC; revised 14 June 2026 UTC; accepted 21 June 2026 UTC)

Abstract

In this paper I argue that predominant gendering practices support a proof ideal similar to the one operative in mathematics, contributing to the erasure and assimilation of countercultural practices. After fleshing out the analogy, I argue it can be productive: in gender as in mathematics, there is room for rethinking what we mean by—and want from—proof. The proposal is to think of gender in terms of an agent's *gender grounds*, i.e., the set of first-person gender proofs accepted or rejected by said agent. This framework avoids common worries about deflationary and essentialized notions of gender identity, provides many of the usual epistemic benefits of proof, is compatible with first-person authority over one's gender, and fruitfully complements an ameliorative semantic pluralism for gender terms.

1. Introduction

Philosophy of mathematics has long recognized a mismatch between the proof ideal exemplified by *formal proofs*, learned in formal logic courses, and the *mathematical proofs* published in journals and taught in classrooms. Formal proofs are gapless sequences of unquestionably valid logical inferences; mathematical proofs are gappy, in need of interpretation, and susceptible to ambiguity. Despite the distinction being uncontroversial, the proof ideal remains influential on several levels. On one hand, it supports an absolutist epistemology of mathematics, not to mention a public perception of mathematics, as an unassailable fortress of certainty and objectivity. On the other hand, it plays a role in actual practice, for example by supporting an expectation that more clarity and justifications are always in principle available, through the process of bringing one's proof closer and closer to a formal one.

Something similar occurs in a very different context, namely the ascription of gender categories. Predominant gendering practices support a proof ideal much like the one in mathematics, contributing to the erasure and assimilation of countercultural practices. When everything works in accordance with the dominant conception, gender is as self-evident as an axiom; it is imbued with the alleged objectivity of commonsense. Meanwhile, everything that deviates from the dominant conception (or claims to do so)

© The Author(s), 2026. Published by Cambridge University Press on behalf of Hypatia Inc. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

opens itself to a demand for proof; yet proofs of deviation can never be as solid as the ideal demands, which leaves gender misfits at an epistemic disadvantage.

A somewhat popular reaction (within trans philosophy, at least) to this sorry state of affairs is to *reject* the demand for proof, often alongside the very idea that gender can or should be provable. For example, Bettcher (2009) argues that we should give up on epistemic first-person authority over one's gender, i.e., the idea that we can justifiably know our gender, and focus instead on ethical first-person authority, i.e. the right to have one's gender self-avowals respected. Hernandez and Bell (2025) reject the notion of gender identity precisely because (among other things) it primarily exists to *justify* trans identities to outsiders, and cannot even do that properly. Bex-Priestley (2022) seems to suggest that there is really nothing to prove at all, insofar as we can conceive of genders as names.

My view is that we can reject the outside demand for (gender) proof without thereby giving up the value that proofs can have *for ourselves*—for example, the ability to explain, validate, and illuminate one's gender. The analogy with mathematics is instructive: in gender as in mathematics, there is always room for rethinking what we mean by—and want from—proof. This rethinking is not arbitrary but rather involves problematizing—or even just playing with—certain aspects of dominant practices while keeping others fixed, although what stays fixed and what changes may vary. Roughly, my proposal is to model a person's gender as the set of putative gender proofs that are salient to them, with some of those proofs being accepted and others being rejected. I will argue that this perspective offers many of the usual benefits of proof, while still emphasizing (ethical) first-person authority via both the role of salience and the freedom to pick a framework. It is also fruitful when it comes to ongoing projects of moving beyond deflationary or essentialized notions of gender identity, and engineering liberatory gender meanings.

The paper is structured as follows. Section 2 draws on the philosophy of mathematics to spell out the distinction between formal and mathematical proofs, and the proof ideal regulating their connection in mainstream mathematical practice. Section 3 introduces the notion of gender proof, and explores the analogy with mathematical proof. Section 4 builds on the analogy to suggest a trans-inclusive proof-based approach to gender identity, and argues that this fruitfully complements Matthew Cull's ameliorative semantic pluralism for gender terms. Section 5 clarifies the scope of the proposal and addresses some objections. Finally, Section 6 recaps and points to future work.

2. Mathematical proofs

By a *proof* I mean an argument conclusively establishing the correctness of a statement (conclusion) from other given statements (premises). Further specifications of this rough idea depend on the particular context: what it means to establish a conclusion in a court of law is different from what it means in, say, theoretical physics. My comparative focus in this paper will be on two extensively studied varieties of proof, namely *formal proof* and *mathematical proof*. I will argue that much about the role of proof in gender contexts pays debt to these two conceptions.

There are a couple features of proofs that are worth putting to the forefront. First, proofs *justify* their conclusion as long as we accept each individual step and premise. This is usually taken to be the essential role of a proof: what makes an argument a proof is that it provides a sufficiently strong (in some sense to be specified) justification for its conclusion. In formal proofs, this is achieved by requiring that the only acceptable steps

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

be those warranted by formal logic; meanwhile, philosophy of mathematics has to deal with explaining the reliability of mathematical inferences which—at least on the surface—do not appear to be strictly logical.[1]

Second, proofs can serve an *explanatory* and *illuminating* function. By learning or coming up with a (sound) proof, we may get an insight on why a certain conclusion is true, or further our understanding of a topic. In a slogan, the best proofs can tell us not just *that* something is true, but also why and how. This is not a necessary requirement on a proof, but it is often desirable, which is why it can be valuable to look for alternative proofs of an already established conclusion. Virtually every account of mathematical explanation allows for some proofs to be more explanatory than others, although there is disagreement on whether this is a fully objective matter, and on whether proofs offer *causal* explanations or not.[2]

Insofar as the steps are required to be explicit, logical laws are understood to be necessary and universal, and the language is such that whether a logical law applies or not is fully unambiguous, formal proofs have a privileged epistemic status: there is no room for interpretation or disagreement about the validity of a formal proof, and the resulting knowledge is indefeasible. Now, this is a lot of requirements, and very few proofs in the wild satisfy them, outside of (some) logic textbooks and papers. Be that as it may, formal proofs are often treated as an ideal all proofs should strive for: the closer to a formal proof your argument is, the more justified your conclusion is. Sometimes this extends to the claim that all "proper" proofs are ultimately *reducible* to formal proofs, most notably in (typical) logicist treatments of mathematics and metaphysics; other times, the idea is simply that formalization makes theories *better* insofar as it forces precision and rigor.

Nevertheless, ordinary mathematical proofs cannot be seen as a mere approximation or stand-in for formal proofs. For one thing, there are some serious issues with the view that mathematical proofs are indicating formal proofs.[3] Furthermore, mathematical proofs observably lack the epistemic properties usually ascribed to formal proofs: they are routinely accepted even in the presence of untraversed gaps;[4] they are often revised;[5] and they are occasionally disagreed on, even by experts.[6] This doesn't mean mathematics is at the mercy of epistemological anarchism, or even that it doesn't have a privileged epistemic status. Mathematical knowledge remains one of the clearest examples of (putative) objective knowledge, in virtue of its seeming stability across time, and relative lack of disagreement compared to other disciplines. The question is where this stability and agreement come from.[7]

It is worth distinguishing three stages of mathematical proof. First, we have the proof sketch born out of the mathematician's subjectivity.[8] This may already *feel* like a proof to the individual, but it is not going to be accepted by others as such in this form. Second, we have published mathematical proofs, whose required form (on pains of non-publication)

[1]For more on this distinction, see Hamami (2018) and references therein.

[2]See, e.g., Lange (2016), Lehet (2021), and Baron et al. (2020). I will treat the notion of explanation very naively here, since splitting the discussion based on the different accounts would take us too far afield.

[3]See De Toffoli and Giardino (2015) and Starikova and Van Bendegem (2021) for case studies, and Tanswell (2015) for a general argument.

[4]See Fallis (2003) and Andersen (2020).

[5]See De Toffoli (2021) and references therein.

[6]Case studies can be found in Rosental (2008) and Aberdein (2023).

[7]Contra philosophical folklore, this paucity of disagreement doesn't seem to be essential to mathematics; rather, as Wagner (2022) argues, it is a relatively recent phenomenon.

[8]This step is greatly emphasized by Burton (1995).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

is shaped by the ideal: logically classical inferences, language reducible to set theory, etc. The reliability of such proofs is established by both the process of putting them in this form, and the subsequent peer review: through this process, mathematical knowledge becomes accepted as such.[9] Finally, there are the ideal formal proofs: these are far rarer, and hardly surveyable by humans past a certain minimal level of complexity. Regardless of whether or not it is possible in principle to turn every mathematical proof into a formal one, most published proofs do not receive such a treatment, and yet are accepted anyway; so the contribution of formalization to mathematical knowledge appears to be relatively limited.[10]

Since ordinary proofs are by and large not ideal, whether they fulfill their purposes (justification, explanation, and illumination) or not depends on the *audience*. More specifically, it depends on the audience's proof standards (which arguments they are willing to accept), their competence, and their willingness to either fill the gaps or trust the prover to have filled them.[11] In case of doubt, it is possible to ask for more detail: in fact, such a request is in principle admissible until the proof becomes fully formal, a gapless logical argument from accepted axioms. But in practice this is almost never feasible, both because of time constraints and because the resulting proof might be too large to survey: trust and competence must intervene to stop the doubting process.[12]

Furthermore, the bedrock itself can be room for debate. By and large, mathematics as a field accepts classical set theory (i.e., set theory grounded in classical logic)—as the endpoint of backwards inquiry: once we get to a formal proof in classical set theory, there's no more questions to ask—or at the very least, any remaining questions can be left to the logicians and philosophers. However—even setting aside radical skepticist worries—the very existence of alternative logics challenges the notion of an obviously valid step, and in particular the idea that the inferences warranted by classical logic are *always* reliable.[13] More generally, alternative mathematics—the most well-known example being constructive mathematics—challenge the logic, foundations, and norms of mainstream mathematics.[14] So an agreement on such norms—which the existence of alternatives shows to be nontrivial—is a precondition on the acceptance of any given proof.

3. Gender proofs

So, what does any of this have to do with gender? The central link is the notion of *gender proof*, by which I mean a proof whose conclusion relates an individual X to some gender term. Some (putative) examples often found in the wild: "X has a penis, therefore X is a man"; "X is not a man, therefore X is a woman"; "X satisfies at least two of the DSM-5 criteria for gender dysphoria, therefore X is trans"; "self-evidently, X is a man."[15]

[9]Social constructivists like Ernest (1998) may go further in saying that mathematical knowledge is *generated* through this process, but I'm not assuming this here. For more on this, see, e.g., Granville (2023).

[10]A notorious example of a proof too long and complex for one person to survey—let alone any putative formalization—is the classification of finite simple groups, discussed by Habgood-Coote and Tanswell (2023).

[11]See especially Dutilh Novaes (2020), where proofs are understood as a cooperative dialogue between a Prover and a Skeptic.

[12]For more on trust and testimony in mathematics, see Andersen (2020) and Andersen et al. (2021).

[13]For many examples and philosophical discussion, see Aberdein and Read (2009).

[14]See Bloor (1991), Van Bendegem (2016), and Mangraviti (2025).

[15]Throughout the paper, I will treat self-evident statements as a special case of provable statements. This is standard in formal contexts; still, if it is cause for concern, one can simply rewrite such statements to bring out an argumentative structure more explicitly, e.g., "It is self-evident that X is a man, therefore X is a man."

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

Why call these proofs? The first step is recognizing that the conclusions of these arguments are widely treated as *truth-bearers*. Many instances of gender questioning are explicitly truth-directed, a matter of finding the truth about someone's gender. Self-questioning often involves looking for a yes/no answer to the question "Am I really the gender I was assigned at birth?"[16] Furthermore, trans individuals are routinely accused of gender deception (pretending to be a different gender than they *really* are) or delusion (thinking they are a different gender than they *really* are), which relies on gender categorization being something that can be true or false.[17] One may also think of online "transvestigators," making a sport out of trying to *prove* that this or that person is actually trans.

Another factor is that most people behave as if they *know* their own gender, not to mention other people's genders too. Insofar as gender beliefs are understood as knowledge, this suggests that they are often understood as justified, and thus in principle *justifiable*. This can be separated from the question of whether they are *soundly* justified, or whether the assumption of justifiability is correct; my point is just that gender knowledge—in the sense of knowledge about who belongs to which gender—is *treated* as knowledge in all respects. Gender proofs are, in practice, used to justify such knowledge.

The last ingredient is objectivity. Talk of proof may seem inappropriate if gender knowledge was not understood as objective. But from a typical cis perspective—by which I mean the perspective of someone who hasn't seriously questioned their own gender, or spent much time around trans folks—there is an overwhelming direct match between the (perceived) objectivity of commonsense and their gender beliefs. After all, the *vast* majority of their gender judgments are never challenged; and when they are, it can be written off as a *perceptual* confusion or mistake. This is what Dembroff (2020) refers to as "cis commonsense": regardless of whether it is objective or not, the point is that it is *perceived* as objective, and tracks gender beliefs. Thus, gender is understood to be *provable*—because it is most often proven by cis commonsense.

Now, if gender is understood as provable, this supports a *demand for proof*. Gender can be doubted; a proof can be asked.[18] The upshot is that gender misfits face a double bind. On one hand, cis commonsense and associated self-evident criteria are notoriously trans-exclusionary; on the other, narratives built on gender subjectivity are perceived as lacking the objectivity required of proofs, often even by the subjects themselves. This is not just a barrier to communication, but also to successful questioning and self-understanding; furthermore, it allows bad actors to frame trans activism as rejecting objectivity in favor of subjectivity, picking feelings over facts, etc.[19]

Enter science, with its fancy diagnoses and clearly defined membership criteria. The medical establishment has the epistemic authority to extract objective proofs from subjective narratives, but from a trans perspective this has several downsides. Narratives are required to fit a highly standardized model in order to be even considered—the notorious "even as a child, I always knew . . . "—and the extraction process can distort them even further. Furthermore, the appeal to medical authority concedes that trans

[16]For formal discussion, see Silva (2025).

[17]See Bettcher (2007).

[18]As Bettcher (2009) argues, there is plenty of room to challenge this doubt on *ethical* grounds, regardless of the epistemic situation; although see Bex-Priestley (2022) and Turyn (2023) for arguments that this may not be enough.

[19]See Jenkins (2023, sect. 8.2.2).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

people are at a disadvantage, as scientific objectivity is still far from the ideal, certainly nowhere near the veneer of objectivity carried by cis commonsense—a gap compounded by rising popular distrust of experts. Scientific arguments, unlike commonsense, can in principle be questioned forever, *by their own standards*; if commonsense wants the upper hand, it can have it.[20]

The analogy with mathematical proofs is enlightening here. The individual process of constructing a mathematical proof is much like the process of constructing a gender narrative, as described by Ashley (2023): pieces of reality (gendered/mathematical experiences, previously established results) can be combined in a variety of ways to get to a conclusion. Reality constrains the space of possible proofs, but doesn't determine where the proof goes, or what it should prove: a framework and putative conclusion must be chosen, and even within a fixed framework the same conclusion may be proved in different ways. And yet, for both gender and mathematical proofs, there is an implicit objectivity ideal at play: the assumption that there is a unique correct answer that we can get to via unambiguous and unquestionable proof standards. At the most elementary level, we have cis commonsense on one side, and "mathematical" commonsense on the other, supporting basic self-evident truths like "all right angles are equal" and "$2 + 2 = 4$." Once we move past commonsense, the individual process is not enough for objectivity: the narrative must be put through a further process of refinement and normalization. Subjective mathematical proofs get reworked into a standardized format—a prerequisite for publication—which makes them amenable to assessment by the tribunal of classical logic and set theory; only then, and only after peer review and community checking, can the proof be accepted as knowledge-generating. Similarly, subjective gender narratives must be turned into standardized doctor-friendly narratives, which will then be turned by doctors into evidence for an objective diagnosis.[21]

Such complex proofs *can*, as it were, contradict commonsense. A gender dysphoria diagnosis may justify categorizing someone against cis commonsense; but the contradiction is sophisticated enough to not be considered a threat. Commonsense remains "valid unless it's an exceptional case," putting all the burden on the exception to prove its exceptional—pathological—status. Similarly, on the mathematics side, consider for example the Banach-Tarski paradox, a widely accepted proof that a ball in Euclidean space can be decomposed into parts which can then be used to make *two* balls identical to the first one. This seems to contradict mathematical commonsense; and sure enough this kind of result, relying as it does on highly non-constructive principles, might have been controversial at the start of the twentieth century. Yet it is now standard mathematical knowledge: the proof justifies it and explains why commonsense goes awry in this particular case.[22]

[20]This doesn't stop trans-exclusionary activists from appealing to scientific reality. However, the rhetorical force of such appeals entirely depends on tracking cis commonsense; scientific reality that deviates is either doubted or dismissed as irrelevant. That standard medical narratives bode poorly for trans acceptance in the long run is amply recognized in trans literature, going back at least to Stone (2013).

[21]With this analogy I am not trying to suggest that medical professionals see themselves as engaging in proof. Nevertheless, medical diagnosis is often taken to be the best approximation of objectivity we have in cases where neither commonsense nor (mathematical) proof are available. And regardless of how diagnosticians may feel about it, thinking of diagnoses as some kind of proof *is* fairly widespread among both diagnosis-seekers and concerned parties. Of course this is a *bad* approximation of proof, but that's precisely my point: insofar as we're judged by the standard of commonsense and ideal proof, medical diagnosis will always fall short.

[22]As Lakatos (2015) discusses, pathological cases are not a threat to mathematics, because we can always deal with them by amending the relevant definitions to exclude them (monster-barring), or rejecting the

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

Since the gap between ideal and nonideal proofs cannot usually be crossed, there is virtually unlimited room for doubting the latter. One can always ask for more gaps to be filled; one can always ask for more justification of each statement. The ideal's role is to preserve the *expectation* that such demands can be answered ad infinitum: much like the individual's mathematical result can always be doubted, so can the individual's gender proof always be doubted. This is fertile ground for testimonial injustice: since the ideal is (under usual conditions) unattainable, there being an end to the questioning relies at least partly on the epistemic credibility of the prover.[23] And in the gender case, it is trans people—who already suffer a credibility deficit due to their epistemically marginalized status—that most often defy cis commonsense, and can thus only offer a highly nonideal "scientific" proof.

Another similarity is the existence of a dominant conception such that everything deviating from that conception is seen as pathological. In particular, these dominant conceptions determine the proof standards: what counts as a gender proof, and what counts as a mathematical proof. In the case of gender, we have what Dembroff (2019) calls the "Western dominant gender ideology": the strict man/woman binary, with its biological and teleological associations, and a hierarchical order.[24] A great deal of gender nonconforming individuals do not really "fit" the conception: they thus belong to what Dembroff calls *critical gender kinds*, an offense punished by either invisibility or forceful correction. In the case of mathematics, we have what Mangraviti (2025) calls MATH: a uniform conception of mathematical practice such that everything outside of it—e.g., intuitionistic or inconsistent mathematics—Is either excluded as "not mathematics" or forcefully reappropriated as more of the same. MATH includes, for example, the use of a foundational set theory as an arbiter for what counts as acceptable ontology, and the use of classical logic as an arbiter for what counts as an acceptable logical inference.

These conceptions are primarily used in a *normative* way: they serve to delineate and enforce what *proper* gender is, what *proper* mathematics is. So a failure to account for all kinds of observable deviations does not *falsify* them per se. However, the idea that gender nonconforming practices generate *valuable* gender knowledge is foundational to trans philosophy;[25] similarly, bottom-up approaches to the epistemology of mathematics could hardly write off practices just because they fail to conform to a priori philosophical assumptions on what mathematics should be like. Critical math and gender kinds should then be taken seriously as possible knowledge-generating practices, despite rejecting some "obviously" valid arguments as part of their criticality. To dismiss the possibility a priori is to engage in what Dotson (2012) calls contributory injustice: the dominant conceptions can remain *unchallenged* only insofar as all putative alternatives are hidden away or willfully misinterpreted.

Questioning either dominant conception—and in particular, the associated proof standards—is met by moral panic. In the case of gender, this is usually framed as an attack on commonsense; in the case of mathematics, it is framed as an attack on knowledge itself. This is less of a disanalogy than it might seem: it's just that most well-known critical math kinds are not aiming at the commonsense level, while critical

cases' relevance altogether (exception-barring). This is the same logic by which recognizing non-binary individuals does little to challenge the gender binary.

[23]For examples of epistemic injustice in mathematics, see Rittberg et al. (2020).

[24]Dominant conceptions should be understood as relative to a given society. Here I will refer to *the* dominant conception for simplicity, but keep in mind this is a gross idealization.

[25]See e.g. Aultman (2018) and Bettcher (2019).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

gender kinds are. A critical math kind questioning "2 + 2 = 4" may well be called an attack on commonsense as well; conversely, appeals to "biology 101" charge trans people with defying (scientific) knowledge.

Hernandez (2024) describes the typical reaction to worlds ruled by alternative gender conceptions as a "moral shock." Meanwhile, here is Hilbert on intuitionistic mathematics:

> Taking the principle of excluded middle from the mathematician would be the same, say, as proscribing the telescope to the astronomer or to the boxer the use of his fists. To prohibit existence statements and the principle of excluded middle is tantamount to relinquishing the science of mathematics altogether. For, compared with the immense expanse of modern mathematics, what would the wretched remnants mean, the few isolated results, incomplete and unrelated, that the intuitionists have obtained without the use of the logical ε-axiom? (1927, 476)

For a more recent example, the mere suggestion by Horgan (1993) that mathematics may no longer rely on deductive proof in the future famously generated an uproar, as both reported and exemplified by Krantz (1994): "the ideas presented there are dangerous—dangerous to you, to me, and to our profession and our subject. A number of good people have stood up . . . " (10).

The similarity in moral panics should not be surprising. In common rhetoric, the idea that someone could be, say, both a man and a woman is akin to 2 + 2 possibly not being equal to 4. Both gender and mathematics tap into an idea of unshakeable certainty: self-evident in its basics, provable in its complications. To question either dominant conception is to question the possibility of certainty, and open the floodgates of instability; or so the story goes.

4. Gender as proofs

So much for the analogy. But where does this leave us? There is much to be said about the historical role of the proof ideal in oppressing marginalized individuals, and the complicit role of (especially) mathematics in it.[26] If that's right, the analogy is more than a "mere" analogy. However, in the remainder of this paper I will focus instead on how the analogy—whether it points to a genuine causal link or not—can be *productive*. My claim is that there are fruitful, trans-inclusive ways to think of gender in terms of gender proofs, and thinking of math proofs is helpful in getting there.

4.1 The framework

First, some background. Due to the inadequacy of the dominant conception of gender, trans-supportive political movements have often appealed to *gender identity*, which is usually understood (very roughly) as an inner sense of one's gender.[27] Some trans scholars have been openly critical of this notion, taking it to be overburdened, ciscentric, and overall more trouble than it's worth. For example, Briggs and George observe that

[26]See e.g. Lanius (2015), Ferreira da Silva (2017), Kather (2023), and Kollosche (2024).

[27]See Cosker-Rowland (2023) for a survey of positions concerning gender and gender identity.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

> the concept of "gender identity" ... is expected to fill a variety of roles: *justifying* medical transition, *explaining* why people are drawn toward particular gendered behaviors as forms of self-expression, *explaining* why people like to be categorized as men or women or both or neither, and *undergirding legitiimacy* of trans people's inner lives (2023, 27; emphasis mine)

Hernandez and Bell put it even more strongly: "trans people primarily call on 'gender identity' when we are trying to *explain* ourselves to the relentless curiosity of our cis family and friends, not when we are trying to *understand* ourselves and talk to one another" (2025, 1336; emphasis mine). The suggestion then is to drop this notion outside of diplomatic usages, or at least to engage in some serious disambiguation.

Others have attempted to flesh out the naive notion of gender identity into something less problematic. For example, Ashley suggests that "it may be helpful to think of gender identity as a form of *narrative* identity" (2023, 1061; emphasis mine). Something similar can be found in the notion of *existential self-identity* put forward by Bettcher: "many transpeople believe that we are men, women, or something else for particular reasons: *we have accounts of why we believe what we do*" (2009, 109; emphasis mine). And later:

> By existential self-identity, I mean an answer to the question "Who am I?" where this question is taken in a deep sense. ... the fact that one holds all of the beliefs that one holds (true or false, self-regarding or not) goes into the set of facts that determines "who one is, really." Much of one's attitudes, values, and commitment go likewise into making this determination. (2009, 110)

I claim that gender proofs are key to taking both perspectives on board. Proofs are like Ashley's narratives: they must be grounded in reality—built out of true premises—but we are free to build them and interpret them in a variety of ways. There is no single correct way to put together the available pieces. Proofs are also like Bettcher's existential answers: a proof of *our own* gender that we are willing to accept can be "an account of why we believe what we do." As already discussed, proofs can serve a variety of roles: they can justify, explain, and illuminate. Furthermore, one can have different proofs of the same result, which may shed light on different aspects of the same truth. So, while the conclusion alone—say, "I am a woman"—may not say much, a proof of it—or better, a *set of proofs* of it—can say a lot more.

Let's make this more precise. Say that an agent *X accepts* a proof if they take it to be *sound*; and that *X rejects* it if they take it to be *unsound*. Usually, this can be understood in terms of belief; but I want to leave room for, for example, political acts of acceptance and rejections as well.[28] Acceptance and rejection are not exhaustive, since *X* may have no attitude at all toward a certain proof; a proof is *X-salient* if *X* accepts it or rejects it.[29] Finally, a proof is *first-person* if its conclusion has the form "I am ..." or "I am not ..."

[28]For example, as I will discuss in the next subsection, gender grounds can be built with the intention of introducing new gender meanings. In such a case, taking a proof to be sound may be less about believing the premises to be true, and more about choosing a meaning that makes them true—even if *after* the meaning has been fixed it makes sense to speak of belief in both cases.

[29]By a proof being not X-salient I don't mean that X is not currently thinking of it. Rather, I mean that even if X were to sit down and consider what proofs they might accept (or reject) for a given conclusion, they would not bother to consider that proof. It's salience *upon reflection*.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

We now arrive at the main definition. Let the *gender grounds* of X be the pair (X_+, X_-) where:

- X_+ is the set of first-person gender proofs accepted by X;
- X_- is the set of first-person gender proofs rejected by X.

Note that a first-person proof is X-salient if and only if it appears in the gender grounds of X. The idea is this: if at least one gender proof in X_+ ends in, for example, "X is genderqueer," then X has a valid (to them) reason to identify as (in some sense) genderqueer; if at least one gender proof in X_- does, then there is some reason to identify as genderqueer that X rejects. Put differently, every proof in the gender grounds of X is *part* of their gender identification, either directly (for accepted proofs) or by way of contrast (for rejected proofs).

Some toy examples might help. Tim, when pondering on his manhood, may reason as follows: "The people in my life see me as a man. They also treat me as a man. (If people see me and treat me as a man, then I'm a man.) Hence I'm a man." But he may also reason: "My documents say I'm male. (If I'm an adult male, then I'm a man.) Hence I'm a man." And this may well be all that his considering himself a man amounts to. So Tim's gender grounds may contain these two proofs—and only these two proofs—in Tim_+. This means that Tim has two reasons (according to his own standards) to identify as a man. However, suppose also that Tim was severely bullied as a kid. He was scrawny, bad at sports, and bad with girls; so his classmates would routinely call him "not a man." This has led to this line of argument being very salient to Tim, even as an adult. So Tim_- contains "I am scrawny. I am bad at sports. I am bad with girls. (If I'm a man, I must be either bulky, good at sports, or good with girls.) Therefore, I am not a man"; Tim's gender comes with an explicit rejection of this argument.[30]

Tim may be a bit of a simplistic example, but I would hazard a guess that many gender grounds are not much more complicated. Even for trans people, sometimes it really is "just" a very strong feeling, especially if that feeling is left unexamined. Importantly, however, gender grounds *can* be more complicated. For one thing, different proofs in X_+ may have different conclusions. It may be that X is a man according to some proof in X_+ and a woman according to another. This may be a form of gender fluidity, in the sense that X's choice of identification varies depending on the time; but it would also be consistent for X to make a stable choice on which label(s) to adopt. The framework leaves room for individuals having identical gender grounds, yet meaningfully using different labels.[31] After all, many people don't even bother with a label, or publicly pick one merely for reasons of convenience, safety, or exhaustion: there is no necessity of seeing such contingent circumstances as themselves part of one's gender (although it is possible, of course). I would still expect there to be some systematic connections between labels and grounds, but that is an empirical question, so it is good for the framework not to settle it a priori.

It also seems plausible that X_+ may be empty for some people. An agender identity may be built entirely out of rejections: it is not the case that I am a man just because I am

[30]I am not assuming any *necessary* causal relation between life experiences and gender grounds. Someone other than Tim may well have brushed such teasing off, and never seriously entertained the argument at all; or, for that matter, have accepted the argument.

[31]This is not to exclude that adoption of a label *can* be part of one's gender grounds, as in the classic "I call myself a woman, therefore I am a woman."

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

sometimes treated like one, it is not the case that I am a woman just because that's what my documents say, etc. This is not the same (prima facie, at least) as an agender identity built entirely out of proofs of negated statements: here is why I am not a man, here is why I am not a woman, etc. There is also a difference between a proof being non-salient, and a proof being actively rejected: many trans women may find the argument "I was born with a penis, therefore I am a man" *very* salient given how often it is thrown at them, so it may be part of their narrative identity to explicitly reject it. Similarly, non-binary individuals may find salience in arguments like "I am not a man, therefore I am a woman," if only for the sake of rejecting them.[32]

One consequence of this framework is that features of our gender grounds can be imposed on us against our will, for example, the aforementioned penis in the trans woman case. I think this makes sense for two reasons. The first one is that gender grounds are fundamentally *private*. I am not suggesting that people have any obligation to reveal their entire gender grounds when discussing their gender; rather, gender grounds are an explanatory tool that can be deployed partially or in full as one sees fit. The second reason is that salience is *contingent*: gender grounds can *change*, evolve over time, and individuals have some power over them. Admittedly, such power is not unrestricted: for example, the salience of the penis proof may be psychologically unavoidable for at least some trans women because of constant transphobia or past trauma or both. However, it is not *logically* necessary. If anything, *if* the salience of a particular argument is harmful to the individual, then that is a useful pointer to what a better gendered world might look like in practice.

4.2 Soundness

Up to now, I have framed everything in terms of individual attitudes. I have said nothing on what, if anything, makes the gender grounds of X *actually* sound. How does the presence of a proof in X_+ relate to the truth of its conclusion? I do think self-identification is not always about truth; adequate gender grounds do not *need* to be sound to make a statement. In fact, insofar as critical gender kinds are assessed from the hermeneutical standpoint of the dominant conception, the premises leading to the criticality in question are going to be unsound—that's just what being critical means. As Bettcher points out: "The background reasons for acting also inform how the success of the self-identification is to be assessed. When somebody engages in the political act of category-claiming, the question whether she has made a true statement isn't germane" (2009, 110).

[32]A referee objects that we can also have non-proof-based reasons to identify with particular genders: they suggest a case where X is assigned female at birth and only accepts gender-critical proofs, yet is severely dysphoric, which gives them a reason to identify as a different gender. I see two possible ways to read this scenario. If X ends up thinking of themself as not a woman due to their dysphoria, then they *do* have another gender proof available, along the lines of "I was assigned female at birth, I'm severely dysphoric, … therefore I am not a woman." The point is not that they must be thinking of this as a proof in order to update their self-identification; rather, the proof is an idealized model of what they take to ground their gender—in this case, their severe dysphoria. Meanwhile, on the reading where X is severely dysphoric but still considers themself a woman, there are two options. If dysphoria is salient to X as a gender determinant, but (for whatever reason) they think it doesn't determine theirs, then a dysphoria-based proof will occur as a *rejected* proof. But if X doesn't think of dysphoria as having anything to do with gender, then the grounds will not mention dysphoria at all: in this case X simply *does not have* a reason to identify as not a woman (given their understanding of "woman").

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

Nevertheless, we can—and should—go further. Gender grounds are a good fit with the gender pluralism of Cull (2024), which they describe as follows:

> To be an ameliorative semantic pluralist, then, is to call for *more* conceptual engineering. It is to ask ordinary people to investigate their relationship to gender, to throw out those aspects of their gender(s) that do not speak to them and to build new aspects to their gender(s), borrowing and drawing on the genders of others, and rethinking what gendered life might look like. (2024, 87)

One way to understand this proposal is as a call for engineering new gender grounds. On this reading, ameliorative semantic pluralism has the following goals:

1. build new gender proofs;
2. find new ways to reject dominant gender proofs, i.e., proofs associated with the dominant conception of gender;
3. extract meanings from gender grounds.

Crucially, if meaning comes from the gender grounds themselves, then soundness comes relatively cheap: new gender terms will *start* from the assumption that they make certain gender proofs sound or unsound. Interaction with whatever gender meanings X is familiar with before engaging in grounds engineering only occurs at the level of proof selection: which proofs X finds salient and acceptable (or rejectable) will depend on the gender meanings floating around X's social context, at the very least in the sense that they will influence X's choice of words. After X's gender grounds have been formed, we can technically "forget" these pre-existing meanings for the purpose of extracting new meanings from the grounds.

The upshot is that if at least one gender proof in X_+ ends in "X is genderqueer," and so X accepts a certain argument that they are (in some sense) genderqueer, then X *is* (in that sense) genderqueer, and so the proof is sound in virtue of the meaning of the terms involved.[33] Meanwhile, if the proof "I have a penis, therefore I'm a man" is in X_-, then we know that "man" here is understood in such a way that having a penis is not a sufficient condition. Importantly, gender grounds can underdetermine the meanings of gender terms: generally speaking, each proof is going to impose *some* conditions, but nothing like a definition.[34]

This still tracks the analogy with mathematical proof. It is often the case in mathematics that we leave a definition open in the attempt of proving something, and then we fill it in based on what it turns out we need in the proof; arguably, that's how most mathematical definitions arise. Furthermore, we may decide to revise an already given definition because it turns out that it doesn't do what we wanted it to do (notable

[33]This doesn't remove *all* constraints. Not every new definition is conservative over previously existing language, so truths entailed by a newly introduced gender term may contradict previously accepted truths; this is hardly a deal-breaker, but it may require some negotiation. Furthermore, human error is still possible: *X* may later find a mistake in the proof such that it was not valid after all. I will come back to this in the next section.

[34]For this reason, I am also not committed to an inferentialist reading of gender terms, such that their meaning is *exhausted* by the kind of proofs they appear in. For an approach going in that direction, see Silva and Pennycook (n.d.).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

historical examples are the notions of compactness, polyhedron, function, ...).[35] The other direction—a precise definition is given at the start, and kept fixed throughout the proof—occurs too, but that's the same in the gender case: one *can* derive one's gender grounds from unambiguous definitions, and the framework accounts for that too.

Different gender grounds may give rise to incompatible understandings of the same terms; that is where pluralism comes in. Going back to our Tim example, the meaning of "man" arising from his gender grounds involves being an adult male, and being treated as a man. This is largely compatible with the dominant conception, so these grounds do not directly suggest any new meanings (although the dominant conception contains a lot more that is not needed here!). On the other hand, gender grounds containing accepted proofs ending in both "I am a man" and "I am a woman" suggest meanings of "man" and "woman" which allow for their coexistence within a single individual, which directly contradicts the dominant conception. It may be that one meaning can fit both grounds, or not; thinking in these terms does not directly answer such questions, but rather provides an open space to think about them. Some meanings may also be connected to gender grounds without associated terms occurring in any particular proof, as in the examples of agender identity discussed earlier.

5. Clarifications, objections, and replies

Having spelled out the basics of my proposal, it will help to clarify its scope and answer some possible objections in the process.

5.1 From gender subjectivity to gender grounds

The starting point is, as Cull puts it, "ordinary people" and "their relationship to gender." In this particular sense, gender grounds are *descriptive*: they are models of individuals' relationships to gender. For the sake of preserving first-person authority over gender, the meaning of gender terms is left unspecified, but the pool of candidates is restricted to those that make the grounds sound. The project is then to extract, from the corpus of gender grounds, a plurality of meanings that can cover all possible cases.[36]

By referring to gender grounds as descriptive, however, I do not mean that there is some cognitive reality that they are directly capturing.[37] I don't think most people relate to their genders in a proof-based fashion, any more than untrained math users relate to math in a proof-based fashion.[38] The way people relate to gender is *just* the starting point: it takes an explicit act of model-building to go from there to gender grounds, and even then it's an open-ended process. This is the work requested by Cull's proposal, which asks for individuals to *theorize* their own gender. It is not something that just happens; work must be put into it. While Cull (2020) focuses on the construction of

[35]Discussion of these examples is found in Raman-Sundström (2015) and Lakatos (2015). My view of mathematical concepts is strongly influenced by Schlimm (2012).

[36]In fact, for all I've said here it is *possible* one may need not a plurality at all. Monism is not incompatible with the framework I'm proposing; at worst it makes it a bit overkill, but the framework remains useful as a way to get to that conclusion. I point to Cull (2024) for arguments against monism.

[37]Thanks to a referee for pushing me to elaborate on this.

[38]In fact, it took millennia for *trained* mathematicians to get interested in systematic proof-based presentations, nor has said interest remained stable in history.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

phenomenological narratives, I shift the focus to the construction of gender grounds as defined here. I see the two proposals as largely compatible, speaking to different theorizing tendencies.

Much like published mathematical proofs do not capture everything about the subjective experience of mathematics, so do gender grounds leave some things behind. That's fine, because gender grounds are not required to say all there is to say about a person's gender. Rather, they have a very specific purpose: suggesting gender meanings, and carrying justificatory and explanatory power. This is also why I'm not particularly worried about the *possibility* of building gender grounds: it is "simply" a matter of investigating your answer to the question why, looking for arguments that present a plausible approximation. Adequacy can be graded.

I reckon this way of thinking about one's own gender will not resonate with everyone. Math anxiety is widespread, and any analogy with mathematical proof has a chance to trigger it. It is also a markedly analytic way of thinking, and many have criticized analytic philosophy's obsession with formalism as actively detrimental to the understanding of things like one's own sense of gender. For what it's worth, I'm not interested in arguing that this is *the* right way of thinking about gender. But I also reject the notion that it's a perspective alien to real people; at the very least it resonates with me, and (anecdotally) I'm not *that* special. On an affective level, then, my main audience is those gendered individuals who do find relief in formalism and proof, and feel left behind by other approaches.

On a *philosophical* level, however, it is not necessary that any given individual takes the time to develop their gender grounds; the epistemic upshot that gender *can* be thought of like this remains valuable either way, because it means that objectivity, justification, and explanation *can* be accessed. This is both a philosophically helpful point, and—at least for some folks—a relief.

5.2 Too many gender meanings

One may worry about the proliferation of "bad" gender meanings.[39] People identify as a given gender for all kind of reasons, some of which are bound to be questionable—just think of toxic masculinity!

My answer is two-fold. First, this is a problem with society, not with the framework. If we want first-person authority over gender, then we need first-person authority over gender *grounds*, that is, over what being a certain gender means *to us*: I would find it barely removed from misgendering to tell someone "yes, you are a woman, but not in *your* sense." The important point is that one's gender grounds carry no implications for what *other* people's gender grounds should be: first-person proofs only strictly require first-person premises, and even insofar as universal beliefs do occur as premises, they can always be chalked up to idiosyncratic gender meanings. So any harmful meanings remain "contained," so to speak.[40]

[39]Something like this worry is raised by Bex-Priestley (2022) against Bettcher's notion of existential self-identity.

[40]A referee worries about proofs like "I and only I decide what the genders are and who has them. Susie identifies as non-binary, but I say that Susie is a woman and non-binary doesn't exist. And I say that I'm a woman, too. So, I am a woman." My answer is that the relevant gender proof in this case seems to be: "If I say I'm gender X, then I'm X. And I say that I'm gender X. So I'm gender X." The idea is that we can always extract a "non-spreading" gender proof by removing or restricting logically irrelevant premises. Of course

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

That being said, the extraction of gender meanings is *not* the endpoint: the ultimate goal of the ameliorative project is to come up with gender terms that both reflect individual experiences *and* are not harmful, which at the very least requires moving past the dominant conception. Capturing the current operative meanings in individuals' gender narratives is just the first step. There are also important questions about adoption, spread, and policy to be asked, but they are well beyond the scope of this paper; my goal here is simply to provide a framework to work through the project.

Similarly, while there are plenty of interesting philosophy of language questions about what it means to "generate" meanings like this, it's clear enough that we *can* define our terms however we like in mathematics *and* make sense of them, even if the exact mechanisms are philosophically controversial.[41] What I'm suggesting is applying the same way of thinking to gender, independently of the gritty philosophical details.[42] Following Yap (forthcoming), we may think of the meanings under question as living in distinct linguistic frameworks, each with their own gender concepts and associated proofs. This freedom of framework is the core advantage of thinking in terms of gender grounds: it is the freedom to build one's gender narrative—as emphasized by Ashley (2023)—while at the same time preserving the *possibility* of proof.[43]

One may worry that communication would break down under this picture, as everyone would be using the terms differently. But access to the full gender grounds of a person is overkill for communication; and insofar as gender term users are aware of the associations that gender terms are carrying *right now* due to the dominant conception, not only will their gender grounds be influenced by the conception (so they are not going to be utterly arbitrary), but each use of gender terms can be supplemented as needed depending on context. This does mean that sometimes gender terms will deliver the wrong information through unrealized stereotype; but this is an overwhelmingly common phenomenon well beyond gender, so I don't see it as a defect of the account.[44]

---

people do sometimes generalize such proofs to apply to others; but gender grounds are focused on capturing what grounds their understanding of an individual's own gender, not their gendering of others. One could enforce this by requiring that proofs in gender grounds be first-person *throughout*: not only have first-person conclusions, but also only appeal to first-person premises (at least when said premises involve gender terms). More generally, we could try to postulate away gender proofs with unnecessarily strong premises, much like we may want to sideline mathematical proofs with unnecessarily strong premises; this would let gender grounds be sound while forcing very few commitments about the extension of associated gender terms. However, I'm not convinced the added definitional complexity would be worth the gain, so I set this aside here; I prefer thinking of it as a practical modeling guideline.

[41]Granted, one could go full formalist and claim that whatever comes out of formal frameworks is, strictly speaking, meaningless. But this is at best a terminological point for the discussion at hand: it is not controversial that *in practice* formal frameworks can be used and made sense of.

[42]Worries about mathematical terms only allowing this because of their exceptional status are overblown, for many of the same reasons already discussed in section 2: see especially Tanswell (2018).

[43]To be sure, logical tolerance means we are free to develop frameworks according to whatever rules and meanings, but it does not dispense us from our duty to assess the frameworks we develop for harm. If a framework turns out to be harmful, then that constitutes a reason to chuck it away; in fact, that's what is being argued about the dominant conception!

[44]A similar answer applies to a referee's worry about what my account entails for feminist solidarity. It's not a worry that has much to do with my account specifically: there are many challenges to attempts to ground feminist solidarity in this or that meaning of "woman," and I hold the (not too uncommon, I think) view that meanings are just a bad ground for this. Even if my account led to full polysemy, there's nothing stopping the women going to the river from sharing a revolution with those going to the financial institution; worst case scenario, they can bond over their shared label.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

5.3 Gender relativism and pluralism

A different objection starts from the fact that many people want their identification with a given gender to be true, rather than true relative to a given framework. My account cannot respect such a wish, since it conceives of truth as relative to (possibly incompatible) gender meanings—or so the objection goes.[45]

Now, the view I have presented here is a *pluralist* view, not a relativist one: it is, at worst, a matter of people reaching superficially different conclusions due to using words differently. The fact that a plurality of meanings can sometimes lead to disagreement on which words to use, or confusion on what words mean in a given conversational context, doesn't mean that the parties are not speaking truly tout court. Still, the objection does point to a real concern, namely that gender monists—pushing for one particular correct meaning of "man," "woman," etc.—are unlikely to be happy with my proposal. This is not a concern for my view specifically—it applies to every semantical gender pluralist—but I'll say a couple of words anyway.

Admittedly, gender grounds appear to stack the deck against monism when paired with the actual world: on the surface at least, people apply gender terms to themselves in a variety of different ways. But the deck being stacked is not an assumption of pluralism, it's *evidence* for it. Looking at how people use gender terms, it is hard to see how every single person's gender identification can be true at the same time, without appealing to a multiplicity of meanings. If I'm wrong, then it will be possible to find a unique set of gender meanings that are compatible with everyone's gender grounds. My proposal is open to both options.[46]

Pluralism or not, what I've been trying to emphasize is that a valid gender proof can be valuable and objective even if it's building on gender meanings that aren't widely shared, in the same way mathematical proofs relying on compactness are all valid and objective even if different authors understand compactness differently. Freedom of framework in mathematics does not undermine mathematical truth and objectivity; similarly, gender truth and objectivity is not undermined by a plurality of gender meanings.

That being said, one could still use the gender grounds framework to argue for a privileged selection of gender meanings (among those extracted from gender grounds) on moral, political, or even just pragmatical considerations. Similarly, in mathematics some formal systems tend to be treated as more acceptable than others (for example, the ones falling under standard set theory), and mathematicians like Woodin (2010) are still pining for the one correct standard model. I am as opposed to this attitude (at least insofar as it is used to justify monism) in mathematics as in gender, but it is available, and so I reckon that even people radically disagreeing with me could find the framework valuable. Either way, this kind of "cleaning up" is a further step, coming *after* the analysis of gender grounds; furthermore, it is a question about which terms we should use, not (directly, at least) about what is true.

5.4 Proof and first-person authority

Another worry might be that the insistence on proof makes it impossible for gender grounds to really respect first-person authority over gender. After all, gender proofs *are*

[45]Thanks to a referee for raising this objection.

[46]Of course monists could also pivot to arguing that how people think of their own gender doesn't matter at all, but then we are drifting far apart in terms of theoretical commitments.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

proofs. This means that the soundness of proofs in gender grounds *can* in principle be challenged from the outside. Freedom to pick a framework is not the same as freedom to do whatever within the framework that one has picked. This is perfectly analogous to the case of critical math kinds: mathematicians who, say, reject the Law of Excluded Middle (LEM) may not be fairly faulted for asserting something incompatible with LEM (as that is consistent with the standards of their own practice) but this doesn't shield them from making other kinds of mistakes. Nothing about rejecting LEM warrants asserting $2 + 2 = 5$. Furthermore, I have said nothing to exclude purely factual statements from occurring as premises in gender proofs, so it stands to reason that their truth could be challenged.

Now, in practice, most premises in gender grounds seem to be of the sort that it is hard to doubt from the outside without a massive dose of testimonial injustice, either because they're easily verifiable or because they refer to internal states or private experiences. Furthermore, any definitional premises specifying the meaning of gender terms will be sound by default, since the operative meaning is determined by what makes the proof sound. Universal premises may be more easily challenged, but that is easy to fix: since what matters is the first-person conclusion, a sound proof can be recovered by simply moving to the first-person instance. So the room for doubt should not be overstated.

More importantly, doubting the soundness of someone's gender proofs is *not* a good reason to dismiss one's self-identification. We maintain first-person authority on our gender grounds to the extent that it is up to us which proofs we take to be salient, which meanings we take the gender terms to have, and maybe even which logic we use; and that is all the authority we really need. If someone points out that one of my proofs seems to be invalid—and I accept that it is so by my own standards—then maybe I'll modify my gender grounds accordingly; or maybe I'll have an existential crisis, and revise my gender identification; or maybe I'll simply accept that I'm not sure what my gender grounds are, and will stick with the dodgy ones for now. None of this is available to an external questioner for challenging; nor are questioners entitled to know our gender grounds before accepting how we label ourselves. So the in-principle possibility of questioning one's gender grounds is really quite harmless, and does not warrant questioning one's self-identification.

The upshot of all this is that *ethical* first-person authority remains central. The freedom to choose one's gender grounds does not rest on epistemic grounds, but on ethical grounds. The advantage of gender grounds is not to show how everyone is necessarily right about their gender; rather, it is to provide a lens through which everyone *can* prove their gender, if they are so inclined. Proofs can be faulty, and frameworks are contingent; but if this doesn't prevent *mathematical* proofs from being proofs—and, as shown in section 2, it does not—it shouldn't prevent gender proofs either.

One may still worry that allowing for gender proofs in *any* form is going to keep the demand for proof alive.[47] But even if that was the case, it would be far less pernicious than now. After all, when the transphobe—or, for that matter, the confused questioner—asks for a proof, they are not going to be satisfied with just *any* proofs; they want proofs *of a particular kind*. But that is exactly what the proposal here is pushing back against: that gender justification can be reduced to a particular kind (or even to a particular argument). So, in this narrow sense, the demand for proof is clearly rejected.

[47]Thanks to Laura Caponetto for first raising this objection.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

At worst, the demand could become a push for individuals to figure out their own gender grounds; it's unclear to me that this is a bad thing, and either way I do not treat having one's gender grounds figured out as a *precondition* for having one's gender respected.[48] Of course nothing about this proposal will convince people who think a particular kind of proof *should* be given; my arguments rest on ethical first-person authority, which is incompatible with such a demand. But this puts me in no worse rhetorical situation than those who deny provability to begin with.

5.5 Saving the analogy

Finally, I want to address two objections questioning the value of the driving analogy. A referee suggests that *reasons* could similarly serve a justificatory and explanatory purpose. So why talk about proof at all?

What the analogy with mathematical proof supplies beyond mere reasons talk is, first, objectivity in a strong sense: mere reasons would be like scientific diagnoses in this respect, falling far too short of the ideal. Second, the relationship between objectivity and freedom of framework is far more clearly codified in a mathematical context than elsewhere. The closer one gets to objectivity, the weirder it sounds to speak of freedom to choose one's reasons (which is part of why, I think, the idea of gender being up to the individual is often viewed as inconsistent—denying reality, and all that); but once we get to mathematics the relationship becomes clear again, since mathematics is more easily construed as both objective and deeply free. Hence my suggestion to think of gender along those lines.[49]

The second objection points to a potentially harmful disanalogy between the dominant conceptions at play.[50] Unlike the dominant conception of gender, the dominant conception of mathematics is there for a good reason: it would be hard to deny that mathematics as it is practiced today is eminently *useful*, especially as a tool for science. So the worry is, on one hand, that the comparison may only serve to rehabilitate the dominant conception of gender; and on the other, that it doesn't seem to be necessary to give up one to give up the other.

My answer is to bite the bullet: the dominant gender conception is *undoubtedly* useful. It wouldn't be there if it wasn't. The question this framing raises, however, is: useful for what? There is no shortage of transfeminist Marxists arguing that it is useful for keeping capitalism afloat, for example.[51] If that's the kind of uses we are talking about, then maybe usefulness is not that straightforward an argument for why it is good to keep it around. More generally, I think that, once the discussion becomes about *usefulness*, we are already on the right track. Dominant conceptions don't sell themselves on usefulness, but on naturalness and truth. Talking about usefulness requires talking about aims, and carries fewer excuses to avoid talking about harm. It also makes it relatively unproblematic to discuss alternatives: it may be controversial that more than one conception can be true, but it's obvious enough that more than one conception can be useful.

[48]This also leaves room for gender without gender grounds, following Barnes (2022).

[49]That being said, I am not terribly committed to gender proofs having a particular form. For example, I don't think they have to be *deductive* proofs: if someone's gender grounds are better understood as including, say, inductive proofs, so be it.

[50]Thanks to Francesca Boccuni for raising this worry.

[51]See most of the chapters in Gleeson and O'Rourke (2023).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

As for giving up MATH: while moving beyond MATH may give us more tools to build (and think of) new kinds of gender grounds, I am not suggesting that MATH has to be rejected for an ameliorative semantic pluralism about gender to kick in. If MATH is to be given up, it will not be because GENDER is problematic, but because MATH itself is, which I have not argued in this paper; although it should be noted that the literature is not lacking such arguments.[52]

6. Conclusion

The proof ideal has a pernicious influence over gender discourse: it fosters an expectation of self-evidence, objectivity, and unshakeable underlying truth, while at the same time justifying endless doubting of marginalized cases, and limiting the epistemic tools at their disposal. However, failure of the proof ideal in the paradigmatic maths case—social entanglement, need for interpretation, existence of alternatives—suggests that there is room for gender to be thought differently even within the provability constraint. In particular, I suggested that *gender grounds*, that is, sets of first-person gender proofs which an individual accepts or rejects, can provide gender identity with justificatory and explanatory force without overburdening any single argument, all while respecting the diversity of gender narratives in the wild, and preserving first-person authority. Furthermore, gender grounds are a natural companion to the project of engineering liberatory gender meanings from personal narratives.

Now, the details of my proposal are still quite tentative. In particular, I think the strict acceptance/rejection binary is too limiting: a more accurate model could allow for proofs to be weighed differently, or for other attitudes to count (e.g., to account for temporal shifts and histories). Furthermore, a lot more could be said on how to extract gender meanings from gender grounds, how to compare such meanings, etc. Some of these questions might be fruitfully related to discussions in the philosophy of logic and mathematics, for example, concerning the identity conditions on proofs. I also think that critical math kinds, challenging the dominant conceptions of logic and mathematics, may be of help in constructing or expressing critical gender kinds, challenging the dominant conception of gender; conversely, at least some critical gender kinds may point to alternative logics and mathematics, as some of the feminist logic literature seems to suggest.[53] I hope the sketch provided in this paper suffices to show that the idea is promising: gender grounds can do much of what gender identity is supposed to do, and they can do it without giving up on the notion of proof.

Acknowledgments. Early versions of this paper were presented at the 2024 "Trans/Feminist Philosophy: Pasts, Presents, and Futures" Conference at the University of Guelph, the CRESA WIP seminar, and the 2025 Feminist Logic workshop at the Ruhr University Bochum; thanks to the respective audiences for their feedback. Thanks also to Emil Eva Rosina, Matthew Cull, and Karolina Tytko for moral support and helpful discussion. Finally, thanks to several referees (and editors) for helping me improve the paper a great deal. This work was supported by the Deutsche Forschungsgemeinschaft (DFG), grant number 534806587.

[52]Again, I point to Mangraviti (2025) for a survey of proposed alternatives. One could also try and argue that MATH is problematic in part *because* it supports things like GENDER; but nothing I say in this paper depends on it. For more on that angle, see Kather (2026).

[53]See e.g. Eckert (forthcoming) and Kosten (2025).

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

References

Aberdein, A. 2023. Deep disagreement in mathematics. *Global Philosophy* 33 (1): 17.

Aberdein, A., and S. Read. 2009. The philosophy of alternative logics. In *The Development of Modern Logic*, ed. L. Haaparanta. New York: Oxford University Press.

Andersen, L. E. 2020. Acceptable gaps in mathematical proofs. *Synthese* 197 (1): 233–47.

Andersen, L. E., H. Andersen, and H. K. Sørensen. 2021. The role of testimony in mathematics. *Synthese* 199 (1): 859–70.

Ashley, F. 2023. What is it like to have a gender identity? *Mind* 132 (528):1053–73.

Aultman, B. L. 2018. Feeling as knowing: Trans phenomenology and epistemic justice. PhD thesis, CUNY.

Barnes, E. 2022. Gender without gender identity: The case of cognitive disability. *Mind* 131 (523): 838–64.

Baron, S., M. Colyvan, and E. Ripley. 2020. A counterfactual approach to explanation in mathematics. *Philosophia Mathematica* 28 (1): 1–34.

Bettcher, T. M. 2007. Evil deceivers and make-believers: On transphobic violence and the politics of illusion. *Hypatia* 22 (3): 43–65.

Bettcher, T. M. 2009. Trans identities and first-person authority. In *You've changed: Sex reassignment and personal identity*, ed. L. J. Schrage. New York: Oxford University Press.

Bettcher, T. M. 2019. What is trans philosophy? *Hypatia* 34 (4): 644–67.

Bex-Priestley, G. 2022. Gender as name. *Journal of Ethics and Social Philosophy* 23: 189.

Bloor, D. 1991. *Knowledge and social imagery*. Chicago: University of Chicago Press.

Briggs, R., and B. George. 2023. *What even is gender?* Abingdon, UK: Routledge.

Burton, L. 1995. Moving towards a feminist epistemology of mathematics. *Educational Studies in Mathematics* 28 (3): 275–91.

Cosker-Rowland, R. 2023. Recent work on gender identity and gender. *Analysis* 83 (4): 801–20.

Cull, M. J. 2020. Engineering genders: Pluralism, trans identities, and feminist philosophy. PhD thesis, University of Sheffield, UK.

Cull, M. J. 2024. *What gender should be*. London: Bloomsbury Publishing.

Dembroff, R. 2019. Beyond binary: Genderqueer as critical gender kind. *Philosopher's Imprint* 20 (9):1–23.

Dembroff, R. 2020. Cisgender commonsense and philosophy's transgender trouble. *Transgender Studies Quarterly* 7 (3): 399–406.

De Toffoli, S. 2021. Groundwork for a fallibilist account of mathematics. *Philosophical Quarterly* 71 (4): 76.

De Toffoli, S., and V. Giardino. 2015. An inquiry into the practice of proving in low-dimensional topology. In *From logic to practice*, ed. G. Lolli, M. Panza, and G. Venturi. Cham: Springer.

Dotson, K. 2012. A cautionary tale: On limiting epistemic oppression. *Frontiers: A Journal of Women Studies* 33 (1): 24–47.

Dutilh Novaes, C. 2020. *The dialogical roots of deduction: Historical, cognitive, and philosophical perspectives on reasoning*. Cambridge: Cambridge University Press.

Eckert, M. Forthcoming. Re-centering and genderqueering Val Plumwood's feminist logic. In *Feminist philosophy and formal logic*., ed. A. Yap and R. Cook. Minneapolis:University of Minnesota Press.

Ernest, P. 1998. *Social constructivism as a philosophy of mathematics*. Albany, NY: State University of New York Press.

Fallis, D. 2003. Intentional gaps in mathematical proofs. *Synthese* 134 (1/2):45–69.

Ferreira da Silva, D. 2017. 1 (life)÷ 0 (blackness) = ∞ − ∞ or ∞/∞: On matter beyond the equation of value. *E-flux Journal* 79: 1–11.

Gleeson, J., and E. O'Rourke. 2023. *Transgender Marxism*. London: Pluto Press.

Granville, A. 2023. Accepted proofs: Objective truth, or culturally robust. *Annals of Mathematics and Philosophy* 2: 25–90.

Habgood-Coote, J., and F. S. Tanswell. 2023. Group knowledge and mathematical collaboration: A philosophical examination of the classification of finite simple groups. *Episteme* 20 (2): 281–307.

Hamami, Y. 2018. Mathematical inference and logical inference. *Review of Symbolic Logic* 11 (4): 665–704.

Hernandez, E. 2024. Moral shock and trans "worlds" of sense. *Journal of the American Philosophical Association* 10 (4): 761–79.

Hernandez, E., and R. Bell. 2025. Much ado about nothing: Unmotivating "gender identity." *Ergo* 12 (50): 1313–40.

Hilbert, D. 1927. The foundations of mathematics. In *From Frege to Gödel: A source book in mathematical logic, 1879–1931*, ed. J. Van Heijenoort. Cambridge, MA: Harvard University Press.

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press

Horgan, J. 1993. The death of proof. *Scientific American* 269 (4): 92–103.
Jenkins, K. 2023. *Ontology and oppression: Race, gender, and social reality*. New York: Oxford University Press.
Kather, C.-J. 2023. Mathematik, rationalität und humanismus: Paradigmen der zeitgenössischen westlichen bedeutungsgebung. *Polylog* 50: 99–111.
Kather, C.-J. 2026. *The epistemic violence of mathematics: Decolonial-feminist re-writings of the "rational" and the "human"*. Bielefeld: Transcript.
Kollosche, D. 2024. Dehumanisation through mathematics. In *Breaking images: Iconoclastic analyses of mathematics and its education*, ed. B. Greer, D. Kollosche, and O. Skovsmose. Cambridge: Open Book Publishers.
Kosten, R. 2025. A transformative intuitionist logic for examining negation in identity-thinking. *Australasian Journal of Logic* 22 (4): 438–74.
Krantz, S. G. 1994. The immortality of proof. *Notices of the American Mathematical Society* 41 (1): 10–13.
Lakatos, I. 2015. *Proofs and refutations: The logic of mathematical discovery*. Cambridge: Cambridge University Press.
Lange, M. 2016. *Because without cause: Non-casual explanations in science and mathematics*. New York: Oxford University Press.
Lanius, C. 2015. Fact check: Your demand for statistical proof is racist. *Cyborgology*. https://thesocietypages.org/cyborgology/2015/01/12/fact-check-your-demand-for-statistical-proof-is-racist/
Lehet, E. 2021. Mathematical explanation in practice. *Axiomathes* 31 (5): 553–74.
Mangraviti, F. 2025. Critical math kinds: A framework for the philosophy of alternative mathematics. *Erkenntnis* 80: 2197–2217.
Raman-Sundström, M. 2015. A pedagogical history of compactness. *American Mathematical Monthly* 122 (7): 619–35.
Rittberg, C. J., F. S. Tanswell, and J. P. Van Bendegem. 2020. Epistemic injustice in mathematics. *Synthese* 197 (9): 3875–3904.
Rosental, C. 2008. *Weaving self-evidence: A sociology of logic*. Princeton: Princeton University Press.
Schlimm, D. 2012. Mathematical concepts and investigative practice. In *Scientific concepts and investigative practice*, ed. U. Feest and F. Steinle. Berlin: de Gruyter.
Silva, F. 2025. Being a woman and wanting to be a woman: An application of subject matters, questions and FDE. *Australasian Journal of Logic* 22 (4): 410–37.
Silva, M., and P. Pennycook. N.d. Knowing how to play the identity game: Inferentialist lessons for normative resistance. Under review.
Starikova, I., and J. P. Van Bendegem. 2021. Revisiting the mutilated chessboard or the many roles of a picture. *Logique et Analyse* 255: 289–312.
Stone, S. 2013. The empire strikes back: A posttranssexual manifesto. In *The transgender studies reader*, ed. S. Stryker and S. Whittle. New York: Routledge.
Tanswell, F. 2015. A problem with the dependence of informal proofs on formal proofs. *Philosophia Mathematica* 23 (3): 295–310.
Tanswell, F. S. 2018. Conceptual engineering for mathematical concepts. *Inquiry* 61 (8): 881–913.
Turyn, G. 2023. Gender and first-person authority. *Synthese* 201 (4): 122.
Van Bendegem, J. P. 2016. Contingency in mathematics: Two case studies. In *Science as it could have been: Discussing the contingency/inevitability problem*, ed. L. Soler, E. Trizio, and A. Pickering. Pittsburgh: University of Pittsburgh Press.
Wagner, R. 2022. Mathematical consensus: A research program. *Axiomathes* 32 (Suppl. 3): 1185–1204.
Woodin, H. 2010. Strong axioms of infinity and the search for V. In *Proceedings of the International Congress of Mathematicians 2010*, ed. R. Bathia, vol. I. Singapore: World Scientific Publishing.
Yap, A. Forthcoming. The logical syntax of prejudice: Oppression and the constitutive a priori. In *Feminist philosophy and formal logic*, ed. A. Yap and R. Cook. Minneapolis: University of Minnesota Press.

Franci Mangraviti is currently a post-doc at ETH Zurich. They began their academic career in mathematics, before turning to logic and finally to philosophy. Their research mainly revolves around "alternative" logics and mathematics, and their interactions with feminist and trans philosophy.

Cite this article: Mangraviti, F. (2026). "Math Proofs, Gender Proofs." *Hypatia* 1–21. https://doi.org/10.1017/hyp.2026.10100

https://doi.org/10.1017/hyp.2026.10100 Published online by Cambridge University Press