Journal of Humanistic Mathematics

Volume 16 | Issue 1 January 2026

Mathematics and Ethics: Narratives and Conversations

David Pritchard
University of Strathclyde

Mathematics and Ethics: Narratives and Conversations

David Pritchard

Department of Mathematics & Statistics, University of Strathclyde, Glasgow G1 1XH, SCOTLAND
david.pritchard@strath.ac.uk

Abstract

We provide an eclectic overview of various narratives that mathematicians use to describe mathematics. We discuss some of the ethical issues and approaches that each narrative tends to emphasise, and how these can lead to productive conversation in the absence of a universally agreed philosophical or ethical framework. We also discuss the dangers of a deficit model of ethical engagement, and other threats to conversation.

1. Introduction: the almost accidental ethics seminars

In 2015, I found myself leading workshops for postgraduate research students on professional issues in mathematical research. These workshops were meant to cover topics ranging from research funding to publication to careers. We soon found that our most intense and rewarding discussions were about how one should behave in a given situation, and why. We had stumbled into ethics.

At that time, mathematicians generally regarded ethics in mathematics (EiM) as a niche interest; it has since expanded to fill a slightly larger niche.[1]

[1] Some developments of which I am aware include the Cambridge *Ethics in Mathematics* project, including conferences held in 2018 and 2019; the *Synthese* collection on Virtue Theory of Mathematical Practices (2020-21); the *Journal of Humanistic Mathematics* special issue on Ethics in Mathematics (volume **12** issue 2, 2022); the edited volume *Ethics in Mathematics Education* (edited by P. Ernest; Springer, 2024); and the inclusion of ethics in the UK Quality Assurance Agency's 2023 benchmark statement for MSOR [2].

This paper is partly a review and largely a reflection on my experience, addressed to other mathematicians and mathematics teachers who share that interest. Rather than offering a systematic approach to the ethics of mathematics, it considers how to enable the conversations through which a shared exploration of ethical issues can develop. That exploration, like this paper, is a work in progress.

The premise of this paper is that conversation is necessary in order to build, if not ethical consensus, then at least a shared awareness of the ethical landscape. There may be situations in which conversation is impossible and opposing ethical beliefs must collide, or in which minimum standards of behaviour must be collectively enforced. However, any gains achieved by collisions or enforcement will be fragile unless they are underpinned by a living ethical tradition.

Papers in this area often describe widespread resistance to claims that mathematics has an ethical or value-laden dimension. This has not been my own experience (cf. [31, 58]). Mathematicians' resistance to EiM initiatives is often founded on a strong sense that mathematical practice does have innate values, combined with a suspicion that antithetical values are being smuggled in under the guise of ethics. The point is not whether this suspicion is fair, or these innate values are coherent: to make progress we must find ways of talking that acknowledge them.

We cannot start from first principles. There is no single generally agreed foundation for ethical reasoning nor a single generally agreed definition of mathematics. In practice, many mathematicians' working philosophy consists largely of metaphors or narratives [27] — "mathematics is a language"; "mathematics is a technology"; "mathematics is an art form" — each of which captures part of our practice and experience, and none of which is readily reconciled with the others. For most of us, our eclectic working philosophy is complemented by an equally eclectic working system of ethics. We are consequentialists when consequences seem obvious, deontologists when rules seem clear, virtue theorists when pressed to defend our art. The chances of agreeing on premises are slim.

Nevertheless, productive conversation is possible, and it often starts from concrete questions [3, 36]. Here is a situation: a messy, real-world situation, not a thought experiment. How would you behave, and why? Conversations of this kind rarely degenerate into arguments over axioms — or not immedi-

ately, at any rate — and can press us to explore our own eclectic choices by articulating them.

Both in such conversations and in more general discussion, it is helpful to be alert to the narratives we use for mathematics and how those narratives shape our ethical thinking (cf. [53]). No narrative is comprehensive; each brings different ethical issues to the fore, and sits easily or less easily with different ethical approaches. In this paper, we will consider some of the more common narratives in this way.

One distinction should be acknowledged at the outset before being blurred. The word "mathematics" can refer to a set of practices and activities, a body of knowledge, or a loosely-defined disciplinary community. These senses are, of course, not independent of each other, but frustration can result when they are used at cross purposes. It is hard to discuss mathematics without occasionally slipping between these senses; for productive conversation, both parties must accept that the slippage is taking place.

2. Ethical theories and practical wisdom

> I would do anything for love (but I won't do that).[2]
> — Meat Loaf (1993)

To support our discussion of narratives it is useful to sketch some systematic approaches to ethics. This sketch is far from comprehensive, but it may help to orient ourselves a little and to put names to theories which, while not always articulated, can be detected haunting the conversation.

A consequentialist approach [51] defines a desirable outcome (such as the traditional "maximising the total of human happiness") and judges actions as good or bad by assessing the extent to which they achieve this outcome. This is probably the most familiar modern approach, despite problems that immediately present themselves to a mathematician (how can one quantify happiness?) and problems that ought to (can one reliably predict the consequences of actions in a complex world?)

A deontological approach, by contrast, judges actions by whether they conform to moral duty, usually expressed as following a universal moral law [4].

[2] Readers may wish to consider which approaches are implicit in Mr Loaf's statement.

In discussions, this often manifests itself not through direct appeals to such laws, but by through protests that "you just can't do things like that".

Virtue-based approaches emphasise character and behaviour over individual actions: one's behaviour should reflect and nurture desirable characteristics (virtues). Different virtue-ethics systems emphasise different virtues, and relational systems such as ethics of care can be understood from a virtue perspective [16, chapters 3 and 6]; the most thoroughly developed system in mathematics treats virtues as characteristics that lead to human flourishing (eudaimonia). [15] provides a detailed treatment of how virtue theory can be used to capture the widespread sense[3] that doing good mathematics is good in itself but also not the be-all and end-all of virtue; we will return briefly to this treatment below.

If we consider doing mathematics itself to be a form of flourishing [54] then there is a natural overlap with the related concept of epistemic virtues: characteristics or behaviours that promote the flourishing of knowledge, specifically mathematics. Epistemic virtues may be associated with people or with practices and theories [1, 55]. We will also return to these below.

Regardless of the ethical system one employs, to translate principles into actions in a specific domain such as mathematics typically requires a nuanced and clear-eyed engagement with the realities of that domain. In virtue ethics, the quality required for this engagement is often called practical wisdom, or phronesis [16, 26]. Although discussions of ethics in mathematics, as in other domains, are often couched in terms of ethical theories, the real value of such discussions is often in developing our practical wisdom, and sometimes allowing it to reshape our theories.

3. Some narratives of mathematics

The five narratives of mathematics that we will consider in detail are encountered fairly frequently in the literature on EiM and/or the workshops in which I have been involved. They are all internal narratives, in contrast to external or public narratives [13, 48]; three of them align quite closely with three of the narratives explored from a virtue perspective by [27].

[3] Widespread among mathematicians, if not elsewhere.

Several of these narratives overlap — for example, a language can be considered as a technology, and a profession has similarities to a game — and so some ideas naturally thread different narratives together. This sort of overlap is a nuisance to taxonomy but a benefit to conversation.

3.1. "Mathematics is a technology"

> Once rockets are up, who cares where they come down?
> That's not my department, says Wernher von Braun.
> — Tom Lehrer, *Wernher von Braun* (c. 1964)

In this narrative, mathematics is seen as a tool, or a collection of tools, with the potential to be applied to the non-mathematical world. (It roughly corresponds to [27]'s "mathematics is useful".) As with any technology, the tools may not have been developed with these applications in mind, and the effects of using them may be unpredictable, but the tools inevitably shape their applications.

This narrative is probably the most thoroughly developed in EiM, and in recent years it has drawn strongly on work in computer science. A particularly thorough treatment is given in [10], while [36] provides practical advice for introducing ethics to students from this perspective. It fits naturally with a consequentialist approach: the authors of [10] frame their aim as empowering readers "to reduce the risk of undesirable and unwanted consequences".

A natural area of conversation concerns the social ramifications of technology. The authors of [10] stress the risks of embedded bias, arising both from data and from modelling assumptions, and the often unintended harm that results. Recent examples, ranging from predictive policing to large language models, are easy to find and provide a natural entry point for discussion. When a piece of mathematics is seen as a technology it is also natural to discuss costs (such as the human time invested in developing it or the computational resources required to implement it) and sponsors (who pays us to do this work, and why?)

How far is the developer of a technology responsible for the use of their technology? In my experience, few mathematicians adopt the position caricatured by Tom Lehrer, but there is scope for genuine debate as the chain of consequences becomes longer and less predictable. In the framework proposed in [10], the potential for lengthy chains of consequences obliges mathe-

maticians to act as responsibly as possible, actively anticipating and mitigating risks. The authors of [27] approach a similar conclusion from a different angle when they consider the "mathematics is useful" narrative from the perspective of virtue.

The practical application of these principles is, of course, the tricky part. In classroom discussion, it can be helpful to weigh and criticise the arguments offered in both historical and continuing debates, such as those over mathematicians' involvement with the "Star Wars" programme [42, pages 297–305] and with the intelligence services [33].

At the most general level, mathematics can be seen not simply as a collection of tools, but as a pervasive technology, applied throughout society by phrasing questions in quantitative or otherwise mathematical terms [11, 41]. At this point, the technological narrative overlaps with another narrative: mathematics as language.

3.2. "Mathematics is a language"

> Die Mathematiker sind eine Art Franzosen: redet man zu ihnen, so übersetzen sie es in ihre Sprache, und dann ist es alsobald ganz etwas Anderes.
> [Mathematicians are a kind of Frenchman: you tell them something; they translate it into their own language; and hey presto! it means something completely different.]
>
> — Johann Wolfgang von Goethe, *Maximen und Reflexionen* (1829)

The claim that mathematics is a language can open a surprisingly rich seam of ethical issues. Although mathematics is not a language in the same sense as (for example) Èdè Yorùbá or Gàidhlig, it is widely used as a means of description and communication: this is a common justification for its place in education, and a pervasive perception among students and teachers [17].

A natural and productive question is who is included and excluded by this choice of language. The "transparency paradox" [41] is crucial here: although mathematics is in principle completely transparent, with explicit definitions and derivations, in practice it is often completely opaque to outsiders. If mathematics is a language, it is sometimes a secret language [13], inflicting "epistemic injustice" [45] on those who do not speak it.

Even different subdisciplines of mathematics can be mutually incomprehensible. Understanding a field of mathematical research often depends on connecting with both a written and an oral tradition [56]; Morris [38] reflects on the virtues this entails, while Gordon [18] discusses the effect of the traditional written presentation of mathematics in which heuristics and motivation are often omitted. Considering epistemic justice and injustice leads naturally to discussion of whose duty it is to maintain the communications infrastructure (from expository papers to outreach) that keeps mathematics comprehensible, and what duty we have to equip a wider audience to understand and criticise mathematical claims.

Perhaps the most basic ethical responsibility associated with language is to use it to tell the truth. This might seem trivial for mathematics, in which claims are in principle highly verifiable, but when considered alongside the transparency paradox it becomes more interesting. In principle our statements can be verified; in practice, even how many published theorems are thoroughly checked? In the wider public sphere, it is all too easy to find mathematics used to bluff or bewilder, allowing nonsense to take a free ride on the perception of mathematics as rigorous and authoritative. A productive pedagogical starting point can be to consider the pseudo-mathematical equations, such as the infamous "Blue Monday" formula [7], that appear regularly in the media. What damage do these do both to the discipline and more widely? And where is the line between a silly-but-harmless gimmick and a corrosion of integrity? (We will return to this in §3.5 when we consider mathematics as a game.)

Deciding to use mathematics for communication or description at all is a choice with ethical dimensions. This process has been called "mathematisation" or "mathematising" [11, 27], or more evocatively, "scripting the world in mathematics" [52]. It tends to be more obvious to sociologists than to mathematicians that mathematisation imposes a strong order on what (or whom) mathematics is used to describe, and that the legitimacy of mathematical reasoning rubs off, without justification, on the modelling assumptions used to translate the world into mathematics. (There is a strong link here to mathematics as a technology, particularly data science and algorithms: see [10, 52] for discussion.)

Mathematisation can be seen as ethically or epistemically virtuous, complementing other perspectives and thus enabling more complete understanding

[27, 54]. It can also be vicious [11, 14]. A productive exercise with students can be to take an example of mathematical modelling — I have recently used the predictive-policing model from [46] — and dissect it. What is being modelled? How is it being measured? What is being left out? Who made these choices, and why?

One of the oldest and most pervasive mathematisations is money. Money itself can be understood as a language, allowing commodities' value to be negotiated in an uncertain world; Johnson [25] argues that it can only function on the basis of the ethical norms — reciprocity, sincerity, and charity — which allow a trusted consensus to form, and that the uncritical use of mathematics to make deterministic predictions in the teeth of uncertainty violates these norms. Thus, recent financial crises result from failure to respect the intrinsic ethics of finance. This argument offers an alternative starting point for financial mathematicians who find the political assumptions of much EiM literature offputting.

Finally, the parallel between modelling and translation suggests that mathematical modellers may have something to learn from translators. Translation ethics, like EiM, is a sprawling area with many acute questions and little theoretical consensus, in which different theories of translation foreground different ethical approaches [30]. Particularly relevant questions involve the fidelity of a translation (or a mathematical model?) to its original (a real-world system?). Fidelity can be understood in a variety of ways [8, pages 15–18] or in some theories made entirely secondary [21].

Does the following account of translational action sound like an apt description of some fields of mathematical modelling?

> *The "Design-Text," i.e. a text that is tailor-made for a specific purpose in a specific situation or context, can differ greatly from the source text... and does not necessarily need to be linked to a source text at all.* [21]

If so, what ethical implications might this difference carry?

3.3. "Mathematics is a profession"

> All professions are conspiracies against the laity.
> — George Bernard Shaw, *The Doctor's Dilemma* (1906)

A particularly useful narrative when introducing students to EiM is that of mathematics as a profession — the profession in which they are serving their apprenticeship. In this narrative, mathematics is a community defined, like medicine or law, by access to specialised knowledge, which claims the right to define and maintain its own standards and in return imposes certain duties on its members. (A deontological approach often fits most comfortably with this narrative.) Professionalism can be seen as a response to the transparency paradox noted in §3.2 between those within and outwith the profession; it provides a mechanism for maintaining trust in the absence of full transparency.

Mathematics, of course, is only debatably a profession [39, 43]. It lacks clear criteria for membership and definitive professional bodies, and mathematicians have no social monopoly on doing mathematics. However, this ambiguity can be an advantage, because it foregrounds some crucial questions.

Who counts as a member of the profession, and who decides this? Most mathematicians have a fairly strong conviction that our discipline deserves autonomy: we should be the arbiters of what counts as mathematics. Asking who "we" are links that conviction directly to troubling questions of social justice: who gets access to mathematical education; who gets taken seriously; how the boundaries of "mathematics" are drawn to include or exclude certain groups.

What responsibilities do mathematicians owe to our colleagues? Collegiality — behaving fairly to one's fellow mathematicians — seems uncontroversial, but it is easy to identify scenarios, both historical and contemporary, in which it breaks under strain [22]; the concept of disciplinary stewardship [57] may be useful here. Particularly interesting discussions follow from situations in which bad behaviour (ranging from selfishness to bullying) appears to benefit the profession overall: the authors of [55] provide an interesting discussion of the infamous Gelfand seminar which can be contrasted with the ethic of generosity described in [38].

What responsibilities do mathematicians owe to our clients? The concept of a client for mathematical research fits more naturally with the narrative of mathematics as technology, but as Hersh [22] argues, it can be thought of as whoever pays your salary. Considering the difference between a client and

a customer in this context allows concerns from the "technology" narrative to be extended to other areas of mathematics, from research to teaching and outreach.

Another productive direction concerns codes of conduct, codes of ethics, and ethical oaths [39, 44]. It can be instructive to compare the codes of various learned and professional societies and discuss the limits of codification; Hersh [23] provides an instructive satire, and a glimpse of the struggles that lie behind the bland faces of such codes.

3.4. "Mathematics is an art form"

> Beauty is the first test: there is no permanent place in the world for ugly mathematics.
>
> — G. H. Hardy, *A Mathematician's Apology* (1940)

A popular narrative among pure mathematicians, which is not unknown even among applied mathematicians, is that mathematics is an art (in the terms of [27], "mathematics is beautiful").

Proponents of this narrative often claim that mathematics itself is value-free, or at any rate that the values it possesses are truth and beauty, and so ethical considerations are irrelevant. At the same time, they tend to insist on mathematicians' right to determine what constitutes good, or beautiful, mathematics, and our duty to defend that right against usurpers [6] who aim to redefine it.

This apparent paradox — the duty to protect a value-free space — is a useful entry point to ethics. In this narrative, doing and appreciating mathematics is a part of human flourishing, whether one understands this in an elitist sense [19, 47], or in the more radically inclusive spirit of [54]: "a vitally human endeavour, grounded in basic desires that we all share, and elevated by virtues to which we can all aspire". The appropriate tool, as this choice of words indicates, is virtue ethics.

Ernest [15] provides a useful structure, following MacIntyre's three-level formulation of virtue ethics. The first level consists of the qualities (ethical and epistemic) that lead to doing good mathematics; the second consists of qualities that contribute to a good, or flourishing life; the third, qualities that nurture a flourishing tradition which benefits humanity collectively. Crucial to this approach is that at the second level we aim to tell a consistent ethical

story about ourselves. This point sounds nebulous until we consider it in practice: discussing concrete scenarios swiftly brings out comments such as "that seems hypocritical" or "you have to be able to live with yourself".

The most productive conversations around this narrative tend to start with the internal ethics of the mathematical community before moving up MacIntyre's levels. Are there "productive vices", or mathematicians whose bad behaviour must be tolerated for the greater good of the art? (Again, see [55] on the Gelfand seminar; this is also a good starting point for a sensitively handled discussion of toxic behaviours and the cult of the brilliant jerk.) Do we have a duty to make the art form accessible to others, and if so then how? What are our standards of mathematical beauty and who determines them? (A historical perspective can be helpful here.)

We can also approach ethics obliquely within this narrative by asking, if mathematics is an art form, which other art forms it resembles. If we draw connections between mathematics and poetry (e.g. [28]) we form a bridge to the issues of mathematics as language. If we compare mathematics to visual art, this raises similar questions of representation and abstraction: another form of "scripting the world". If, alternatively, we link mathematics to music, this leads naturally to discussions of taste. (Almost everyone, it seems, has tastes in music, and remembers their teenage years when those tastes seemed overpoweringly important.) Who forms our tastes in mathematics? What tribes or subcultures do they make us part of? What is the role of a critic in mathematics [50] and what power do they hold? All of these are value-laden questions; all cause us to interrogate the practices around the art.

3.5. "Mathematics is a game"

> La science ne présente que trois intérêts : 1º les applications techniques ; 2º jeu d'échecs ; 3º chemin vers Dieu. (Le jeu d'échecs est agrémenté de concours, prix et médailles.)
> [Science offers only three kinds of interest: 1. technical applications; 2. a chess game; 3. a way to God. (The chess game is embellished with competitions, prizes and medals.)]
> — Simone Weil, *La pesanteur et la grâce* (1947)

It is helpful to distinguish between two senses of a "game". Mathematics can be considered as play, characterised by freedom; and it can be considered as a sport, characterised by competition and reward [40]. Both narratives come

up in conversation but seem to be somewhat underexplored in published discussions of EiM; both lead readily to serious discussions of power and fairness.

The narrative of mathematics as play emphasises our freedom to create and explore new mathematical concepts, which need not be motivated by utility or directly model anything in the physical world. (Su [54, chapter 4] argues that such free play is a basic form of human flourishing.) This narrative overlaps somewhat with mathematics as art, and raises many of the same issues, but it tends to place more emphasis on the experience of the participants – play does not require an audience.

A useful concept, going back to [24], is that play takes place in a "magic circle", a space into which we step voluntarily, and within which our actions do not have consequences outwith the circle. More recent discussions emphasise the permeability of the magic circle considered as a social norm [40, §5]. What are the social consequences of playing well or badly? Who is invited to play and who is excluded? This can immediately foreground questions of belonging, identity, and power in mathematics. A productive area to consider is recreational mathematics, which at its best provides a magic circle in which professional and amateur mathematicians meet – though not necessarily on quite the same terms. (Consider, for example, the contrasting ways in which the work on recreational tiling problems by the "amateur" Marjorie Rice and the "professional" Roger Penrose is generally presented.) Similar issues arise in play as a component of learning, in which the magic circle becomes a safe space for creative failure. Who is allowed to play there, and on whose terms?

Karaali [29] considers the permeability of the magic circle from another angle, pointing out that even apparently frivolous play ("jests") may have consequences. She takes the example of "zombie apocalypse" models, widely used as a fun introduction to epidemiology, and considers the undertones of a model that rewards a merciless response to an imaginary threat; this resonates with concerns about the morality of violence in video games [40, §7]. (There are also echoes of the infamous textbook question quoted by [49].) As Karaali points out, by framing what we do as pure play we run the risk of claiming to be "useful mathematicians doing useless mathematics" [29]; if we take utility seriously it leads us back towards the narrative of mathematics as technology.

The narrative of mathematics as a sport captures mathematicians' tendency to compete for credit and rewards, even when these do not correspond to external goods such as career progression; it corresponds roughly to the "mathematicians aim at theorem-credit" narrative in [27]. The rewards for which we compete range from such theorem-credits [38, 56], through authorships and citations more generally, all the way up to prizes and eponyms.

There is a substantial literature on the philosophy and ethics of sport, much of which has parallels in mathematics [12]. A sport is not defined purely by the rules, which are surrounded by socially negotiated conventions that define intangibles such as "the spirit of the game" and "the beauty of mathematics". (There is a natural connection here with collegiality and codification in the context of a profession.) The social negotiation is reflected in questions of sportsmanship and gamesmanship. To what extent is it fair to draw inspiration from someone else's results and not credit them? Is it sometimes ethical to exploit or break the rules for the benefit of one's "team" (discipline / university / colleagues), for example in how one writes grant applications or peer reviews — just as a football player might be expected to dive in the penalty box? Authorship is a particularly interesting conversation-starter: should authorship be assigned on the basis of whom it will benefit to be given the credit [35], or is this somehow cheating?

At the level of priority, prizes and eponyms, productive questions can be asked about how, or whether, the reward structure of mathematics benefits the discipline. Which epistemic virtues do our definitions of discovery reflect [20, 37]? Does the reward structure encourage productive ambition [19, 38], or perhaps "productive vices" [55]? Does it promote certain fashionable areas at the expense of others, and secure prestige for a self-perpetuating clique [5]? Does it tend to penalise mathematicians who focus on the "infrastructure" of exposition [56]? Does it perpetuate names that are better forgotten? (Many mathematicians will argue that the names of certain Nazi mathematicians should be honoured despite their politics; that discussion becomes more interesting when we consider that those politics involved forcing their rivals out of academia.)

3.6. Other narratives of mathematics

The five narratives discussed above are not comprehensive. It may be helpful to mention briefly another couple of narratives; the reader is encouraged to think of more.

"Mathematics is (a search for) truth or understanding." This narrative covers a range of philosophical positions, which all share a sense that mathematical knowledge is in some sense objective, and that its value does not rest solely on its applications. In practice, the ethical issues that arise are similar to those of "mathematics is an art form", only with slightly higher stakes, and ideas from virtue theory can be useful in bridging the gap between good mathematics and good behaviour. (Su [54, chapters 6–7] discusses both permanence and truth as eudaimonic virtues of mathematics; similarly, Kant and Sarikaya [27, §3.3] discuss understanding as a virtue.)

"Mathematics is a gift." This narrative of mathematics tends to accompany the popular trope of the mathematician as geek/genius/eccentric. It is perhaps the dominant external narrative of mathematics, with well-known harmful effects for minoritised groups [34]. Within mathematics it is often adopted with a certain self-consciousness, and perhaps partly in self-defence (see the interviewees in [13]). It is probably best approached as an example of the defensive narratives discussed below.

4. What makes talking about ethics hard?

> "and what is the use of a book", thought Alice, "without pictures or conversations?"
>
> — Lewis Carroll, *Alice's Adventures in Wonderland* (1866)

As the previous section has indicated, many narratives of mathematics are available, and each tends to centre a different set of ethical issues. It is not surprising that conversation sometimes breaks down because we find ourselves talking at cross purposes. Often this difficulty can be circumvented and the conversation restored by realising that two inconsistent narratives are in play; as the previous section indicates, it can be productive to accept the other person's narrative and to start by exploring the ethical issues that it raises.

It is also important to acknowledge that good-faith resistance to EiM initiatives exists, and to treat it as such. Of course, not all resistance is in good faith. Some is deliberately insincere, a mere cover for selfish or malicious intentions, and some springs from a kind of weaponised naivety.

In classroom discussion, it can be helpful to recognise defensive narratives: rhetorical positions that are adopted when someone fears losing control of the conversation. (The phrase "just to play devil's advocate" often signals such a narrative.) One defensive tactic is to pivot from discussing mathematics as a discipline to discussing it purely as a body of knowledge (it does no harm to cede the terminology here in order to broaden the conversation again). Another, especially when questions of diversity arise, is to double down on the narrative of mathematics as a gift — a kind of Platonic charism instantly recognised by others who have received it. In my experience, few mathematicians are genuinely committed to this position. A useful classroom exercise is to put students in the position of a panel making a decision about conference speakers or prize recipients and arguing their merits: the elusive nature of mathematical brilliance quickly becomes apparent.

One trap for EiM advocates to avoid is the deficit model of ethical engagement. I have borrowed this term from science communication: in our context, a deficit model suggests that if mathematicians only knew more history, studied more sociology, adopted the correct philosophical framework, or did enough moral calisthenics, then they would rise to a higher level of ethical engagement (cf. [9, 31]). In some cases this may be true, but by failing to engage with mathematicians' existing narratives, this model risks being counter-productive.

It is important to be sensitive to questions of credibility and trust. By taking an interest in EiM, we place ourselves in some sense on the edge of the mathematical community, where our perspectives are influenced as much by historians, philosophers or sociologists of mathematics as by mathematicians. This is both necessary and dangerous. To describe our discipline accurately, including its flaws, we need an outside view. To negotiate or renegotiate its norms, we need to work from within, from a position in which we can ask our colleagues and students to trust us.

The deficit model harms such trust, as does the disciplinary one-upmanship that pervades academia: no-one likes to be scolded by spectators who never get their hands dirty at the chalkface. Particular care needs to be taken with provocations designed to expose mathematicians' lack of ethical awareness. Used appropriately, these can be valuable; used heavy-handedly they cause immediate resentment.

We must also be prepared, sometimes, to lose control. Most of those of us who engage in EiM initiatives do so not just because we believe that other mathematicians should consider ethics more carefully, but because we hope that if they do so, then they will come to agree with us. This applies especially to political issues, where it is both easy and self-defeating to demand agreement with our conclusions as the price of entry to the conversation. (This is not to say that anybody owes conversation to people whose politics deny their own basic rights. In such cases the task of conversation, if it is possible, must fall to someone else.)

In my experience, resistance to "politics" in mathematics often arises from a fear that the internal values of the discipline are being overridden, and it is particularly strong in mathematicians who have experienced or escaped from totalitarian regimes. For such people, resistance to "enemies of the art itself" [15] is also an ethical duty, rooted in the heroism of artists such as Osip Mandelstam who refused to compromise with the absolute demands of the Soviet regime. Like Hardy [19], who wrote as an aging anti-militarist during wartime, they may also feel compelled to justify treating mathematics as a consolation and escape.

If we wish to overcome this resistance, we need to frame the conflict as one between different goods, not between good and evil. MacIntyre's system of virtue ethics (see [15] and §3.4 above) may offer the most constructive route towards conversation, with its emphasis on the consistency of one's life and values. If we aim to enable genuine engagement with EiM, we may have to accept that sincere consistency will sometimes leave different mathematicians in somewhat different positions. Like other disciplines (cf. [32]) we may have to learn to live with a pluralist approach, developing our own practical wisdom and even allowing our principles to be challenged by the sincere resistance of others.

Finally, we must be careful in how much we allow EiM to become institutionalised. To prevent gross abuses of power and to address ethical issues at a systemic level, we need tools, including institutional policies, ethics committees, and codes of conduct. However, these bring with them the danger that ethics is reduced to compliance: if I have followed the formal process, then I can't be blamed. When institutional ethics requirements are sandwiched between cyber-security training and the branding requirements for Powerpoint slides, ethics does not emerge as a living and vital concern. Real engagement often starts precisely where the rules leave off.

5. Conclusions: opportunities and questions

If we are to engage with fellow mathematicians on ethical issues, then conversation is the only option. Grading their level of ethical engagement, enforcing mandatory ethics training, or haranguing them for their philosophical muddle-headedness may all seem appealing, but move nothing forward. In that conversation, we need to be alert to our own implicit narratives and the issues they bring into focus, as well as to those of our interlocutors. Even initially unpromising narratives can readily lead to serious ethical conversation. I hope that by making some of these narratives explicit, this paper may make the conversation easier.

Different narratives have so far been explored to quite different extents within EiM. The narrative that "mathematics is a technology" has been developed quite thoroughly in recent years, and there are now resources based on this narrative that aim to speak directly to mathematicians (Alayont [3] and Miller [36] provide useful overviews). For other narratives, such as "mathematics is a language" and "mathematics is an art form", there is a substantial body of discussion to draw on, but much of it remains external to mathematics; the challenge is to bring it into the internal conversation. "Mathematics is a profession" remains, and will probably always remain, an ambiguous claim, but that ambiguity itself presents opportunities. The narratives of "mathematics is a game" seem to present different opportunities: how productively can concepts such as sportsmanship or the magic circle of play be translated into terms that make sense to mathematicians?

It is also asking what our own narratives of "ethics in mathematics" are, and what we mean it to achieve. Is it a reaction and a deterrent to specific and immediate harms done by, or in the name of, mathematics? Is it part of an effort to re-establish mathematics as a contingent, fallible, and value-laden human activity? Is it a way to put mathematics back into its place as a technical discipline that must defer to philosophy or sociology? Is it a defence for mathematicians who might otherwise be put to evil use? Is it a necessary part of flourishing as a good (or virtuous) mathematician? Arguments can be made for each of these; which of them really matters to us is something we might not discover until we hear ourselves speak.

Acknowledgements. I am grateful to around 170 students who have taken part in my workshops, and to the many colleagues who have helped me to develop my ideas, either by joining the conversation or by telling me at

length that I am wrong. I would also like to thank the Editors, an anonymous reviewer, and an internal reader for their comments on a previous version of the manuscript.

References

[1] Andrew Aberdein, Colin Jakob Rittberg, and Fenner Stanley Tanswell, "Virtue theory of mathematical practices: an introduction," *Synthese*, Volume **199** (2021), pages 10167–10180.

[2] Quality Assurance Agency, *Subject Benchmark Statement: Mathematics, Statistics and Operational Research*, 2023. Available at https://www.qaa.ac.uk/the-quality-code/subject-benchmark-statements/subject-benchmark-statement-mathematics-statistics-and-operational-research, last accessed on January 22, 2026.

[3] Feryal Alayont, "A case for ethics in the mathematics major curriculum," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (2022), pages 160–177. doi:10.5642/jhummath.CXSI3022

[4] Larry Alexander and Michael Moore, "Deontological ethics. In Edward N. Zalta and Uri Nodelman, editors, *The Stanford Encyclopedia of Philosophy*. Winter 2024 edition, 2024. https://plato.stanford.edu/archives/win2024/entries/ethics-deontological.

[5] Michael Barany, "The Fields Medal should return to its roots," *Nature*, Volume **553** (2018), pages 271–273.

[6] Viktor Blåsjö, "Mathematicians versus philosophers in recent work on mathematical beauty," *Journal of Humanistic Mathematics*, Volume **8** Issue 1 (2018), pages 414–431. doi:10.5642/jhummath.201801.20

[7] Dean Burnett, "Blue Monday: a depressing day of nonsense science (again)," *The Guardian*, 21 January 2013. Available at https://theguardian.com/science/brain-flapping/2013/jan/21/blue-monday-depressing-day-nonsense-science, last accessed on January 22, 2026.

[8] Andrew Chesterman, "Virtue ethics in translation," pages 13-24 in [30].

[9] Maurice Chiodo and Piers Bursill-Hall, "Four levels of ethical engagement," Technical report, University of Cambridge Ethics in Mathematics Project, 2018. Discussion Paper 1/2018. https://www.ethics-in-mathematics.com/assets/dp/18_1.pdf, last accessed on January 22, 2026.

[10] Maurice Chiodo and Dennis Müller, "Manifesto for the responsible development of mathematical works: a tool for practitioners and for management," preprint; arXiv:2306.09131 [math.HO], 2023.

[11] Philip J. Davis, "Applied mathematics as social contract," *Mathematics Magazine*, Volume **61** Issue 3 (1988), pages 139–147.

[12] John William Devine and Francisco Javier Lopez Frias, "Philosophy of sport," *The Stanford Encyclopedia of Philosophy*, Fall 2023 edition, 2023. Available at https://plato.stanford.edu/archives/fall2023/entries/sport/, last accessed on January 22, 2026.

[13] Debbie Epstein, Heather Mendick, and Marie-Pierre Moreau, "Imagining the mathematician: young people talking about popular representations of maths," *Discourse: Studies in the Cultural Politics of Education*, Volume **31** Issue 1 (2010), pages 45–60.

[14] Paul Ernest, "Values and the social responsibility of mathematics," *Philosophy of Mathematics Education Journal*, Issue 22 (2007). Available at https://sites.exeter.ac.uk/pmej.

[15] Paul Ernest, "Mathematics, ethics and purism: an application of MacIntyre's virtue theory," *Synthese*, Volume **199** (2021), pages 3137–3167.

[16] Dwight Furrow, *Ethics*, Key Concepts in Philosophy. Continuum, 2005.

[17] Nurgül Düzenli Gökalp, "Mathematics — how do students and teachers perceive it?" *International Journal of Innovation in Science and Mathematics Education*, Volume **28** Issue 1 (2020), pages 16–28.

[18] Marshall Gordon, "The formal presentation language of mathematics and communication ethics," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (2022), pages 28–48. doi:10.5642/jhummath.OOTE2363

[19] G. H. Hardy, *A Mathematician's Apology*, Cambridge University Press, 1940.

[20] Michael Harris, "Virtues of priority," preprint, arXiv:2003.08242v1 [math.HO], 2020.

[21] Gernot Hebenstreit, "Functional tranlsation theories and ethics," pages 58-71 in [30].

[22] Reuben Hersh, "Mathematics and ethics," *The Mathematical Intelligencer*, Volume **12** Issue 3 (1990), pages 13–15.

[23] Reuben Hersh, "Ethics for mathematicians," *Philosophy of Mathematics Education Journal*, Issue 22 (2007). Available at https://sites.exeter.ac.uk/pmej.

[24] Johan Huizinga, *Homo Ludens: A Study of the Play Element in Culture*, Temple Smith, 1970. Originally published as *Homo Ludens. Proeve eener bepaling van het spel-element der cultuur* (1938); translator of this edition not credited.

[25] Timothy Johnson, *Ethics in Quantitative Finance: A Pragmatic Financial Market Theory*, Palgrave Macmillan, 2017.

[26] Lauris Christopher Kaldjian, "Teaching practical wisdom in medicine through clinical judgement, goals of care, and ethical reasoning," *Journal of Medical Ethics*, Volume **36** (2010), pages 550–562.

[27] Deborah Kant and Deniz Sarikaya, "Mathematizing as a virtuous practice: different narratives and their consequences for mathematics education and society," *Synthese*, Volume **199** (2021), pages 3405–3429.

[28] Gizem Karaali, "Can zombies write mathematical poetry? Mathematical poetry as a model for humanistic mathematics," *Journal of Mathematics and the Arts*, Volume **8** Issue 1–2 (2014), pages 38–45.

[29] Gizem Karaali, "Doing math in jest: Reflections on useless math, the unreasonable effectiveness of mathematics, and the ethical obligations of mathematicians," *The Mathematical Intelligencer*, Volume **41** (2019), pages 10–13.

[30] Kaisa Koskinen and Nike K. Pokorn, editors, *The Routledge Handbook of Translation and Ethics*, Routledge, 2021.

[31] Roman Kossak, "Is there ethics in mathematics?", preprint, arXiv:2507.01185v2 [math.HO], 2025.

[32] David O. Kronlid and Johan Öhman, "An environmental ethical conceptual framework for research on sustainability and environmental education," *Environmental Education Research*, Volume **19** Issue 1 (2012), pages 21–44.

[33] Tom Leinster, "Math and mass surveillance: A roundup," *The n-Category Café*, 15 July 2014. Available at https://golem.ph.utexas.edu/category/2014/07/math_and_mass_surveillance_a_r.html, last accessed on January 22, 2026.

[34] Sarah-Jane Leslie, Andrei Cimpian, Meredith Meyer, and Edward Freeland, "Expectations of brilliance underlie gender distributions across academic disciplines," *Science*, Volume **347** Issue 6219 (2015), pages 262–265.

[35] Max Liboiron, Justine Ammendolia, Katharine Winsor, Alex Zahara, Hillary Bradshaw, Jessica Melvin, Charles Mather, Natalya Dawe, Emily Wells, France Liboiron, Bojan Fürst, Coco Coyle, Jacquelyn Saturno, Melissa Novacefski, Sam Westcott, and Grandmother Liboiron, "Equity in author order: A feminist laboratory's approach," *Catalyst: Feminism, Theory, Technoscience*, Volume **3** Issue 2 (2017), pages 1–17.

[36] Alison N. Miller, "A mini-seminar: Teaching ethics in mathematics in an hour a week," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (2022), pages 178–203. doi:10.5642/jhummath.XWBZ9758

[37] David Philip Miller, *Discovering Water: James Watt, Henry Cavendish and the Nineteenth-Century 'Water Controversy'*, Routledge, 2004.

[38] Rebecca Lea Morris, "Intellectual generosity and the reward structure of mathematics," *Synthese*, Volume **199** (2021), pages 345–367.

[39] Dennis Müller, Maurice Chiodo, and James Franklin, "A Hippocratic Oath for mathematicians? Mapping the landscape of ethics in mathematics," *Science and Engineering Ethics*, Volume **28** (2022), page 41.

[40] C. Thi Nguyen, "Philosophy of games," *Philosophy Compass*, Volume **12** (2017), page e12426.

[41] Gregor Nickel, "Ethics and mathematics: some observations fifty years later," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (2022), pages 7–27. doi:10.5642/jhummath.PXMY2159

[42] Everett Pitcher, *A History of the Second Fifty Years, American Mathematical Society, 1939–1988, Volume I.* American Mathematical Society, 1988. Available at https://www.ams.org/publicoutreach/math-history/hmpitcher-index, last accessed on January 22, 2026.

[43] David Pritchard, "Ethics for professionals?", talk at *Ethics in Mathematics 1* conference (University of Cambridge), April 2018. Recording available at https://www.ethics-in-mathematics.com/EiM1/, last accessed on January 22, 2026.

[44] Colin Jakob Rittberg, "Hippocratic Oaths for mathematicians?" *Philosophia*, Volume **51** (2023), pages 1579–1603.

[45] Colin Jakob Rittberg, Fenner Stanley Tanswell, and Jean Paul Van Bendegem, "Epistemic injustice in mathematics," *Synthese*, Volume **197** (2020), pages 3875–3904.

[46] Victor Rotaru, Yi Huang, Timmy Li, James Evans, and Ishanu Chattopadhyay, "Event-level prediction of urban crime reveals a signature of enforcement bias in US cities," *Nature Human Behaviour*, Volume **6** (2022), pages 1056–1068.

[47] Bertrand Russell, "The study of mathematics," chapter IV in *Philosophical Essays*, Allen & Unwin, 1910.

[48] Lim Chap Sam, *Public Images of Mathematics*, PhD thesis, University of Exeter, 1999.

[49] Bonnie Jean Shulman, "Is there enough poison gas to kill the city?: The teaching of ethics in mathematics classes," *The College Mathematics Journal*, Volume **33** Issue 2 (2002), pages 118–125.

[50] Nathalie Sinclair, "Aesthetic considerations in mathematics," *Journal of Humanistic Mathematics*, Volume **1** Issue 1 (January 2011), pages 2–32. doi:10.5642/jhummath.201101.03

[51] Walter Sinnott-Armstrong, "Consequentialism," *The Stanford Encyclopedia of Philosophy*, Winter 2023 edition, 2023. Available at https://plato.stanford.edu/archives/win2023/entries/consequentialism, last accessed on January 22, 2026.

[52] Ole Skovsmose, Keiko Yasukawa, and Ole Ravn, "Scripting the world in mathematics and its ethical implications," *Philosophy of Mathematics Education Journal*, Issue 26 (2011). Available at https://sites.exeter.ac.uk/pmej.

[53] Richard Spindler, "Foundational mathematical beliefs and ethics in mathematical practice and education," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (July 2022), pages 49–71. doi:10.5642/jhummath.GOSN2205

[54] Francis Su, *Mathematics for Human Flourishing*, Yale University Press, 2022.

[55] Fenner Stanley Tanswell and Ian James Kidd, "Mathematical practice and epistemic virtue and vice," *Synthese*, Volume **199** (2021), pages 407–426.

[56] William P. Thurston, "On proof and progress in mathematics," *Bulletin of the American Mathematical Society*, Volume **30** (1994), pages 161–177.

[57] Rochelle E. Tractenberg, "Stewardship of mathematics: essential training for contributors to, and users of, the practice of mathematics," *Journal of Humanistic Mathematics*, Volume **12** Issue 2 (July 2022), pages 221–253. doi:10.5642/jhummath.PMAT5804

[58] Rochelle E. Tractenberg, Victor I. Piercey, and Catherine A. Buell, "Defining "ethical mathematical practice" through engagement with discipline-adjacent practice standards and the mathematical community," *Science and Engineering Ethics*, Volume **30** Article Number 15 (2024).