Review of *Mathematics without Apologies: Portrait of a Problematic Vocation,* by Michael Harris. Princeton U. Press 2015. xxii+438 pages.

According to the dust jacket, "*Mathematics without Apologies* takes the reader on an unapologetic guided tour of the mathematical life, from the philosophy and sociology of mathematics, to its reflection in film and popular music, with detours through the mathematical and mystical traditions of Russia, India, medieval Islam, the Bronx, and beyond." That will do fine as a summary of its contents.

There are many fascinating and insightful nuggets in Harris' book. For example, his comparison (p. 218) of Erdős and Grothendieck — the great exemplars, with Grigori Perelman, of the unworldly mathematical genius — is admirable:

> Erdős had more than a few things in common with Grothendieck. Both men were extraordinarily devoted to their mothers. Both were Central European Jews displaced, irreversably, by World War II. Erdős left Hungary and just kept traveling, while Grothendieck remained stateless for many years by choice. While Grothendieck's premonition of the avatar ladder reaches ceaselessly upward, Erdős built a no less tangled horizontal network of collaborations.

However, overall, I can't remember when I last read a book that was as "unapologetically" self-satisfied and self-congratulatory. The general spirit of the book is exemplified in a scene reported in chapter 6 (p. 161). Reine Graves, who co-directed the mathematician Edward Frenkel's film *Rites of Love and Math*, was asked at a reception why she decided to make a film about mathematics.

> Graves . . . gave the best possible answer. Mathematics, she began, is *un des derniers domains où il y a vraie passion* [one of the last areas where there is a genuine passion]. . . . Mathematics, like a very few other activities — she mentioned physics and sculpture — is practiced without complacency [*sans autosatisfaction*]; instead there is a true *exigence au travail* [demanding work ethic]. Mathematicians seek to *percer le mystère*. You can see it at once in *l'oiel qui brille* [the eye that gleams].

Harris makes similar claims throughout the book; for instance he writes that math is "one of the few remaining human activities not driven by commercial considerations."

Look, I'm as susceptible[1] as the next guy to flattery from French experimental film directors making oracular pronouncements in French; but really this is *merde de taureau.* Or, at least, it bears no relation to the world as I've encountered it. Over the years, I've known a fair number of mathematicians and a few physicists, and certainly they are mostly deeply interested in what they are doing; but they have no greater a *vraie passion* or work ethic than (somewhat at random) the neuroscientists, historians, librarians, musicians, violin makers, writers, journalists, photographers, Quenya enthusiasts, and rock gardeners that I've known. Of these, in fact, I would say that the rock gardeners take the prize for *vraie passion* and *exigence au travail*; and journalists for desire to *percer le mystère*. Sad to say, I have never noticed *l'oiel qui brille*; perhaps that requires a film director's eye. As for *autosatisfaction*, I've rarely seen it so vividly on display as in Harris' book.

Creative artists and adoring sophisticated women with a worshipful attitude toward mathematics and mathematicians are a recurring presence in Harris' book. "Is it any wonder," he muses contentedly, "that, in popular culture's serious precincts, the mathematician has become

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[1] By which I mean that presumably I would be as susceptible, if it ever happened, which is exceedingly improbable, and if I spoke French.

the romantic figure of choice?" (p. 310). Chapter 6 traces the romantic cult of the mathematician from the eighteenth century to the present. I am sorry to spoil Harris' idea of the eighteenth-century mathematics students at Cambridge as "objects of romantic interest" but the quote that he cites (p. 148) does not mean that the Wranglers were admired by society ladies; it means that they visited brothels. In any case, the quote is from a satire and can hardly be relied on for historical accuracy.[2]

Harris is just as pleased with himself as with his chosen field. On p. 38, he tells us that "By granting me tenure at the age of twenty-seven, Brandeis ratified my permanent admission to the community of mathematicians. . . . [T]he privileges befitting my charismatic status . . . included and still include regular invitations to research centers like the IAS [Institute for Advanced Study], the IHES, or the TATA Institute for Fundamental Research . . . the Fields Institute in Toronto, the Mathematical Sciences Research Institute (MSRI) in Berkeley, or the Institute Henri Poincaré in Paris" and so on and on, for two pages. Presumably this is somewhat tongue-in-cheek, or at least Harris has convinced himself that it is. But the line between this and the garden-variety arrogant jerk whose idea of conversation is to recite his C.V. is fainter than Harris realizes.

Harris pats himself on the back vigorously for being too pure of soul to *grok* anything so vulgar and grasping as finance:

> It's not the equations that make it difficult for a mathematician like me to grasp quantitative finance. My problem is with adopting the psychology, the motivations, the *persona* of *Investor* ... Someone who . . . has never aspired to playing *Investor*, a figure whose cardinal virtue is maximizing returns, is at a distinct disadvantage.

I'm not buying it. I don't understand much about finance myself, for the simple reason I find it boring, I'd much rather spend my time thinking about other things, and my income is large enough that I can live comfortably without being clever about investing. Moreover, whether or not Eugene Fama is right that no one can ever beat the market, it would unquestionably require a lot of work, since it would involve outsmarting a lot of people who are pretty much as smart as me and are working hard at it. So I am presumably just as well off with my savings in an index fund. Dollars to donuts Harris' actual motivations are the same. In any case, ignorance is never a matter for self-congratulation; it is too easy to attain.

Harris is disgusted with the philistines in government who dare question why mathematical research should be funded at taxpayer expense. He gives a very extensive historical survey and deep analysis of the various justification given for doing mathematics: primarily playing off the argument that mathematics is beautiful or that it is art (Hardy's justification) against the argument that mathematics has practical benefits (the "Golden Goose" argument). He argues, obviously correctly, that the Golden Goose argument has very little to do with the practice or motivations of most pure mathematicians; and he is not content with the art argument, since mathematics is many ways actually not very similar to the mainstream arts. The position he ends up with is that mathematics, and other abstract intellectual studies, are forms of creative play and deserves support on that basis. He writes[3] (p. 70)

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[2]The full quote, from *The Friendly and Honest Advice of an Old Tory to the Vice-Chancellor of Cambridge,* (1751) is as follows: "The Wranglers I am told on the first Day of their Exercise have usually expected that all the young Ladies of their Acquaintance (whether such as have sometimes made their Bands, or who are more genteely employed in keeping the Bar at a Tavern or a Coffee-house) should wish them Joy of their Honours. To give them an opportunity of doing so, their Manner has been to spend the Morning in going to several of their Houses." Quoted in *Social Life at the English Universities in the Eighteeth Century,* p. 398.
http://archive.org/stream/cu31924100477466/cu31924100477466_djvu.txt

[3]The immediate subject here is philosophy; but clearly he intends that it applies to mathematics as well.

> [W]hy is it a matter of general interest ... to have a small group of people working at the limit of their creative power on something they enjoy? ... [I]f the question is taken at face value, it answers itself. Indeed, if the notion of general (or public) interest means anything at all, it should be a matter of general interest that work should be a source of pleasure for as many people as possible.

The idea that the best examplar of the public interest is funding for philosophers or mathematicians does seem rather parochial and self-serving. Nowhere in his long discussion does Harris raise or acknowledge the obvious question here: If the goal is to maximize the pleasure that people get out of their work, is the best use of finite government funding actually to support research on algebraic number theory; or might the net gain of utility be greater if the funds were spend in alleviating the horrible working conditions of migrant workers, people who pack things in Amazon.com warehouses, and so on? The question in Harris' discussion is always "What's the right way to think about mathematics?", never "What's the right way to spend government funds?" which is the problem that the philistines are obliged to face. I am, certainly, in no position to criticize Harris for being the beneficiary of an economic system that distributes material goods in a spectacularly unequal way, since I am equally a beneficiary of that system; but it seems to me that it is in bad taste for him to be so complacent about it.

In practical terms, arguing that mathematics without clear direct practical applications (essentially all of pure math and much of so-called "applied math") should be funded on the basis of its being creative pleasure rather than a golden goose of practical applications is pretty much tantamount to saying that it should be funded at the level of the NEH rather than at the level of the NSF.[4] Whether or not Harris would be content with this outcome is not clear to me. If you want to argue that there should continue to be more government funding for math than for history, comparative literature, philosophy, and so on, then you have to argue that mathematics serves the general interest in some ways that these other fields do not. The argument from "creative pleasure" does not distinguish math from these other fields; and the claim that these fields are more corrupted by commercialism than math is hogwash.

Ihe idea of math as the last bastion of purity in a corrupt world is a destructive delusion, as is the image of mathematicians as an elect group of noble souls, deserving of being placed on pedestals by glamorous women. "We had fed the heart on fantasies // The heart's grown brutal from the fare," wrote Yeats. I am not sure that "brutal" is the right word here, but certainly arrogant.

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[4]The 2015 budget for the NSF's Division for Mathematical Sciences is $224 million. The entire budget for the NEH is $167.5 million, and the budget for the NEA is $158 million.