

The value of mathematicians in the AI age

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What this is about

Given the societal changes around the corner, discussing the value of professional mathematicians in the upcoming era is perhaps a scope too narrow: all in all, if AI kills us all or the singularity happens, who cares about these people? Even if things do not go that far, it is a plausible scenario that in a few years the combination of AI and robotics will be able to replace humans in most jobs, a fact that would radically transform society and, in relation to the scope of this essay, might lead someone to question the value of humans in general (I know: the value of what humans *do* is not the same as the value of what humans *are*. But still).

And yet, understanding whether there is value, as I think is the case, in one specific job that seems to be taken over by AI might help shed light on the bigger picture and this is a subject I have competence in. Also, and specifically for my profession, I believe that my role as an intellectual is to first recognise and accept a change that is occurring and then question which kind of future I want, so that in the current turmoil I can steer the wheel in the appropriate direction whenever I'm able to.

I am aware that the topics discussed here touch something quite deep, often somehow linked to our identities (despite what I wrote a few lines above, when asked what I do for a living I do not answer 'I *do* math' but rather 'I *am* a mathematician'): this is another good reason to have an honest look at what is happening and reexamine the foundations of our value, if any, both toward society and within our community.

A lot has been written on the matter recently, and a lot I have read. While obviously I agree more with someone and less with someone else, I shall try not to criticise any specific position, but rather just express my own: many of us have strong opinions on the matter, and I believe these opinions should be openly discussed, so that each viewpoint, expectation, value and fear is brought to the surface.

Regardless of the specific view each of us might have, I think we can all agree that we are entering uncharted territory and that nobody has a clear view of how the future will be. This might certainly be scary, but I encourage all of us to embrace this new adventure with excitement and explore the new world, and contribute to its building, with the spirit of pioneers.

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The value of mathematicians for society

In the last decades, the unwritten reason why the work of mathematicians has been funded has been teaching and research. Now that research is soon to be done by machines, such a societal contract should be reexamined and rediscussed.

My core message is that the key added value brought by mathematicians is, and in fact has always been, in the human understanding of math¹: the role of math as the basic language of science does not change if tomorrow new math is produced by machines, and in fact once freed from the need to do research, mathematicians will have much more time to study math than they have today.

If we, humanity, give up the idea of deep human understanding of math, then I'm afraid we will soon give up the idea of understanding any science at all, and thus soon any control over the world, including, in particular, AI. I strongly advise against this scenario, and thus insist that we should have a community of people able to understand math.

A few points in this direction:

- Despite being an atheist, I believe that the universe obeys some laws, and that the role of physics is to understand these laws. In doing so it has done a great job so far, but the task is not complete yet, and a theory of everything is still missing. Now, suppose that tomorrow an alien (for instance: an AI) tells us that indeed such a theory exists and gives us a book in which the theory is explained, but such a book is written in a language we cannot understand. In this case, will tomorrow's situation really be different from today's one for me? I mean, I already firmly believe that such a theory exists, so what am I gaining? Just the confirmation that my act of faith was correct? This surely is better than nothing, but not very much so. What I would really like is for me, or perhaps for us humans, to be able to understand what is written in that book, and to this aim the understanding of deep mathematical concepts will very likely be crucial.
- Somehow more concretely, suppose that tomorrow AI finds a cure for cancer. Then one might argue that even if humanity does not understand the mechanism behind it, surely we might be happy that a cure exists and just treat people with it. This is certainly true, but nevertheless I note that either we give up the idea of understanding what is going on with this cure, or we do not. It might be that I am just a curious person, but I am against giving up on understanding it, thus advocate the latter option, which requires us to understand medicine, biology, chemistry, physics (recall also the need of elaborate medical machinery) and thus surely also math.

To this I would add that while the pursuit of knowledge is, I think, noble per sé and thus needs no justification, at the practical level the societal impact of research at the frontiers of pure math has been mostly that of keeping alive and vibrant, through an intense intellectual challenge, a community of mathematicians, whose role has been to contribute to the culture broth of basic research from which innovation has typically sparked. To this extent, the actual math research achievements, say in the last decades, have not been that relevant: they mostly had a role just within pure math and certain branches of theoretical physics. Perhaps a good, and slightly brutal, illustration of this comes from the recent solution of the millennium problem, i.e. one of the most important problems in math, concerning the equations of fluid dynamics:

¹This is, of course, very much in line with Thurston's famous essay "On proof and progress in mathematics", which is still very current (even in its title!)

now we know that the solutions of the forced Navier-Stokes equations can blow up in finite time, yet the plumbing industry won't change a tiny bit.

In this sense the upcoming automation of research will not really change much from the perspective of usefulness of mathematicians for society. It does change a lot, however, for mathematicians themselves and if we want to have mathematicians in the future, these changes have to be thoroughly discussed.

The value of mathematicians for mathematicians

Grant me for a moment that in the near future most, if not all, of the research in math will be done by AI² and let me elaborate on what kind of future we might expect and what we should aim for in it. Even if you are not convinced by this claim, still notice that what I'm writing in this section is valid even if things remain as they are today, i.e. with about half of math papers produced via intensive use of AI³.

If the claim holds, then a tsunami is coming for math and due to the forces in place it is not reasonable to expect that academia will go on roughly as it is and AI will be tamed to the current state of affairs⁴. Rather, we should deeply reform research institutions to work in a world where AI will play a central role.

The core issue, as I see it, is that automated research will disrupt the current value system in academia: for ages, mathematicians have been assessed mostly by the research they produced (we can discuss whether this was a smart choice or not, but that was it). If research is going to be automated, then surely this won't be the case anymore. Notice that this is true even if all mathematicians continue to do research in parallel with AI: once a process is automated, the outcome becomes cheaper and thus loses value. This has already happened thousands of times throughout history when a technological change occurred. This time is about research in math: what once required months of hard work, discussions, conferences, collaborations etc, now is, or soon will be, just one prompt away. I am not saying this lightly and as already mentioned I am aware of the psychological impact of the redefinition of our value system: up to now our entire professional validation, and thus for many also part of the personal validation, passed through the math we produced. This won't be the case anymore.

It is thus imperative, if we want to still have a community of mathematicians, that we rediscuss and redefine the internal values upon which such a community is built. My perspective on this matter is that we should value knowing, understanding and communicating math, which are the keys needed to pursue the goal of human understanding of math I mentioned before. These have always been important in the field, but for some reason their relevance has been overshadowed by the imperative of doing as much research as possible, well described by the famous 'publish or perish' dictum: how often did we not study a topic just because we knew it would have been hard to publish on it? Now that we are relieved from the pressure of publishing, this — understandable given the old value system, but nevertheless rather crazy — line of thought has no reason to exist anymore. Admittedly, I take this part of the story with a

²I am aware that this is a controversial take: I will argue for this claim in the next section. Notice that I am not looking forward to such a future: I was happy the way things were (which does not mean I can't be happy in tomorrow's world).

³The number of arXiv submissions in math in September '26 is 30% higher than that in August '26 and more than twice that of September '25 (data from arXiv monthly submissions). My assumption is that AI has something to do with this.

⁴I have just one kind question for the AI-workers that will mass-produce statements: please only put online stuff that either you understand as correct or that is lean-certified.

bit of relief: for a person interested in studying math, this is actually the best time in history. Future practitioners will very likely know much more math than current ones and will likewise have more chances to know about neighbouring disciplines, with beneficial effects on human understanding of science in general.

Switching to a new value system will not be easy. Below I will briefly discuss two key challenges: the authorship issue and the next-generation side of the story.

Authorship. Among the changes caused by the automation of research, perhaps the one that will be the hardest to digest will be that future mathematicians will not author anything: they simply won't have work to put their signature on. As of yesterday, if I had an idea I could write up a paper on it, and it didn't matter how brilliant or insignificant the resulting work was: still on the first page, right below the title, there was my name. Signing papers was surely a key part of the gratification I got from my work: on one hand from it I could get some appreciation from colleagues and on the other it gave me the possibility of adding my tiny contribution to the Eternal Book of Math. In a world where AI is intensively used to produce papers, being an author loses its significance. What does it mean if I sign a paper that is mostly AI-generated? And what does it mean to sign a paper and to say that AI had little to no role in its preparation? Even assuming I am being honest in this declaration, why does this information matter in a world where, likely, the same result could have been obtained with a few prompts to a latest-generation AI model⁵? Am I asking for some credit from the community? What for, precisely?

Perhaps one aspect where human authorship will still play a role will be in communicating math and creating stories around it. In a world overpopulated by theorems, likely more than those humanity can possibly navigate, we will need a certain critique of mathematics to guide us through this ocean of statements. Why is a subject relevant? On what grounds is it based? What are the core ideas? What the connections with other fields, both within and outside math? What should I be acquainted with if I want to understand a certain topic? Or even, very simply: why is this beautiful? These are all questions that a human Cicerone can offer answers to (I mean: to other humans) and creating these maps while having access to, *de facto*, Erdős' book might actually turn out to be fascinating⁶.

I am not saying that the loss of significance of authorship in research will happen quickly, but I do not see how it can survive for long in a context where most of the research is either machine-assisted or entirely machine-made. With this happening, the very same reasons for doing math will change and with them the kind of people attracted to the profession. For instance, I admit that if I were in my 20s I am not sure I would choose the same job today and, likewise, it might be that those who also enjoy the performative aspects of the work will simply

⁵This might not be the situation today, but as I shall argue in the next section I believe it will soon be the case for, at least, the vast majority of papers.

⁶There are a number of stimulating ontological questions related to this discussion, avoided by the pragmatic take of this essay that puts value in the *human* understanding of math. Unfortunately, I am not acquainted enough with the topic to say anything meaningful or to provide a roadmap to the existing literature, but a basic question is: does non-human knowledge exist at all?

With an AI tool capable of answering some (many? all?) mathematical questions we throw at it we can ask: when does this math start existing? The moment we switch on the tool, the moment the question is posed, or the moment the answer is provided? And what if also the question has been asked by the AI and the answer stored in some server no human has accessed yet? Our answers to these are related to how we will perceive our role in this world: will we be merely explorers, or will we have a part in the creative process?

lose interest and pick different career paths. On the other hand, people more inclined toward the genuine enjoyment of the intellectual activity might benefit from being relieved of the pressure to do research (and all that comes with it, such as sleepless nights, grant applications, paper submissions etc.) and actually decide to pick this career.

Again, I think it is up to us, the current generation of mathematicians, to ask what value, if any, there is in being a mathematician: the next generation of mathematicians will exist if and only if we find this value, both toward society and in our community, and communicate it properly. As written above, I believe there is such value and will fiercely fight for it. Should we fail to agree and communicate our values, well, then so be it: we will be the last human mathematicians and our research institutions will be converted into beautiful museums⁷.

Another consequence of the automation of research is that the entire ecosystem built around research production will fall. For instance, properly crediting previous contributions will not really matter anymore if such contributions are machine-made. Also, scientific journals will not have any role tomorrow, as their main *raison d'être* today is to grant status to the published papers, and thus to their authors.

In fact, even the necessity of having papers as we always had is in question now: will we really need an introduction and a collection of preliminary results for each new theorem? I am not so sure, and suggest that we should find new ways to organise and access the research. The human-made critique I mentioned above might be, among others, one of the options.

Next generation. In a world where knowing, understanding and communicating math are agreed and shared values, we will need ways to train the next generation of mathematicians and to evaluate them. Here are my two cents.

As for training, we should ‘simply’ shift the focus of PhD studies from the production of new results to understanding math (which has always been a good thing) and communicating math (which also has always been a good thing, even though too often not sufficiently appreciated). In particular, I would not push schools/students into getting the latest, most expensive, model of AI to assist them in research, as doing research won’t really be a thing in the typical PhD. Again, the release from the pressure to produce something new will give students, and teachers, the time to dig down into deep theories: it won’t be unreasonable to, say, have a PhD student study the blow-up in finite time of the forced Navier-Stokes, or any other cornerstone of modern mathematics.

When it comes to hiring, it won’t be difficult to assess candidates’ knowledge and understanding of math and their communication skills: they might for instance be given a few hours to write an essay on a given topic, and/or asked to prepare a lecture on a subject chosen by the committee. Interviews might also play a role. Let me stress that hiring in most of the already existing high-level jobs is based on a mixture of previous experience, recommendation letters and interviews. The possibility of supplementing all of this with a clear set of well-defined work outputs of the candidate, i.e. the publication list seasoned with a few bibliometric indicators, was an exception specific to academia, but the new ecosystem might certainly work well even without it (as in fact it should: if the job changes, so should the selection process).

I know of some concerns about the training of future PhD students. One is that if they do not work hard by doing research they will turn out to be weak mathematicians, another

⁷In this case I will make sure that in mine there will be a picture of myself at the blackboard, to witness those crazy old times when math was hand-made with a 1\$ chalk and not crafted by a trillion\$ machine.

is that knowing the path to ‘the solution’ of the given problems will disrupt the possibility of exploring potentially interesting nearby areas. Maybe I am overly optimistic, but I do not have such concerns. Surely things worked well in the past, but, again, if the work of mathematicians changes, so should their training. On top of this:

- 1) I believe that future generations will be as smart as the current one, thus if they perceive some lack of abilities in areas they believe important, then they will work to build up such abilities. Will this be too late for them to make use of our guidance? Maybe, but that just means that they will have to work a bit harder (which is what we want, right? Also, in any case I do not think I ever taught my students *how* to do research, but rather *what* they could research) to reach their goals, not that such goals cannot be reached at all.
- 2) A relevant part of the math that I learned, in particular all the mathematics I studied as an undergraduate, I learned from books, not via research: it was ‘given’ to me, not explored by me. And thankfully so: this gave me a solid base of knowledge. In particular, I do not share the fear that knowing ‘the correct path’ from the get-go makes it harder to explore alternative routes. Quite the contrary: having a robust picture of a subject clearly in mind has always given, at least to me, a sense of safety in exploring the surroundings.

Math research in the AI age

Here I argue why I do not think that in the near future humans will have any role at all in doing research in math, regardless of the actions that either individuals or the whole community will take⁸.

Supporting arguments are:

- Current AI systems are the dumbest (whatever this means) they will ever be. I don’t know what intelligence is, but available commercial tools are already as good at producing research as most mathematicians, to say the least, and while we cannot improve our capabilities much, they surely can. In this regard notice that in the grand scheme of things Einstein (or your preferred superhero) was not much smarter than the average person. With this I certainly do not intend to minimise the incredible contributions he made to science, but just to underline that he was a human being. As such he ‘ran the same machine’ as everybody else, with a brain of a given size working on principles that are the same as those of everybody else. With experience and tools, we can certainly improve, but we are all still limited by our biology. This is not the same for AI: data centres can still grow significantly and more efficient algorithms can still be found, with both events being very likely. I am not saying that AI capabilities have no theoretical upper bound, nor that they will continue improving at the same pace we have witnessed in the last few years, but given that they are already better at doing research than many of us, they do not need to improve much to become better than all of us.
- AI can be as creative in math (whatever this means) as humans. Again, I do not know what creativity really is, but judging by my own experience I don’t see anything I have ever read and understood in my research area that could not have been, at least in

⁸This essay has been prepared before OpenAI released more than 700 papers on October 6, 2026, a fact that strengthens the arguments collected here.

principle, done by AI. I sincerely hope no colleague gets offended by this claim: if it is of any consolation, please notice that the mathematics I am referring to includes the work I have done myself (and, speaking of creativity, I would say my most important contributions are definitions, not theorems).

Surely there is a whole lot of math that I do not really understand and that feels like magic, and thus extremely creative, to me, meaning I cannot see a path of ‘little intuitions’ that led to the final results nor how these results might have been conceived in the first place (e.g. some of Gromov’s work). But still I would not declare AI incapable of producing such math: I would have no arguments to support the claim other than I am too dumb to argue otherwise, which sounds a bit like throwing the ball where I can’t see it to conclude that nobody can play with it.

Even if I’m wrong on this matter, e.g. say there will be room for human creation of theories, still given the current strength of existing models only a handful of mathematicians will actually be able to provide this sort of contribution. In particular, all the previous discourses around the value of mathematicians and the need to redesign our structures will still be in place.

- AI won’t be shut down. Of course in principle it could, but it won’t happen: the tool is just too useful to society (proof: most people use it) for society to abandon it, regardless of the risks it bears. Analogously, the internet hasn’t been shut down to prevent, e.g., the spread of fake news and factories have not all been closed to prevent pollution. Of course, given the power of these tools and the concentration of such power, I do nevertheless firmly believe that they should be heavily regulated, akin to how nuclear power facilities are.
- AI systems cannot be ignored by the math community. If you are a mathematician active today, then it is likely that in your field you have already witnessed serious advances made also thanks to AI. If we keep on with business as usual, which values research, then this research will mostly be done by somebody using AI, even if all professional mathematicians decide not to use it: it is just too easy, even for non-professionals, to produce research.

Not using AI is also complicated by the fact that it relies on an unprovable claim: suppose that next month I’ll post a paper on arXiv with the complete solution of a major and well-known problem and that I declare that I have not used AI in working on this. Should I be trusted? Would *you* trust me? It is a delicate issue, because on this trust depends my recognition in the community, which, if sufficiently high, brings money, prizes etc. I cannot prove I didn’t use AI, but if the value system in our community remains the one currently in use, where producing new research is the main career driver, then incentives to cheat are just too strong: somebody will simply use AI and declare otherwise. Of course I would never do that, I’m a good guy, and I am sure neither would you, my dear and trustworthy reader. Still, I advise against a system entirely based on mutual trust. For instance: how would you feel if in 2030 a Fields medal is awarded to a person who solved the Riemann hypothesis and declared heavy use of AI? And what if the same person declared no use of AI at all?