Chronicles from the Web

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The myth of mathematicians’ splendid isolation

- The highest level of mathematics research is still seen as a solitary activity.
- Yet innovations made possible by technological advancement and set up by mathematicians, and quite often actively supported by influential members of the community, have been creating new modes of mathematical production and harnessing the power of social computing.
- The power of these innovations comes from developing collective intelligence through sharing information and understanding.
- Newgroups (sci.math, etc.), mailing lists (FOM, DMANET, etc.), online fora (MathLinks, Ask Dr. Math, etc.), blogs (Tao’s *What’s new*, Baez’ *This Week’s Finds*, the *n*-Category Café, etc.), and the Polymath projects are samples of these innovations.
- In this talk, we will focus on one of the most effective innovations so far: MathOverflow (shortly, MO).


MathOverflow: What is it?

- An interactive Q&A website for (mostly) professional mathematicians, which serves both as a collaborative blog and an online community.
- It allows users to ask questions and submit ("post") answers.
- In particular, it awards Karma for good questions and good answers, as the ones and the others can be rated by users, who are accordingly credited merit points for their activity on the website.
- A typical response is an informal dialogue, allowing error and speculation, rather than pretending rigorous mathematical arguments. Yet, the community works hard to maintain fairly high standards, so professionals stay interested and involved.
- Elected monitors are established within the community, and experienced users are able to flag comments and posts for moderators' attention.
- Contributions of enthusiastic users and active and proactive debates taking place on “MathOverflow Meta”, a dual website explicitly designed, e.g., for discussing the policy of MO or creating a consensus around “sensible questions”.

Before logging in

- Extremely friendly interface.
- A list of hot tags (particularly useful for statistics...).
- A list of most recent questions asked, answered, or edited.
- A link to the chat rooms where mathematicians from all around the world do typically discuss questions posted on the forum.
After logging in

- A menu summarizing the credits awarded to the user.
- Links to detailed statistics concerning users’ profile and activity.
User’s profile

Salvo Tringali
Not all those who wander are lost.

1,531 REPUTATION

Top Tags (55)

- nt.number-theory: 42 points 26 points 31 points
- gr.group-theory: 13 points
- co.combinatorics: 13 points
- mathoverflow: 13 points
- math-overflow: 13 points

Top Network Posts

- 22 Correspondences between dual integrals and topological spaces
- 10 Positivessymmetric matrix: $A^2 = 0$
- 7 Locally, linearizable implies linearizability under equivalent metrics?
- 6 Is there a name for this identity involving series?

Newest Posts (5)

- Reference for a strong intermediate value theorem for measures
- A result of separation on non-atomic measures
- Embedding abelian cancellative 2-dimensional semigroups into abelian cancellative topological groups
- A result of separation on non-atomic measures
- Reference request: Cardinal properties of real-valued additive functions (measures, densities, etc.)
- Approximating integers with prime quotients
- Terminology for torsion semigroups where the order of elements is uniformly finite
Early history and development

- MO was created by Berkeley graduate students and postdocs Anton Geraschenko, David Zureick-Brown, and Scott Morrison, and first went online in September 2009.
- About two years later (in June 2011), MO joins the Stack Exchange network (first launched by Atwood and Spolsky in 2009).
- MO didn’t start out as a *professional* mathematics Q&A site. It started out wanting to be one. In particular, it had to:
  - Defend against wave after wave of “trolls” (most notably including undergraduate calculus students posting for homework help...).
  - Discourage and defy a certain propensity of the community to become an open discussion forum for mathematicians (and of individuals to behave as smart asses...).
- As hoped, it expanded very quickly, involving many famous mathematicians around the world, including a number of Fields medalists.
Illustrious users: Terry Tao

Terry Tao
Professor of Mathematics at UCLA

38,786 REPUTATION

Top Tags (182)

- nt.number-theory
  - Score: 865
  - Posts: 51
  - % Posts: 18

- ca.analysis-and-... (Score: 497, Posts: 25)
- fourier-analysis (Score: 299, Posts: 17)
- prime-numbers (Score: 257, Posts: 10)
- pr.probability (Score: 251, Posts: 17)
- co.combinatorics (Score: 221, Posts: 20)

View all tags →
Illustrious users: Tim Gowers

MathOverflow

Questions Tags Users Badges Unanswered

Profile Activity

Profile

Activity

16,542 REPUTATION

15 104 153

Top Tags (132)

nt.number-theory

SCORE 155 POSTS 19 POSTS % 10

set-theory

SCORE 150 POSTS 11

lo.logic

SCORE 149 POSTS 15

co.combinatorics

SCORE 134 POSTS 27

cia.analysis-and-odes

SCORE 154 POSTS 16

fa.functional-analysis

SCORE 112 POSTS 8

View all tags →
Illustrious users: Curtis T. McMullen

Curtis McMullen

Apparently, this user prefers to keep an air of mystery about them.

Top Tags

- complex-geometry: Score 23, Posts 2, Post % 40
- gn.general-topology: Score 19, Posts 2
- ag.algebraic-geometry: Score 16, Posts 2
- riemann-surfaces: Score 10, Posts 1
- differential-geometry: Score 10, Posts 1
- 20-questions: Score 13, Posts 1

Communities

- MathOverflow: Reputation 464
- Mathematics: Reputation 116
- Ask Different: Reputation 111
- Academia: Reputation 101

Profile Activity
Illustrious users: Bill Thurston (1946-2012)

Bill Thurston (1946-2012)

I'm a professor at Cornell. I've previously been at Princeton, Berkeley, MSRI, and UC Davis. Mathematics is a process of staring hard enough with enough perseverance at the fog of muddle and confusion to eventually break through to improved clarity. I'm happy when I can admit, at least to myself, that my thinking is muddled, and I try to overcome the embarrassment that I might reveal ignorance or confusion. Over the years, this has helped me develop clarity in some things, but I remain muddled in many.
Milestones and coarse statistics (updated to Nov 18, 2015)

- Questions: 66k.
- Answers: 106k.
- Answered questions: 78%.
- Users: 49k.
Exceptional users: Hamkins' records (updated to Nov 18, 2015)

- Current Karma: ~118k.
- Current answers: 1260.
- Current questions: 58.
In the words of mathematicians

- MO describes itself as “A place for mathematicians to ask and answer questions.”
- Terence Tao on *What’s new* characterized MO as akin to “the venerable newsgroup *sci.math*, but with more modern, ‘Web 2.0’ features.”
- John C. Baez writes that “MO has become a universal clearinghouse for math questions.”
- According to Gil Kalai, MO “is run by an energetic and impressive group of very (very very) young people.”
- Jordan Ellenberg comments that MO “offers a constantly changing array of new questions” and is “addictive” in a “particularly pure form”.
- Bill Johnson describes MO as “a good resource for mathematics and a fun place as well” (find it tepid? Think again, as B.J. is one of the most active MO users!).
Illustrious users: William Bill Johnson

Bill Johnson
Distinguished Professor of Mathematics at Texas A&M University

Top Tags (112)

- fa.functional-analysis
  - Score: 1,045
  - Posts: 189
  - Posts %: 60

- banach-spaces
  - Score: 750
  - Posts: 151

- gn.general-topology
  - Score: 148
  - Posts: 28

- mg.metric-geometry
  - Score: 103
  - Posts: 15

- pr.probability
  - Score: 98
  - Posts: 15

- real-analysis
  - Score: 91
  - Posts: 11

View all tags →
Why getting involved with MO

- Researchers from all over the world and at any level (from PhD students to Fields medalists) pose questions related to their own research, such as:
  - Questions about well-known, aimed at getting a feeling of the state-of-the-art on the subject and understanding, e.g., if there are (i) interesting subquestions they may try to approach or (ii) strategies that have already been attempted, and if so why they have failed.
  - Open questions that have been passed unnoticed or are known to a restricted circle of specialists, but not particularly famous out of a specific domain.
  - Questions about a technical (and potentially false!) lemma needed in the proof of something intricate, for which people in one’s circle haven’t provided any useful advice.
  - References to existing results that imply or subsume one’s own result (so to include it in the bibliography or understand if it is worth of something or not).

- This has eventually led to a number of collaborations and resulted in publications in top-tier journals where at least significant progress has been made on long-standing open problems and conjectures.

- Responses often present information from experts in a specific field, and are readily checked by other users: the effectiveness of MO comes from information sharing.
Preprints on very famous conjectures: “Strong claims need strong evidence”

Likewise, MO is faster than any traditional channel of discussion in “broadcasting the news” when it comes to “novel mathematics”, while maintaining a very prudential policy, particularly with papers claiming to solve fundamental problems.
Very famous conjectures discussed on MO

Riemann hypothesis via absolute geometry

Several leading mathematicians (e.g. Yuli Manin) have written or said publicly that there is a known outline of a likely natural proof of the Riemann hypothesis using absolute algebraic geometry over the field of one element, some like Mochizuki and Durov are thinking of a possible application of $\mathbb{F}_1$-geometry to an even stronger abc conjecture. It seems that this is one of the driving forces for studying algebraic geometry over $\mathbb{F}_1$ and that the main obstacle to materializing this proof is the geometry over $\mathbb{F}_1$ (cf. MO what is the field with one element, applications of algebraic geometry over a field with one element) is still not satisfactorily developed. Even a longer-term attacker of the Riemann hypothesis from outside the algebraic geometry community, Alain Connes, has concentrated recently in his collaboration with Katia Consani on the development of a version of geometry over $\mathbb{F}_1$.

Could somebody outline for us the ideas in the folklore sketch of the proof of the Riemann hypothesis via absolute geometry? Is the proof analogous to the Deligne’s proof (article) of the Riemann–Weil conjecture (see Wikipedia and MathOverflow question equivalent-statements-of-riemann-hypothesis-in-the-weil-conjectures)?

Grothendieck was not happy with Deligne’s proof since he expected that the proof would/should be based on substantial progress on motives and the standard conjectures on algebraic cycles. Is there any envisioned progress in the motivic picture based on $\mathbb{F}_1$-geometry, or even envisioned extensions of the motivic picture?

ag.algebraic-geometry, nt.number-theory

Up to Nov 18, 2015: More than 600 questions related to the Riemann hypothesis and generalizations thereof (most of them very technical and instructive).
Not especially open problems discussed on MO

100 open problems have been listed and for some of them there has been substantial progress by active users on MO, though not major experts in the specific area.
Publishing and publishers

- According to a 2013 study commissioned by various publishers, MO is very effective: 90% of questions are answered completely or in part, and a nontrivial percentage of discussions address an error in work that has already appeared in print.

- Accordingly, there are initiatives by various publishers of research mathematics interested in creating a multiparty collaboration with MO to:
  - automatically capture citations entered on the website;
  - republish them as linked open data.

- In particular, this would help maintain annotation repositories allowing publishers to make mathematicians coming to their websites aware of MO discussions potentially relevant to the papers they are viewing, and so ultimately to their research work.
Thank you for your attention!