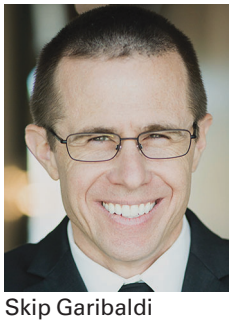
suggests a path that is more pleasant for the individuals involved and leads to an overall culture that will actually solve more hard problems. What's not to like?

Where This Advice Came From

This advice was part of the last public mathematics talk given by Warwick de Launey before succumbing to cancer at the young age of 52. Warwick spent most of his career working on classified mathematics, first in Australia and later in the United States, mostly at the IDA Center for Communications Research in La Jolla. He was named a Distinguished Member of the Crypto-Mathematics Institute for his contributions. He was active in traditional academic mathematics, too, especially combinatorics and design theory, as you can see in his book [1] or the special issue of *Cryptography and Communications* [2] in his honor. His long list of publications and many collaborators attest to him having lived his professional life following this advice.

References

[1] W. de Launey and D. L. Flannery, *Algebraic design theory*, Mathematical Surveys and Monographs, vol. 175, American Mathematical Society, Providence, RI, 2011.
[2] D. L. Flannery and K. J. Horadam, *Guest editorial for the special issue on design theory*, Cryptogr. Commun. **2** (2010), 127–128, DOI 10.1007/s12095-010-0035-x.


Skip Garibaldi


Daniel M. Gordon

Credits

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Keeping a Problem List

Alexander Perry

One of the hardest parts of mathematical research is finding good problems, where "good" means some combination of interesting and doable. For this reason, I think it's important to document our ideas for good problems as they occur to us—especially when we don't have time to investigate them at the moment—before they get lost in the commotion of life. This was my original motivation for starting my own problem list, which I've since come to appreciate for its other benefits as well.

First, how do you keep a problem list? The simple answer is to record any potential research idea that comes to you, but I've found the following habits helpful:

1. Follow the arXiv listings in your subject. When a paper appears that interests you, skim through it to get a general sense of what is proved. Try to think of questions that the paper leaves open, or which could be accessible using its methods, and record them in your list. (You don't need to understand all the details of the paper at this point—that comes later, if you decide to work on the problem.)
2. Attend seminar talks regularly. Again, keep an eye out for open questions, or potential new applications. Discussing with the speaker is a great way to gauge whether you've come up with a good problem.
3. Actively talk about math with others, whether in classes, seminars, conferences, the common room, or online. Record interesting problems that arise, as well as with whom you discussed them, in case you want to resume the conversation later.
4. Every once in a while, do maintenance on your list. This includes organizing the list (e.g., by subject or priority), following up on recent activity and background, and reformulating problems or making them more precise. Sometimes, this process will help inspire new ideas too.

Once you have a problem list, what are its uses? There are a variety of them, beyond the obvious one of being a source of fresh research directions:

1. A problem list's existence can be psychologically useful even if you aren't ready to start a new project. It's reassuring to have a supply of problems waiting, especially in those times when you find yourself stuck on your current research. I've also learned that simply the act of writing down a problem can start ideas percolating—by the time you "officially" begin work on the problem, you may have already subconsciously developed an approach to it!
2. A problem list makes grant writing much easier, and perhaps even fun. Indeed, you can treat grant writing as an opportunity to flesh out approaches to some of your favorite problems on the list.
3. A problem list can be a tool for productive math conversations. When you attend a conference or visit a department, ask experts about aspects of your problems. Sometimes this will help you refine your questions, or even start a collaboration.
4. One day, your problem list will probably contain many more problems than you could ever hope to investigate. Don't worry, there is still a great use for those problems: they can serve as starting points for your students' research.

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Above all, I think of a problem list as a dedication to creativity. Try keeping your own—you may find, as I have, that merely putting a question down on paper can imbue even the most whimsical thought with the seriousness needed to pursue it further.

Alexander Perry

Credits

Author photo is courtesy of the author.

My Research is DUE Tomorrow!

Elizabeth Milićević

In the heart of most academic semesters at Haverford, my daily calendar usually consists of the following items: two to four hours of class lectures or problem sessions, one office hour, one thesis meeting, two on-demand individual student meetings, and one of the following: department meeting, colloquium, college committee meeting, or full faculty meeting. These daily events typically total four to eight hours—and this is only *scheduled* calendar items! Given the vast array of teaching and service demands—which renew themselves *daily*—***where exactly does research fit?!***

My goal in this article is to provide concrete suggestions for *regularly* incorporating research into your own incredibly busy academic year, and to help you ensure that even limited research time packs a punch. But first, we need to figure out how much research time we should realistically add to that calendar. I'll do a simple back-of-the-envelope calculation, which you should adjust using your individual parameters.

Haverford faculty are expected to split their time approximately 50/50 between teaching and research, using Julianna Tymoczko's convenient algorithm for partitioning 100 based on the annual coarse load [Tym20]. The typical 14-week semester at Haverford is followed by one week of exams, totaling 30 weeks of full-time academic instruction per year, during which my calendar looks roughly as described above. Assuming I take four weeks of vacation per year, this leaves 18 weeks available for full-time research, parsed approximately as 16 weeks in the summer and two weeks over the winter break. At 40 hours per week, I can thus manage to collect 720 hours of research time during breaks between semesters, but this is still less than half of my 1920 annual working hours. To make up the deficit, **I commit to eight hours per week of research time**, throughout my 30-week full-time teaching period.

Research Lessons from the Calendar

To cultivate strategies for carving out research time, let's reflect on why my calendar looks as described during the academic year. Although I would joyfully do nearly all parts of my job without any extra structure or incentives, there are simply lots of things which are out of my control: classes meet for a specified number of hours per week, advising year-long senior theses is part of my annual course load, students have certain expectations of my availability, and basic functionality requires that regular department and college business be conducted. But even shadow items which are NOT specifically written into my daily planner also manage to get done *every single day*—why?

As humans, we typically do things *today*—even those phantom to-do items that aren't scheduled directly in our daily calendars—because we face the consequence tomorrow: I'm giving a lecture tomorrow so it needs to be prepared, I'm meeting a student concerned about their performance in the course tomorrow so I need to finish grading their midterm, and the deadline for that NSF letter of recommendation is 5:00 p.m. tomorrow. On the other hand, each of these activities behaves like a gas, expanding into any and all available space and time! Here's a tip to change its state of matter:

- **ALWAYS put off until tomorrow what doesn't need to be done today!**

That's right: a license to procrastinate! The more efficient you're required to be, the more efficient you'll become. Your students are very unlikely to appreciate the additional four hours of effort you poured into making your 1:00 p.m. lecture 5% better by preparing the day before instead of that morning. To *correctly* quote several relevant adages: **done is good**, and perfect is the *enemy* of the good! If you **plan** to be rarely early but never late on all teaching and service tasks, you'll find more openings in your schedule today, for research. So leave everything until the last possible minute—***except your research***.

Research is rarely an emergency. That's not to say that pressing research deadlines don't exist—they occasionally do! Examples include having a collaborator on the job market, an undergraduate research assistant applying for graduate school, a coauthor going up for tenure, a grant proposal or project report due, or agreeing to submit your article to a themed special edition of a journal. You might also

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