Susan Staples

Credits

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Trust Your Instincts When Opportunity Arises

Noah Giansiracusa

At several key points in my education and career I've felt a tension between what I thought I should be doing and what I really wanted to be doing professionally—but a lesson I've learned over and over is that what you should be doing professionally is whatever you really want to be doing. I'll try to convince you of this notion throughout this column, but whether you should follow this advice perhaps depends on whether you want a conventional career or are open to a potential career adventure.

Without exception, whenever I have thrown caution to the wind and followed my passions rather than following more traditional paths, I believe I have come out of it more successful, not to mention happier, than I would have otherwise. The first couple of times this happened I thought it was just serendipity, that the random thing I did against my better judgment somehow, by pure chance, turned out to be professionally beneficial beyond anything I could have anticipated. But it's happened so many times now that I don't think it's simply luck. Here are some overarching reasons why I now believe your career will grow more by trusting your instincts and following your passions than by just doing what you think the profession expects of you:

1. You will be more motivated to work hard, and the product of your work will likely be more creative and inspired, if you are working on something you are passionate about.
2. Your applications (for jobs, promotions, grants, etc.) will stand out more and be more memorable if your career path doesn't look identical to everyone else's.
3. Networking is one of the most important activities you can do at any career stage, and unusual opportunities almost always end up introducing you to people you otherwise would not have met.

I think the easiest way to convince you of this is simply to walk you through various junctures in my life where I did what I wanted to even though at the time I thought this was the "wrong" thing to do.

After one year of grad school I wasn't sure if it, or math more generally, was really for me. Over that first summer rather than studying for exams or doing a directed reading with a potential adviser, as I "should" have done, I decided to test the waters outside of academia and lay the first steps for a possible escape route. I looked for an internship, and ultimately found one that appealed to me on a variety of levels—a public policy fellowship at the National Academies in DC—and went for it even though mathematically this would set me back a whole summer. As grad school progressed I became more interested in math and open to academia, so when graduation came around I put this idea of a career in public policy out of mind and did the usual thing of applying for postdocs. To my surprise, I landed one that was far more prestigious than anything I ever expected or felt I had a chance at. To be quite honest, I was puzzled by why I got it.

A year into that postdoc, in a conversation with my mentor, Bernd Sturmfels, over pizza and beer he encouraged me to try doing some applied and interdisciplinary math, but I pushed back and said I only have a limited time as a postdoc to establish myself professionally so feel I should keep focusing on the pure math I had done in grad school that got me this postdoc. Sturmfels then said, bluntly, that he read dozens and dozens of applications from algebraic geometers that all looked the same, competent and excited to share the latest theorem they had proven, but the reason he selected my application over the others wasn't because my thesis was better than theirs (it wasn't!) nor that I was a stronger mathematician overall (I certainly wasn't!), it was because in grad school I had spent a summer doing a public policy fellowship in DC and that showed him that I was willing to take chances professionally and think outside the box and connect with people in other fields.

I was shocked when he told me this, that the activity I thought set me back in math was actually what set me apart from other mathematicians. This casual comment that my postdoc mentor almost certainly doesn't remember making has been one of the most influential insights of my career—whether consciously or not, it has been at the heart of almost every professional decision I have made since that moment. (I don't think I've ever told you this before, Bernd, so now is my chance: thank you for your wisdom and candor.)

Later in my postdoc, my research was hitting some snags—progress was grinding to a halt and relationships with collaborators were starting to fray. I felt that I should persevere and push through this rough patch, but I was having trouble getting myself to do so. Meanwhile, an

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DOI: https://dx.doi.org/10.1090/noti2233

intriguing opportunity arose. My brother is also a mathematician, a topologist, and we always thought it would be fun to work together, but we're not really in the same field so we hadn't tried to do so yet. Tropical geometry was gaining a lot of attention at the time and seemed like a setting where we could perhaps combine our algebro-geometric and topological backgrounds, but neither of us knew anything about tropical geometry so we'd have to start by learning the basics first. My intuition said this would be fun and so satisfying to finally work with my mathematician brother, but the grown-up voice in my head said this is a distraction from the actual research I should be doing. Thankfully I ignored that latter voice.

Working with my brother was indeed very fun and refreshing! We got to learn a new area together, and we both felt so uninhibited in this work because it wasn't our "serious" research; I think this helped us produce more creative ideas than either of us would have been able to in the fields we were actually trained in. The first paper we wrote together, just for a fun diversion from actual work, is the best paper I've written to date. Not only that, but we've been able to continue working in this area for years now and we've both met so many mathematicians we didn't previously know. Now I realize I was misunderstanding how the balance works: taking up a new project/collaboration/field might take some time away from your other work, but don't worry about that, you'll always find time for the work you need to do—meanwhile you'll double the size of your network, the number of math papers you can read, the number of areas you can work in, etc. You gain far more than you lose. But only do this if you really want to. If your inner voice says to try something new and different in your research program, then you should listen and do it.

At my first tenure-track job the university ran a first-year seminar program where faculty in any department can teach a class on pretty much any topic they propose. And I mean anything: one colleague in another department taught a seminar on bee-keeping, not because that was related to his discipline but just because it was his passionate hobby and he wanted to share it with students. Every student is required to take one of these seminars in their first year of college, so the university appreciates faculty who take part—but this teaching doesn't directly help your own department, because teaching classes like this means less time for the actual math classes the department needs to cover each semester. My chair never discouraged me from doing this, he might have even nominally encouraged it, but somehow I felt this was a really fun teaching opportunity that I'd really love to try but it wasn't what I was hired to do, it wasn't what I was "supposed" to do. To be clear, nobody actually told me this, it was just the conclusion I reached on my own.

I couldn't resist the temptation and ended up teaching a seminar on mathematics in the courtroom (mostly because I wanted to read the fascinating book *Math on Trial* by Leila Schneps and her daughter Coralie Colmez, and figured this would give me the incentive to do so). Not only was it really fun, as I had expected, but so many good things came from this that I didn't expect at all! I got to meet Leila in person and chat with her about the amazing work she's been doing as an expert witness in court cases involving statistics and she convinced me to dig deeper into the field. (I don't think I've told you this before: thank you, Leila, for your encouragement and infectious curiosity.) This nonstandard math class even had a direct, positive impact on my regular algebraic geometry career: when applying for NSF grants you need to include outreach, and it's often hard to think of outreach that is suitable for pure math projects, but I was able to develop this math and law class into an outreach program that I include in my grant proposals and, for better or worse, on more than one occasion that's been the highest-rated part of the proposal!

This math and law topic soon spread from the classroom and outreach to my actual research and led to new papers and excellent collaborations with students. I even gave a colloquium talk to a room that while mostly comprising mathematicians included one law professor too. The law professor slept through most of my talk, but seeing him there in the audience was still one of the highlights of my career. He and I had a nice conversation afterwards, and I remembered another piece of sage advice Sturmfels imparted during my postdoc: don't do interdisciplinary math thinking you'll solve hard problems in other fields and revolutionize distant disciplines by bringing in powerful math, but do talk to scholars in other fields and listen to their ideas and learn about the problems that interest them, for even just having such conversations is a big success.

I'll skip over the details of my circuitous (and not necessarily advisable) path through multiple academic jobs in which each time I felt I had landed in paradise and would never move; then within two or three years external circumstances led me to walk away from what I believed was my one true dream job. But suffice it to say every new job you'll ever consider, whether it's in academia or not, whether it's a step up or a step down in prestige, will provide you with a wealth of new opportunities. And if you trust your instincts and pursue the opportunities that really appeal to you—especially the ones that you deep down yearn for, knowing you'd love to do them even though some of your mentors and peers may judge you skeptically for doing so—then you'll find new happiness and success in your job and never look back with regrets.

I'm an algebraic geometer with a PhD thesis on moduli spaces (advised by a mentor who has patiently supported and believed in me despite what must have looked from the outside like a sequence of self-sabotaging career moves: thank you, Dan Abramovich, for your superhuman devotion to math and mentorship) yet I now teach data science at a business school. It's not where I thought I'd end up,

but I love it! New colleagues to meet, new topics to learn and teach, new opportunities around every corner.

My plan for my first year here was to lay low and learn the ropes. Best not to overextend myself, nor to stand out any more than an algebraic geometer already does in a business school. At least that's what the grown-up voice in my head said. By now you can probably guess what happened when I got an announcement from the dean's office that there's a university-wide curricular reform endeavor underway and proposals for new interdisciplinary courses are sought from all departments, especially courses that bridge the divide between the business departments and the arts & sciences departments. Of course I wisely recognized that I should leave this for others who are more qualified and prepared than me. Even though it's something I thought I'd really enjoy, I resisted temptation and focused on what I had been trained to do and what I believed I was hired to do. Wait, have you been paying attention at all?! Of course I once again threw caution to the wind and dove in head first.

My chair and dean were very supportive: they sat me down and explained why I shouldn't get distracted from my primary obligations nor lose sight of my research-oriented tenure expectations, but that if this is something I really want to do then I have their blessings. I joined an incredible group of colleagues developing a course on discerning Fact from Fiction. It was a great way for a new faculty member like me to meet faculty outside my home department. And it was really stimulating working on the course proposal with them. But when the proposal got approved, nobody on the team had time for it—some were busy chairing their departments, others were serving on time-consuming committees, and others were already doing overload teaching from other approved course proposals. So, I ignored the voice of caution in my head and convinced my chair and dean and proposal team that I was up for the task, even though I most certainly had not convinced myself of that. And as ill-conceived as this was on my part, it's been one of the best decisions of my career (along with all the other poor decisions I've made in the past).

First of all, prepping for the class meant I got to read lots of really interesting books that I otherwise would never have found the time to read. Even though I didn't feel too qualified to teach the material at first, I found it so fascinating that it was almost effortless to speak about it in class each time. Since this section of the class was offered in my department of mathematical sciences, I tailored the overall Facts and Fictions class to be about Truth and Lies in Data. Even though this was a class meant mostly for first-year students, teaching it helped me feel more like an actual data science professor instead of just a math professor faking his way into data science.

The class was taught in Spring 2020, so the pandemic turned it remote halfway through. But since this was a nonstandard math class it wasn't the prerequisite for anything so I felt free to cover pretty much whatever I wanted, totally unconstrained by curricular norms—so as soon as the lockdown struck, we focused the class almost entirely on the pandemic. Every day something data-related about COVID-19 was in the news so the class became an outlet to discuss and try to make sense of the whirlwind of coronavirus chaos together. I learned so much from the class and from my students. Afterwards my university's alumni magazine included this class in an article about teaching during the pandemic (`https://www.bentley.edu/magazine/case-study-covid`). And while I'm mostly used to teaching math classes with, say, 25–35 students, this class had only 10 students and was mostly discussion-based—which meant not only was it rather refreshing, but it was less additional work to teach than I expected.

I got so absorbed in the material from that class that afterwards I decided to try writing a general audience book on the material. I know I should be focusing on writing research papers instead to help with my tenure case and things like that, but at this point in my life I've learned to trust that inner voice (the fun, ambitious, enthusiastic one, not the overly cautious grown-up one) and to follow my professional passions with abandon. Right now I'm very happily teaching the second iteration of this Truth and Lies in Data class. Writing the book has been more engaging and exciting than I ever imagined—and the synergy between teaching the class and writing the book has been very rewarding. I've even enjoyed learning about the publishing industry (the book, titled *How Algorithms Create and Prevent Fake News*, is due out soon). Since the class is being taught remotely anyway due to the pandemic, I decided to post condensed versions of the lectures publicly online on my YouTube channel (`https://www.youtube.com/channel/UC2WFIBiNxDIa1cxp2JddNmA`) which has helped me develop a public-facing side of my job, which is something I always wanted to do but, well, never thought I really should because it's not the standard path.

But now I know: do what you want to do, not what you should do—you'll do better work this way. Don't try to guess what people reading your applications (jobs, promotions, grants, etc.) will want to see—do the things you are passionate about and convince the reader that these are worthwhile endeavors. Don't look around at your peers to see what career paths they have and try to force yourself to have the same one—doing this will make you look like everyone else rather than the unique person that you truly are.

So much of who I am as a mathematician, and who I am as a person, stems from the random opportunities that have arisen along the way. Of all these opportunities, teaching a nonstandard math class is one of the least difficult to get into (it's a lot easier than changing jobs, believe me!) and yet potentially one of the most rewarding, personally and professionally.

You'll be surprised and amazed at the places it will take you and the people you'll meet along the way. And that

brings me to my final expression of gratitude in this article: thank you, Angela Gibney, for editing this AMS column and providing the guidance and support to early-career mathematicians that I have been fortunate enough to receive from you personally for so many years now.

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Author photo is courtesy of Noah Giansiracusa.

When Life Gives You Lemons, Make Mathematicians

Kira Adaricheva, Ben Brubaker, Pat Devlin, Steven J. Miller, Vic Reiner, Alexandra Seceleanu, Adam Sheffer, and Yunus Zeytuncu

This is a happy story during difficult times. It is a story about how the pandemic led to something good. It also describes a new type of undergraduate summer program. We wish to start a discussion about this new approach, how it could be improved, and whether more people should pursue it. Please reach out to the authors to learn more about their experience and potential opportunities to be involved with such programs.

Our story begins in the Spring of 2020, when the pandemic made it clear that summer programs wouldn't run as usual. Many students found themselves stuck at home with nothing to do during the summer. Some programs switched to running remotely and tried to help by accepting more participants than usual (including several programs organized by the authors). However, this support was negligible compared to the number of students who were stuck.

After various Zoom and email discussions, we created the *Polymath REU* program (`https://geometrynyc.wixsite.com/polymathreu`). This is an undergraduate-level version of the original Polymath program (`https://en.wikipedia.org/wiki/Polymath_Project`). The goal of the original Polymath project is to solve problems by forming large-scale collaborations between mathematicians. The collaborative work is done on a dedicated wiki site. This project involves long-standing open problems and some of the world's leading mathematicians. The new program is similar but aimed at undergraduates. It includes modest open problems that do not require significant background. It also involves research mentoring by experts.

The Polymath REU consisted of 12 research projects from a wide variety of mathematical fields. There were 27 research mentors and over 300 undergraduates. The participants came from a wide variety of colleges and universities. There were many participants from top American institutions, from a variety of American institutions we were not familiar with, and from institutions in Mexico, Egypt, the UK, Romania, Israel, Denmark, India, Canada, Portugal, and more.

The program was a success. The exit surveys were quite positive (see Figure 1) and we expect at least 14 resulting manuscripts. We believe that many of these manuscripts will be published in nonundergraduate research journals. An up-to-date status of the manuscripts can be found on the program's website. Results have already been presented in multiple conferences. After the program ended, some participants started non-Polymath projects with their mentors.

We also had the wonderful pleasure of discovering exceptional students who were not accepted to any standard

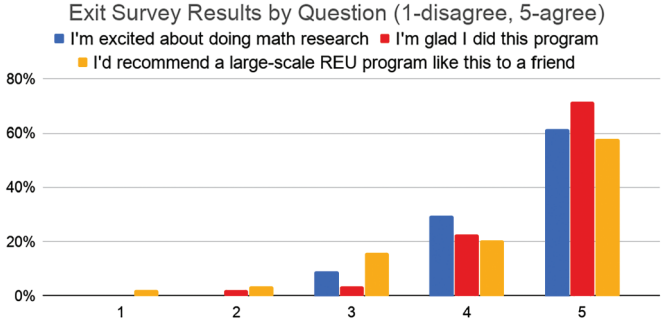

Figure 1. Some results from the exit survey. The *y*-axis is the percentage of people who marked that answer.

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DOI: https://dx.doi.org/10.1090/noti2235