

ADVICE TO MID-CAREER RESEARCHERS

We are starting a new series to provide advice to mid-career researchers. There are a number of programs that SIGMOD organizes for researchers at the beginning of their careers (PhD Symposium and the like) and senior people do not (or should not) need much help. There are considerable challenges for those who are about to transition from an early researcher to a more senior role. In academia, these are people who are about to get tenured that comes with starting to think of moving from shorter-term research objectives to longer-term ones. In industrial research, this corresponds to the transition from participating in projects to initiating and leading them. As a community we don't seem to talk about these challenges much. That is the gap this series attempts to fill. We will get the views of senior researchers from diverse backgrounds and diverse geographies. We will continue as long as we find original advice and the views are not repetitions.

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The Formidable Mid-Career Crisis

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My high school grades were top except for one subject: composition. Free text was (and still is) my absolute nightmare. After high school I only had to do technical writing, which is much easier: it boils down to math. Fact, supporting evidence, implication, which leads to another fact, repeat. So, when Tamer asked me to write a piece about mid-career challenges, I was excited at first, and then I was terrified. I wrote five outlines and veto'ed them all. "I am not good at this," I wanted to say, "ask somebody else!" But, then I remembered – this happens every time I get into unknown territory.

Mid-career, on paper, feels as if you're neither here nor there. You are no longer a hot promising assistant professor, but you are not an established full prof either, and this comes with issues, most prominently, uncertainty. Hurray – you did get through your first promotion, which means two things. First, important people from the international research community that nurtures you to date wrote great things about you in recommendation letters. Second, the other professors in your department want to keep seeing you at the faculty meetings. But after the dust settles, there are many questions. How many committee assignments should you accept? Which ones? Can you still ask around for advice when the going gets tough? Do people expect you to keep working on the same good ol' stuff that got you here or can you go a little out in the wild?

Well, there's good news and there's great news. This mid-career period is your golden age! This is the time to have LOTS and LOTS of fun with no worries and no stress while research is still interesting, but your job no longer depends on that paper being accepted to SIGMOD or VLDB. You are junior enough to still ask around for as much advice as you need, while you are senior enough to attract more and better students. Here below are some thoughts on what worked (in retrospect of course) during my time as a mid-career professor.

Go after a risky vision. Since my student years and as a junior faculty I oscillated between two (seemingly unrelated) topics: hardware/software codesign and scientific data management. It's been hard to choose because the former was more prolific: working with domain scientists produced far less publications than architecture-conscious databases, plus it's difficult to publish interdisciplinary research. Conferences typically center around a single research field and if it is difficult to find reviewers to appraise papers on data management and computer architecture, it is much more challenging to write, review, and publish in data management and neuroscience or astronomy. The latter, however, although rather time-consuming, fulfilled a personal desire to make my work as useful as possible which (strangely!) motivated all my other activities. Many senior faculty advised me to invest my time only on architecture-conscious databases — but it was

impossible for me to quit the super interesting projects I was exposed to, through domain science collaborations.

Mid-career I expanded both directions – I started working on GPU-CPU systems and co-authored and co-led two pillars of the Human Brain Project, an ambitious billion-euro project to understand cognition and brain diseases through combining clinical and simulated neuroscience data and neuromorphic computing. Being immersed in these two related but distant worlds was extremely inspiring: a future became possible where domain scientists never have to install or configure a database again and could express questions regardless of infrastructural limitations. Through endless abstraction (which becomes second nature after so many years in computer science) I resolved to mathematical solutions to combine functionality (expressiveness) and performance (scalability) and decided on the NoDB / RAW vision which, in turn, opened a world of new experiences in research and entrepreneurial activities.

Foster collaborations. If you like to collaborate, data management can be a superb field because it overlaps with many research goals in other fields of computer science but also in domain sciences. I always like to learn from others and collaborations are an excellent way, but they take much time and effort; hence, mid-career is the optimal time to explore working with others. During my eight years as faculty at the Computer Science Department at CMU, I had anywhere from three to six collaborations in parallel at any given time. I worked with computer scientists in the department as well as domain scientists from astronomy, environmental engineering, mechanical engineering, earthquake simulation, and several others. The lessons I learned:

1. *Work on a goal that's exciting for you (too).* When I first heard about the Quake group's quest to study earthquakes in the Los Angeles basin, or about the astronomer's navigation through the Sloan Digital Sky Survey data, for example, I was first fascinated by their goal and wanted to help – and the scientists were equally excited about having a database expert in their team. Nevertheless, in every case it took a long time (nearly 1.5 year) of immersion into their world and of completing DB101 tasks such as schema normalization and index tuning before I saw through to a challenge which allowed me to write a

database paper. The experience was educational and creative, although at the same time stressful because I was an assistant professor for most of this period and I needed publications. As I went on to mid-career, collaborations were a lot more fun.

2. *Hold weekly meetings and assign a student to the project.* I cannot overemphasize the importance of regular (weekly) meetings and having a student assigned to the project to keep a collaboration alive. All the collaborative efforts where meetings were less regular or I didn't assign a student from the start died an inglorious death, and that before I learned a single thing from them. That's not to say that if you have regular meetings and assign a student to the collaboration will always be fruitful, but this way you give the project a fighting chance. Remember, the other party is at most as serious about this collaboration as you are, and they expect at least as much of it as you do.

Organize and promote your students. As you are no longer junior faculty but are still young and energetic, you will likely be attracting your best students during this time – and your advising is essential to help them flourish. Our mission as faculty is to turn students' raw talents into a successful future for them; your expertise and passion is key to this journey. As you probably have already seen, every student is different and their qualifications and needs vary wildly. Each of the 27 Ph.D. students who have graduated from my group to date has been a unique experience for me. I have found new ways to be creative with my advising for each one of them, and in turn each advisee has taught me different things.

A good practice, especially if you like to have a large team like I do, is to encourage them to discuss with each other and work together. Some students will inevitably be loners but most will like talking to others and over time a nourishing pipeline will be formed with a collaborative team culture. As systems take time and group effort to build, I always encourage junior students to work with senior ones initially and spawn off individual PhD topics around the third year, while keeping the collaboration alive until the end of their PhD career. This way students learn to work independently on their own PhDs while co-authoring papers with other students and engaging in other

activities in parallel such as teaching assistantships, helping with proposal writing, applying for fellowships and so on. This way you can also concentrate your advising on higher-level topics and not worry about repeating basic paper structure too often as the osmosis will take care of that.

Despite the teamwork, and even if you have post-docs, you should still make sure to meet with all your students individually every week or at least every two weeks. There are many things the student will tell you but not their peers and each student has different qualities and shortcomings. Senior faculty have always advised me to spend more time with my academically stronger students and invest less time in the weaker ones. I have found spending as much time with a student as they need to be more constructive for my team, as a student with more shortcomings is just a bigger challenge to help shine. In addition, helping late bloomers reinforces the group spirit and smoothens differences amongst students.

Last but not least, I cannot possibly over-emphasize the importance of promoting our students. Examples are the (obvious) practice of having the student's name as first author in a paper rather than our own, nominating excellent students for fellowships or honors regularly, reporting their names to program chairs when they help with reviews and suggesting senior student names for reviewing when appropriate, explain proper etiquette in communications with their peers both offline and at conferences, and most importantly teach them to give great talks. In an era when social networks and indirect communication is taking over our lives (my kids don't even have the "phone" application on their smartphones!), science is based on one-on-one discussions and live presentations; by going out of your way to teach your students to interact, you not only help them find a future, you also set a brilliant example of professional ethics.

Be picky with service you accept. This advice holds in general, but I found the mid-career period particularly challenging in that, from the moment my grace period as junior faculty was over, I was literally showered with invitations to committees. There is a danger that invitations will arrive in the "wrong" order and that you will end up with too much service: for example, you may receive an invitation to a committee of moderate

importance before an assignment which will give you great visibility. There is no way to predict future invitations, so unfortunately you will have to evaluate assignments in-order. I always consider service requests individually, and acceptance is a function of several factors: (a) if my time permits to accept and do the work at a high standard, (b) if it is volunteer work to help underprivileged people, (c) if I will enjoy doing the work, (d) if it will help my career or (e) if a friend is asking – after a few decades in the community this last factor becomes relevant! Each of us may have a different list of criteria or different set of priorities but it is important that you make such a list – and stick to it, which means that you do not accept invitations unless at least one or two of your criteria are met. This way you minimize the probability to have to decline or be overwhelmed by assignments which you would otherwise enjoy.

Summary. I opened this piece with a small example of how, despite that I hate getting out of my comfort zone, I find myself jump at every opportunity to do so. Being a faculty member is unique in that there really is no job description, as each of us defines a successful work day, month, or career differently. The common thread is that being a teacher, an advisor, and a researcher is a labor of love and we are in it for the fun of doing things we've never done before. Unlike a midlife crisis, your mid-career period welcomes risky projects with adrenaline-high unpredictability, stress-free work with interesting peers, energetic meetings with your students, and infinite creativity leading to innovative achievements. And for those of us in a midlife crisis – okay, a BMW M4 is pretty impressive, too.