So you want to be a Research Scientist

Things they don't teach you in graduate school

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Nov 29 · 7 min read ★

Making a career as a researcher can be the most fulfilling and life-affirming experience. Yet I have seen many students tempted by the prospect of a career in research, only to retreat in short order to the relative comfort of engineering. They often treat the episode as a personal failure, a sign they're not 'good enough.' In my experience, it's never a matter of personal worth or talent: It takes a different kind of temperament to thrive in a research setting, one that is often paradoxically somewhat orthogonal to what makes an engineer thrive in their role. Here are some of the dominant tensions I have seen researchers having to face at some point in their career:

Credit: Ben White on Unsplash

1. Research is about ill-posed questions with multiple (or no) answers

Your university training has largely taught you how to solve *well-posed* problems with *unique* answers. But treating research as an exam

problem is a sure way to fail. Much of what you do in research does not get you closer to the answer, but enables you to understand the question better.

> *Measuring progress in units of **learning**, as opposed to units of **solving**, is one of the key paradigm shifts one has to undergo to be effective in a research setting.*

2. Your entire career will be spent working on things that don't work

Almost by definition, once something works, it is no longer research. There is a deep level of angst stemming from the realization that, in the best of scenarios, most of your career will be defined by progress that falls short of actually solving anything, because they're steps in the larger journey from concept to working technology.

I almost gave up on my research career by failing to understand and embrace this simple reality. It was 2004, and my area of research, speech recognition, was in that strange state that it arguably didn't work, yet was being shoved down users' throats mostly for cost reduction purposes. I felt the heavy, resentful gaze of anyone who had ever used an automated 1-800 number over my shoulder. I noticed a disturbing trend at conferences: more and more papers were being published about 'emotion recognition,' which was really a nice way of framing the problem of 'figuring out exactly when a customer was annoyed enough that it was time to send the call to an operator.' I got out of the field for a few years, a choice which helped me tremendously get more perspective on being resilient as a researcher.

3. Your work will probably be obsolete the minute you publish it

Nothing I have done in my career is state-of-the-art today, and very little was still state-of-the-art by the time it had gone through the lengthy publication process. The treadmill of progress is relentless. We measure impact in terms of number of citations, often ignoring that many of these very mentions use one's work as a baseline to show how it is no longer competitive.

FOMO, in this case the fear of someone else beating you to publication, is a huge stressor to many of my colleagues. My constant advice to

those afflicted is that if you're worried about being scooped, you're probably working on the wrong problem in the first place.

> *If it is a problem **you expect to see solved soon** by the community, it is probably not a line of research worth your time in the first place.*

4. With infinite freedom comes infinite responsibility

Good news, you're in control. Bad news, *you* are in control. There is no spec, no blueprint. You may be exploring a completely wrong path, and it's ok. Because you're ok with it, right? As a research manager, much of my role is to act as a therapist for researchers contemplating the abyss of possibilities. I often set boundaries to the research agenda, not because where the boundaries exactly lie matters, but their mere existence helps lower the stress of the unknown.

More often than not, merely reinforcing the path already taken and giving people permission to say 'no' is sufficient. Decision fatigue is a real thing. Charles Sutton has a nice post about the stress and necessity of saying 'no' liberally as a researcher (read the whole series here).

5. Much of research is paradoxically about risk management

Research is inherently risky. Pile risk onto risk, and you get certain disaster. This is why you have to be ruthless about eliminating every other risk from the equation: first and foremost, make sure you trust—and have earned the trust of—your collaborators before engaging in joint research. Most failures aren't technical, they're human. Avoid introducing political and institutional risk. Make sure your funding is secure. However, never compromise on the research risk itself, for example by lowering the ambition just to make the project more palatable to your institution—that's how tepid research is born.

> *Wanting to work on **risky** research is the greatest lie researchers tell themselves: we are all a lot more risk-averse than we think, and every bit of safety you can add to a project directly goes to your research-risk credit line.*

6. You will need to retool often

At the timescale of a career, paradigm shifts occur with some regularity. It is likely that the expertise you've painstakingly acquired over a

decade will be swept away by someone with a better mousetrap. Your ability—or more importantly, your mere willingness—to follow the problem wherever it takes you, even if your true love is the tool you happen to be currently wielding to solve it, can make or break one's career. My own Ph.D. thesis is using a toolkit that probably no one should care about today. Good riddance. It's also often the case that big breakthroughs come from bringing together two presumed disparate lines of research, which often means being willing to learn and absorb the perspective and tooling of a completely new field in short order to even begin to evaluate the possible connections.

7. You'll have to subject yourself to intense scrutiny

There is nothing more suspicious than a single-author paper. I would certainly never trust my own result if it hadn't passed scrutiny of a peer invested in the outcome. The social dynamics of research collaboration are actually part of what makes the scientific product valuable, because the very act of conducting research is prone to tunnel vision and self-reinforcing feedback. I talked in another story about a defining moment of my career that a healthy dose of peer skepticism would have probably prevented from happening.

> *Willingness to be **vulnerable** is a defining characteristic of the best researchers.*

8. Your entire career will largely be measured by one number

And that number will be *public*. Yes, h-index fetishism is a thing, and one you can't easily opt your way out of, because even not making it public naturally raises questions. It's easy to forget that it is a relatively new phenomenon, since the metric was only conceived in 2005. For all its limitations, I find it remarkably robust (read: hard to game) and well correlated to my own personal evaluations of researchers whose work I know well. It also has a lot lower variance than what information you get from an academic's web profile, some of which are terrific works of propaganda art. One day, our enlightened selves may all be judged based on our Bacon-Erdös-Sabbath number. Until then …

9. You won't work a day in your life

I sometimes get asked about how it is to be working alongside famous 'geniuses,' what's different about them and where lies the essence of

their success. And I want to answer that the only thing these people have in common is that they all really work their ass off. And that's the truth, though it's not the whole story. Yes, every single one of them *absolutely* works harder than you (and certainly me), and yes, a common feature is how sharp they are in their focus and dedication, but few of them would also call it work: the true root cause is that they absolutely love what they do, are willing to devote their whole self to it, and much of everything else derives from that.

In my experience as a manager of both researchers and engineers, success as a researcher is often much more connected with how one manages to navigate the pressures of conducting research than to inherent smarts or hard work.

> *Working on things that don't work, without a compass, in a forever changing environment, under the public scrutiny of your peers, takes a certain courage—or folly.*

At the same time, sitting in the seat right next to you, your engineer peers are actually building things that will endure, solving well-defined problems, and exercising the same level of creativity and mastery over their subject matter. Building things that have to work—and are expected to work—takes another kind of bravery and dedication to getting to the finish line, and a healthy dose of self-criticism which is equally difficult to subject oneself to, especially one that can't be waved away with a 'never mind, it's just research …'

Defining what challenge suits your personality best can take a long time (years, in my case), and can change depending on where you are in your career and personal life. The great news for most of us in industrial research is that we don't always have to make this a permanent career choice.