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Viewpoint

Depth and Persistence: What Researchers Need to Know About Impostor Syndrome

Understanding impostor syndrome's complexity and its effect on research persistence.

IMAGE BY SOLARSEVEN

IMPOSTOR SYNDROME IS the unfortunate psychological state where one—who could be rather successful career-wise—feels like a fraud and feels that he or she does not fit in. The phenomenon was first reported by Clance and Imes in 1978 after studying more than 150 high-achieving women.[4] Some suggest that a more accurate name should be self-underappreciation phenomenon or self-depreciation.[7] Unlike devastating physical states such as cancer, impostor syndrome is much more benign. It cannot kill anyone. What it can kill, however, is one's career. Impostor syndrome sabotages it, silently and internally, appearing innocuous and almost trivial. For researchers, impostor syndrome can be deadly. It can sap the energy out of sufferers and erode their scientific pursuits and career dreams. Victims may not even realize they have been suffering from this career-ending cancer, before they lose their zest for work, their passion for research, and stop trying.

I feel extremely compelled to share my deeply intimate research story. It is my obligation as an educator, as a senior female researcher of the community—but most importantly—as someone who now sees the other side and realizes how badly impostor syndrome was holding me back. I am left with no choice.

Public Key Infrastructure

On a cold spring day, I was in a research meeting with a friendly collaborator from Sun Microsystems. I had not published any papers, but was making promising progress on an identity-based encryption project and an access-control project. I had also passed the dreaded week-long programming Ph.D. qualifier exam with flying colors. My collaborator, whom I met for the first time in that meeting, suddenly asked if I was familiar with public key infrastructure (PKI). Caught off guard, I quickly shook my head and said "no" with an awkward smile. But I knew PKI, quite well actually. I did not know why I played dumb.

Fast forward to 2014, I was tenured after moving to a different university in 2009 to solve a two-body problem. I was

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burned out. Luckily, I stepped out of a mild form of post-tenure depression[14] fairly quickly. But I could not help noticing that I consistently did horribly in most of my TV, news, and radio station interviews for my work. I could not look like a bigger fraud in a high-profile 2017 interview. Understandably, CBS never aired that segment. Much later, I learned that the brains of individuals with impostor syndrome tend to overreact to potential threat signals, which inhibits prefrontal-cortex-based brain pathways—a phenomenon referred to as amygdala hijack.[7] Plainly speaking, when I freaked out, I could not think, which happened quite often. Intellectual inauthenticity—downplaying of knowledge, skills, or abilities—is another symptom of impostor syndrome,[13] which explained my earlier PKI episode.

Depth vs. Volume

When Barbara Liskov gave her inspiring Turing lecture, "The Power of Abstraction"[11] at our department, I asked her at the end of our group lunch—how important the volume of work is. The field of computer science has many different successful styles. I was particularly confused by the pure-number-driven assessment approaches (a.k.a. bean counting), which force researchers to simply pump up the volume of papers and grants. Infinity, of course, is the ultimate winner.

In a stern voice, Barbara told me it is all about depth. Being able to work toward a direction and continuously design better solutions to address bigger challenges is much more important than the volume. Gaining research experiences from exploring other problems is useful, which helps one identify the most interesting and suitable area. But ultimately, what matters is depth.

However, pursuing research depth requires a tremendous amount of courage, persistence, and faith. I once did a number of short-lived ad hoc projects, because deep down I was afraid: afraid of committing to my own vision and afraid of asking my students to commit to my vision. Feeling like a fraud also made my research vision blurrier and blurrier.

During her talk, Barbara also calmly showed a black-and-white photo of her sitting in front of a computer wearing an elegant long dress, in response to an earlier question during her visit ("What was it like when you were young?"). First of all, it was a very odd question. But I was more surprised by Barbara Liskov showing her dress in a Turing lecture. Would that not make her appear unprofessional in this male-dominated technical field?

Rock Bottom

One day during my much-needed sabbatical in San Diego, my 9-year-old daughter and I walked to the Torrey Hills Park on a beautiful Southern California afternoon. While my daughter was pounding a handball against the outer wall of a public restroom, I vividly remember feeling like a loser, a big one. I was in a trance, standing under a tree, staring at spotty shadows of leaves on the ground.

My sense of failure was profound and overwhelming. Even though I had many important accomplishments (three U.S. patents on system anomaly detection and document integrity; DARPA, ONR, ARO, and NSF projects; degrees from Peking University, Princeton, Indiana, and Brown; multiple best paper awards, NSF CAREER, and ARO YIP; technical news about my work; and many cybersecurity publications in respectable venues), at that moment, I felt that I knew nothing; I had done nothing useful, nothing that mattered.

People struggling with impostor syndrome do not like to talk about how they feel,[1] as they are ashamed by their self-perceived incompetence. I thought of quitting. I thought of becoming a full-time stay-at-home mom and wife. While I still managed to get papers published and proposals funded, I gradually lost my internal flame as a researcher.

In that brief yet extremely dark period of my career, I lost faith in myself as a researcher. I had no vision about what I could become, how I could contribute to the technological world, and whether or not I had the strength to continue to invent and create. No matter how I compared my work with others in the field, I fell short. I was very certain that I had zero strength in research. I was ready to give up. What is the point of continuing as a researcher?

In a rare circumstance, I was pressed

by an extremely sharp female professor from another institution about the specific plans I could think of to improve their cybersecurity program. "Daphne, what should we do?," she asked anxiously. That question snapped me out of the impostor syndrome fog. Wait, people need me? I have value as a researcher?

The Chicken vs. Egg Problem

Does the experiment not working happen first? Or, does the scientist not believing it would work happen first? If the scientist does not do anything, then it inevitably results in the experiment not working. Thus, the person starts it.

However, the following scenario is also possible. The scientist might have seen some negative indications, for example, someone with authority told the scientist this experiment will fail, or someone repetitively told the scientist he or she is incompetent. Then, the person draws the conclusion that the experiment will never work and it would be both futile and unwise to make any attempts. In that scenario, the environment is the culprit.

Numerous episodes contributed to me feeling like a fraud. A Ph.D. student asked me to change her thesis topic the day after I enthusiastically described my vision, because her husband thought it was obsolete. Another Ph.D. student decided not to join my group, because her cousin told her the thesis topic I chose for her will make her jobless after graduation. A senior Ph.D. student refused to revise our rejected manuscript and demanded to work with a new male professor. A star student of mine with—what I thought and still strongly believe—an outstanding publication record adamantly decided not to apply for any faculty positions, because he thought his publication record with me was too weak.

For many years, people advised me to smile less and to look serious and authoritative. I guess eventually I did manage to achieve that, as my family now urges me to smile more. I can never get it right on the smile spectrum!

Know Your Research Strengths

Overcoming impostor syndrome unlocked my full research potential. I now take a lot more risks in research, specifically in selecting problems. I enjoy working much more. I speak up whenever I deem necessary. I think much more clearly when being interviewed or criticized. My research passion meter now reads fierce, what it should be. There will always be people who think I am weak at research. It is impossible to please everyone. Just like in cybersecurity, it is impossible to achieve perfect security and there will always be attacks that evade detection.

Feeling like a fraud or an outsider has a detrimental long-term effect on research, regardless of one's gender.

Know Your Strengths

Not truly recognizing one's strengths and achievements is not modest. It is stupidity. It denies one from fully capitalizing those strengths. For years, I did not realize that my styles of designing algorithms, conducting quantitative measurements, and developing generalizations and abstractions were my research strengths. My tastes are understandably different, because of my unique training in both natural science and computing. For quite some time, I thought of them as my weaknesses, which I tried to get rid of—unsuccessfully. I felt ashamed of them. I felt ashamed of me always thinking differently, of me always asking my students to work hard on things that mainstream cybersecurity reviewers do not appreciate. Those feelings all stopped when I started to embrace who I am.

I take time to celebrate the research achievements of myself, my students, and my collaborators. Instead of saying "Boy, I got lucky this time," I discuss our research strategies that led to the successful outcomes, as well as mistakes made. Celebrating every achievement helps solidify the process of knowing your research styles and strengths. Embracing your own research strengths, like embracing one's strengths (such as kindness) as a human (for example, Clance,[4] Hunt[7]), needs practice.

I also understand now why Barbara Liskov showed that dress picture—one's outfit has nothing to do with one's research competence!

In the meantime, I make efforts to improve my weaknesses. I do not recommend anyone to hide their weakness, if it is a critical research skill. Also, do not be intimidated by others just because they seem assertive.[22]

Self Help vs. Support System

Earlier studies proposed psychotherapy treatment, focusing on correcting the deeply flawed thought patterns of impostor syndrome sufferers.[4,10] However, I occasionally found myself at the receiving end of impostor-syndrome-inducing microaggression or sexual harassment that caused me to feel like I did not belong. I had to let some minor ones slide, in order to stay fiercely focused on research. I could not control what others said or did, but I could try consciously creating a supportive environment for myself.

Growing a thick skin is insufficient. Lean in alone is not enough. We do not know whether the chicken or the egg comes first, whether the person gives up first or the computing culture—being imperfect as it is[2,3]—pushes the person to quit. Therefore, we need to improve both the chicken and the egg, both the individual and the system.

Raising the awareness of impostor syndrome and creating an honest, open, and judgment-free environment for people to share experiences are excellent starting points. As an executive committee member of ACM SIGSAC, I organize multiple inclusive excellence programs,[8,19,20] where impostor syndrome is a frequently discussed topic. I actively share recordings of my lectures on impostor syndrome.[21] We welcome all people to attend these events, regardless of their gender and race. Great minds do not think alike.

Impostor-Syndrome-Inducing Sexual Harassment

What do one-off hand rubbing, leg touching, thigh grabbing, objectification remarks, or second-class status comments have anything to do with

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research? Speaking from experiences, sexual harassments of all forms significantly dampen, if not completely kill, the research flame of victims. Sexual harassment incidents are well documented (for example, in scientific research[12,15] and in Silicon Valley.[2] Oftentimes, victims choose not to report for fear of workplace retaliation, which widely exists.[3,17] They simply quit, dropping out of graduate school, avoiding meetings where perpetrators may attend, not going to conferences or professional social events. Needless to say, the person's research passion meter gradually points to the dropout zone.

Organizational climate for sexual harassment—a perceived organizational-level tolerance of sexual harassment[6]—is the most potent predictor of sexual harassment.[12,18] I am happy to see that ACM SIGSAC and IEEE Security & Privacy TC recently started to require sponsored conferences to have code of conduct on sexual harassment. I strongly recommend all leaders to read the 2018 landmark report by the National Academies of Sciences, Engineering, and Medicine on sexual harassment[12] and begin understanding the extent of devastation.

Conclusion

Feeling like a fraud or an outsider has a detrimental long-term effect on research, regardless of one's gender. For researchers who are prone to impostor syndrome, the biggest takeaway is to identify and reduce impostor-syndrome-inducing factors. May it be your own thinking habits, may it be the society's implicit bias against you, may it be weekly microaggressions, or may it be sexual harassment. Know that these seemingly unrelated factors can seriously damage one's research career.

How do you know you have it? When self-doubt keeps you from pursuing new opportunities, you are probably experiencing impostor syndrome.[7] But do not be afraid—Maria Klawe has it too.[9]

For community, organization, and research leaders, educate yourself about impostor syndrome too. Be aware of the negative impacts and provide the necessary changes and support for potentially vulnerable underrepresented groups. As our computing community starts to understand the impact of impostor syndrome on undergraduate students (for example, Rosenstein[16]), let's also begin to discuss its broad impact on research. C

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