

Exploration and Exploitation: Navigating and Accepting Uncertainty

In my previous USR posts, I have tackled some form of uncertainty. My LIOC post highlights the uncertainty of a theoretical education's usefulness, while my UMC post highlights how a concept-driven education leads to uncertainties about domain. While each post ends with untangling some of its questions, much uncertainty remains about what my long-term goals are and how I should find work that is fulfilling. What steps should I take now to help me further untangle these uncertainties? Moreover, since there is no magic bullet, how do I become comfortable (and not discouraged) with uncertainties? The idea of *exploration and exploitation*, well-known in the field of machine learning, strikes a balance between exploring new opportunities and utilizing past learnings. This essay talks about how exploration and exploitation can help me overcome and accept uncertainty. The essay first elaborates on what exploration and exploitation means, and how this machine learning idea fits in the context of personal uncertainties. It then talks about how the idea can help me untangle the uncertainty of long-term goals – through diversification of experiences, and learning from social comparisons instead of getting intimidated by them. The essay ends by exploring limitations in the idea – its focus on immediate results and its extremely forward-looking nature – and that sometimes slowing down and reflecting are essential to effectively untangle uncertainty.

The idea of exploration and exploitation in machine learning has parallels with how to navigate personal uncertainties about long-term goals. Simply put, the idea refers to the balance an agent needs to find between exploring new strategies to gain greater rewards (exploration) or sticking to strategies that have worked well so far (exploitation). Over time, the agent learns to find an effective balance between the two. Uncertainties about long-term goals have a similar nature. An individual facing uncertainties cannot continue to exploit existing knowledge sets; uncertainty exists because existing knowledge sets are not adequate for decision-making. The individual thus needs to 'explore' to expand their knowledge sets. Nevertheless, everyone does have some core, non-negotiable portions of existing knowledge sets – their personal values and desires. They would thus 'explore' while continuing to 'exploit' these core knowledge sets – the opportunities they explore to find certainty in long-term goals would be rooted in these very personal aspects of individual identity. A simple example would be that a computer science (CS) student might not know the domain he wants to work in, but is steadfast about working with technology. Exploration and exploitation thus refer to expanding existing knowledge sets, while having a belief in critical past learnings.

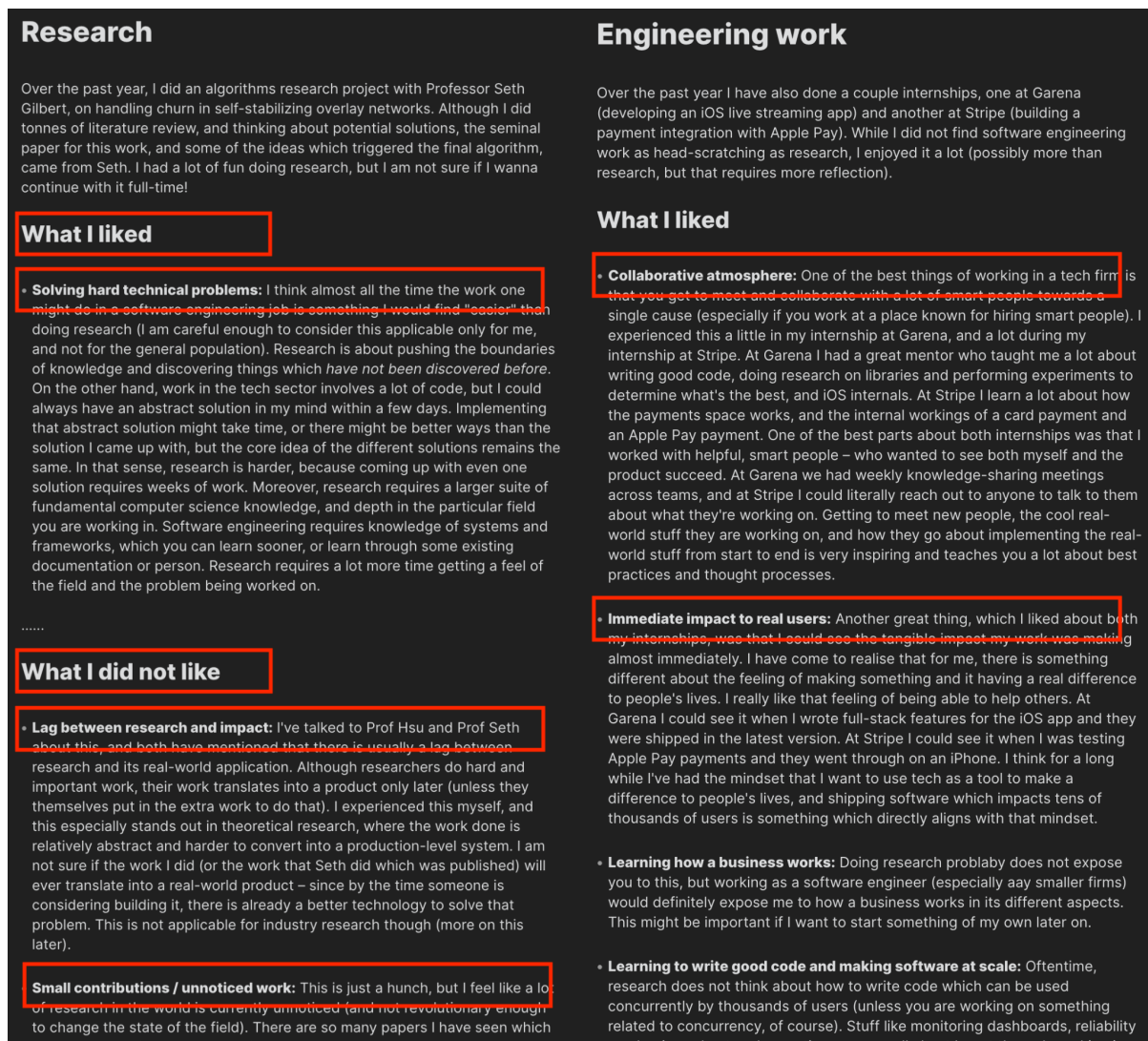


Figure 1: Excerpts from my reflection on research versus software engineering

Exploration and exploitation helps overcome uncertainty by encouraging an individual to engage in diverse experiences, which enhances their knowledge sets to enable more informed future decisions. I briefly mention this in my UMC post – having a diversity of domain experiences can help individuals isolate characteristics about work they would like. The individual thus gets a clearer notion of the self, expanding their exploitation strategy to more concrete criteria and reducing uncertainty in the next decision. Figure 1 is a screenshot of a detailed reflection comparing CS research to software engineering in the industry, with sections on “What I liked” and “What I did not like” in each. The two very different experiences helped me isolate characteristics I like: “immediate impact to real users” and “collaborative atmosphere” in software engineering, and “solving hard technical problems” in research. This ensures that the opportunities I explore in the future are more intentional in avoiding characteristics I do not like and including those I do. These learnings also ensure that I do not just ‘drift’ around and pursue the latest trend – even though AI/ML academic research is very popular right now¹, it does not interest me as much because of academia’s “lag between research and impact” and the probability of “small contributions [and]

¹ The following Tweet contextualizes this claim: <https://twitter.com/lindsey/status/1349078564457508864>.

unnoticed work”. Beyond isolating characteristics from diverse experiences that an individual likes, gaining knowledge about characteristics that do not seem as important in the present is also useful. Individuals sometimes want drastic changes in their personal life and careers – for example deciding to become a parent, or moving from private to public sector. These changes require proportional changes in needs, values, and long-term goals. Past exploratory experiences that previously did not contribute much to exploitation strategies might become useful here, since the long-term goals have changed. Exploring helps expand an individual’s knowledge sets, and the learnings can be exploited to overcome uncertainty and make more informed future decisions.

3. This question is a little more personal: What prompted you to move from an IC role to a management role? In what ways do the roles of a manager and an IC differ, and in what ways are they similar? Moreover, how should one go about evaluating whether a management position will be suitable for them?

This is a great question, but a rather large one! I'll take them one at a time:

What prompted you to move from an IC role to a management role?

I wanted to more actively help folks develop their careers and grow, as well as to step out of the details of implementation and think more broadly about tech/product strategy. I actually switched to EM for the first time at a prior company, so I knew what I was getting into at Stripe.

In what ways do the roles of a manager and an IC differ, and in what ways are they similar?

I would say that management is a fairly different role from being an engineer. There are overlaps in skillset, of course: good EMs should be enough in the technical details that they can help de-ambiguate or provide clarity, or give coaching and practical advice when needed. However, the necessary skillset for an EM is broader and more in flux than that of an IC imo: a good EM should have strategic thinking skills (having the vision), interpersonal skills (being able to lead team(s)), and the core execution skills (technical skills, project management and product skills). I think Camille Fournier's book, [The Manager's Path](#), does a good job of clarifying what an EM's role is - I think it's helpful even as an IC to understand expectations for an EM!

Moreover, how should one go about evaluating whether a management position will be suitable for them?

This is pretty subjective, but in my view, folks should generally be senior engineers before they think about moving to management: it's difficult to coach others or judge technical direction without that base of experience and technical depth. That experience will also give you a deeper idea of *what* a manager does, likely with some opportunities to share in that role (e.g. via project leadership), which will give you a better idea of whether that would be a direction you'd want to grow into. Otherwise, if what I described in the last question sounds interesting to you, I definitely think it's helpful to find lightweight ways to try on that hat.

Figure 2: Email thread with internship manager on engineering management (EM)

Exploration and exploitation can also help in social comparisons, which can be a major driver of an individual’s uncertainty. Exploring diverse experiences often means interacting with new people – for example, when someone interested in research meets a professor or a PhD student. Some of these interactions involve people that are particularly accomplished and passionate about their work, which can make an individual feel intimidated, question their own progress and intensify their sense of uncertainty. Such intimidation goes against untangling uncertainty – individuals question whether exploration is the best strategy and their confidence on personal life trajectories and past learnings gets lowered. A conviction in the idea of exploration and exploitation can help counter this intimidation since it inherently encompasses the notion that individuals have different starting points and past trajectories that are highly dependent on their exploration-exploitation decision points. This makes everyone’s journey highly unique, and helps an individual realize that everyone faces a different set of factors to take them where they currently are. What matters is the choices the individual can make *now* to be on the trajectories they desire. Beyond accepting uncertainty, the idea of exploration helps promote curiosity for others’ exploration-exploitation strategies. The frame of thinking thus shifts from being intimidated and questioning oneself to *understanding the decisions and experiences it took for an individual to become accomplished*. Figure 2 is an email thread with my internship manager discussing her decisions for moving into engineering management, as well as the metrics she used for determining whether management is suited for her. Rather than getting intimidated by effective managers (a role I considered myself inadequate for), the conversation helped me understand the metrics I can employ in the future to judge my suitability for the role. The idea of exploration and exploitation replaces intimidation with curiosity, creating space for

accepting uncertainty as a phase of personal trajectories, as well as generating insights to overcome it.

While the idea of exploration and exploitation helps navigate and accept uncertainty, it needs to be integrated with the notion that growth is a process, and that the act of reflection is also key to expanding knowledge sets. An agent which explores and exploits is *constantly* making decisions on whether to expand knowledge sets or exploit existing ones, failing to consider that sometimes *slowing down and stepping back* is needed to untangle uncertainty. *Slowing down* because growth is a process rather than a point (as mentioned in my SSA post), which means that untangling uncertainty is often a process stretching over a period. Instead of actively making decisions and expecting insights, sometimes one just needs to slow down and engage themselves in processes whose insights will develop and reveal in due time. *Stepping back* because exploration and exploitation is a very forward-looking process; either strategy must be employed to make the best possible choice *for upcoming decisions*. However, reflection often involves gleaning meaning “from our own past experiences” (Dewey), since the act of looking back with updated knowledge can reveal new insights about ourselves and our past decisions, thereby expanding our current knowledge. Every post in USR (including this one) reflects on experiences that happened in the past, and generates new insights I can carry forward in the future. Exploration and exploitation is thus not an all-encompassing solution – we sometimes need to be kind to ourselves and wait out the outcomes from growth-inducing processes, and at other times need to step back and reflect on past experiences to generate new insights for the future.

This essay elaborates on how the strategy of exploration and exploitation can help individuals untangle uncertainty. It can help them overcome some uncertainty by expanding knowledge sets and helping make more informed decisions, while keeping in mind that uncertainties are acceptable and sometimes an inevitable consequence of personal life trajectories. I plan to employ key ideas from this strategy as I untangle my own uncertainties after university, while being kind to myself through growth, and integrating the act of reflection in my experiences and decisions.

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