

Two Directions for Career Decisions: Concepts Versus Domains as Focal Points

I have always believed that studying computer science (CS) is an effective way to make an impact in the future, given the society's increasing dependence on technology. As a result, I diligently spent effort exploring different sub-fields under CS, to have a *wide set of tools* to solve different problems. However, does this focus on tools, or technical concepts, take away focus from the application domains in which the concepts are used? In this essay, I talk about two different approaches to making career decisions – one which starts with understanding *concepts* and applies them to different *domains*, and the other which starts with understanding domains and then figures out concepts to apply. Here, 'concepts' refer to generalisable techniques that can be used to solve a variety of real-world problems, while 'domains' refer to specific, tangible issues existing in the real world. I first explain how my CS curriculum gave primary importance to concepts, encouraging career exploration through exploring different technical concepts. I then talk about how my learnings in *UHB2206: Leadership in a Complex World* gave primary importance to application domains rather than concepts. I conclude by talking about the uncertainty that arose in my career aspirations after discovering the two different approaches and exploring ways to untangle this uncertainty.



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to Julia, Careers

Mon, 9 Dec 2019, 00:16

Hi Julia,

Apologies for the late reply, I have been traveling for the past couple of days. Thanks for replying, looking forward to the coding assessment you'll send! To answer your questions,

1. I chose to apply to Alphalab Capital for two reasons. First is the nature of work; as I previously mentioned, I want to explore opportunities relating to lower-level programming. I have not had any project experience in implementing lower-level details of a system, save for the Operating Systems and Programming Languages course I took in college this semester. I found it really interesting and more challenging than what I have tried out before, and I feel like sometimes general software engineering does not involve as much problem solving and building optimal solutions from scratch as I would like trying. I've been looking for internship experiences which would let me explore a similar opportunity, and quantitative trading firms seemed close enough. Secondly, I would love working in a startup environment because the level of impact and flexibility is usually higher, and the experience is also usually more fast-paced. I would prefer working in such an environment, which is another reason why I chose to apply to Alphalab.

2. As previously mentioned, I have not had past personal project experiences relating to lower-level programming before. I only got seriously started considering the idea last semester. I am learning the programming language Rust these winter holidays though, and am planning to finish a project (probably a Tetris game?) in Rust before the holidays end. My other projects have been very product-focused, and I've had experience with web and Telegram bot development. In terms of coursework, I did Operating Systems and Programming Languages as mentioned before. In my OS course, we implemented various components of an OS like a bash shell, page replacement algorithms, buffered IO, synchronization mechanisms, etc. In my Programming Languages course, we had an assignment where we developed a Prolog parser and interpreter in Haskell.

3. In the fiction category, I recently read this trilogy called *The Three-Body Problem* by Cixin Liu. Thoroughly enjoyed reading it as I think it's extremely witty and explores very interesting philosophical questions. In terms of non-fiction, a great book which comes to my mind and I read recently is *Guns, Germs and Steel*. The book basically explores how certain societies are more prosperous than others and traces the core reasons to geographical and environmental factors from a long time ago.

I hope I have answered your questions well. Thank you, and looking forward to your reply!

Best regards,
Chaitanya.

Fig. 1: Email to a quantitative trading firm asking for an internship

CS curricula usually take *concepts as their focal points*, which are starting points and become the primary frame of reference when thinking about career paths to explore. CS students often first think about *what computer science concepts they want to work with*, rather than *what application domain they want to use CS concepts in*. For example, they would say something like “I am okay working in genetics, medicine or nuclear energy as long as it involves machine learning”, since machine learning is their primary focus, and the domain secondary. Such an approach in CS is

not unreasonable, though. Given how the entire study of computer science is about learning computational concepts, and how such computational concepts are often applicable to many different domains at the same time, focusing on domains could pigeonhole the discipline and compromise with its flexibility and richness. Nevertheless, a consequence of this focus on concepts could mean that those studying CS, when exploring careers, either give the domain a secondary status or no consideration at all. Fig. 1 shows an email I sent while looking for internships in year 2, and my focus on learning different concepts rather than the domain is evident. I talk about wanting to join a particular company because they do work “relating to lower-level programming”, in contrast with my experience in “web and Telegram bot development” in the past. My strategy for career exploration *focused on concepts* like bot and web development, and low-level programming, and I did not consider whether I resonated with the domain of quantitative trading (which I have realised I strongly do not). Because the curriculum encourages thinking through the frame of technical concepts, it becomes possible for concepts to take centre stage in career decisions, rather than the application domain itself.

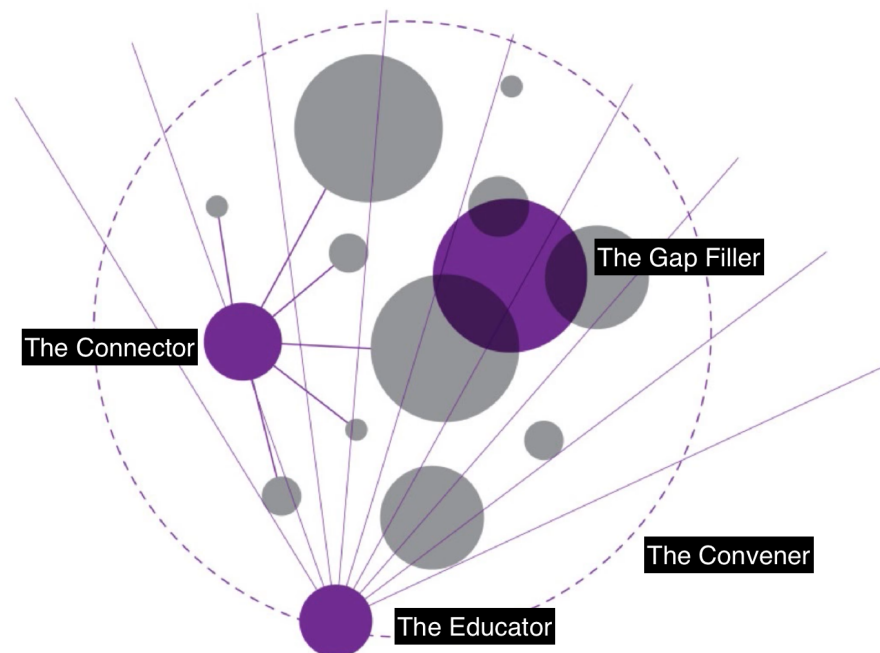


Fig. 2: Different roles in systems-led leadership

innovation and the *USPitch* talked a lot about grit and passion for social change. While every single class helped towards thinking critically about leadership, there was an assumption that leaders have an idea of *what they want to work on* and *what role to play*. The Leadership

Diamond assumed leaders are in a domain that suits them, and the classes on social change assumed that leaders have found a social domain they are passionate about. However, aspiring leaders have “many industries and interests [to] potentially tap into” (Hagh), which can be overwhelming. How should aspiring leaders go about choosing career paths best suited for them? This essay proposes a lesson plan titled ‘Finding the Right Work To Do’, placed after the class on social innovation and change. It briefly establishes the significance of such a class, followed by laying down some discussion ideas and class assignments on two key sections – why aspiring leaders make suboptimal career decisions, as well as some frameworks which can help them evaluate what domains of work, as well as what roles, are best suited for them.

A segment aimed at how leaders can evaluate the right domain of work is in line with the learning outcomes of the module. Firstly, such a lesson is relevant to understanding the dilemmas faced by aspiring leaders, and also a critical success factor in leadership challenges.

Young aspiring leaders have a “limitless number of possibilities that lie ahead” (Hagh), and it makes intuitive sense that to be successful they have to do work they feel strongly about. For example, in the class on social innovation (and during the *USPitch*) we learnt how the best social entrepreneurs are those who are relentless about a cause they strongly believe in.

Fig. 3: Excerpt from a UHB2206 essay on how leaders find their ideal domain

A different approach for career decisions is taking *domains as the focal points* instead, which can lead to personal tension in those used to concepts as focal points. Individuals subscribing to this approach would usually feel strongly about a particular domain and use concepts as a tool to make differences in that domain. For example, instead of using machine learning in whatever domain, a person would say something like “I am really passionate about nuclear energy, and I am going to use my machine learning skills to advance that area”. The module *UHB2206: Leadership in a Complex World* illuminated this approach through two key ideas. The first is systems-led leadership, where leaders “make decisions... based on understanding the systems within which they work” (Systems-Led Leadership). Effective leaders “understand a bit about the challenge, and a bit about what’s already been tried” – focusing on understanding the domain – before deciding “which tool to pick up to contribute” (Papi-Thornton, 8:43). Thus, understanding the domain is the primary focus, and the concept used to solve problems secondary. To illustrate this approach, Fig. 2 is a diagram from a video discussed in class,

representing a system (Papi-Thornton). The purple circles are the different approaches to make a difference in that system, but it is important to first understand the domain before jumping into brainstorming solution concepts. The second idea in UHB2206 driving the importance of domains was that effective social entrepreneurship requires *feeling passionate about a particular cause*. Fig. 3 is the excerpt of an essay I wrote for UHB2206, and it mentions my learning from the class that “the best social entrepreneurs are those who are relentless about a cause they strongly believe in”. For these social entrepreneurs, the cause is a starting point, and concepts are just techniques to make a difference in that cause. This contrast between domains and concepts as focal points led to an internal tension about my career choices. As mentioned in Fig. 3, it made “intuitive sense” to me that one needs to feel strongly about their domain to be successful. In fact, the essay was about how leaders find their ideal domain, and a personal attempt to answer the uncertainty I was facing because of focusing on concepts. The way CS approaches issues made me think more about *how to solve* a variety of problems rather than *which problems I am passionate about*. Thus, domains as focal points are a different approach to career decisions compared to concepts as focal points, and being exposed to both led to personal uncertainties.

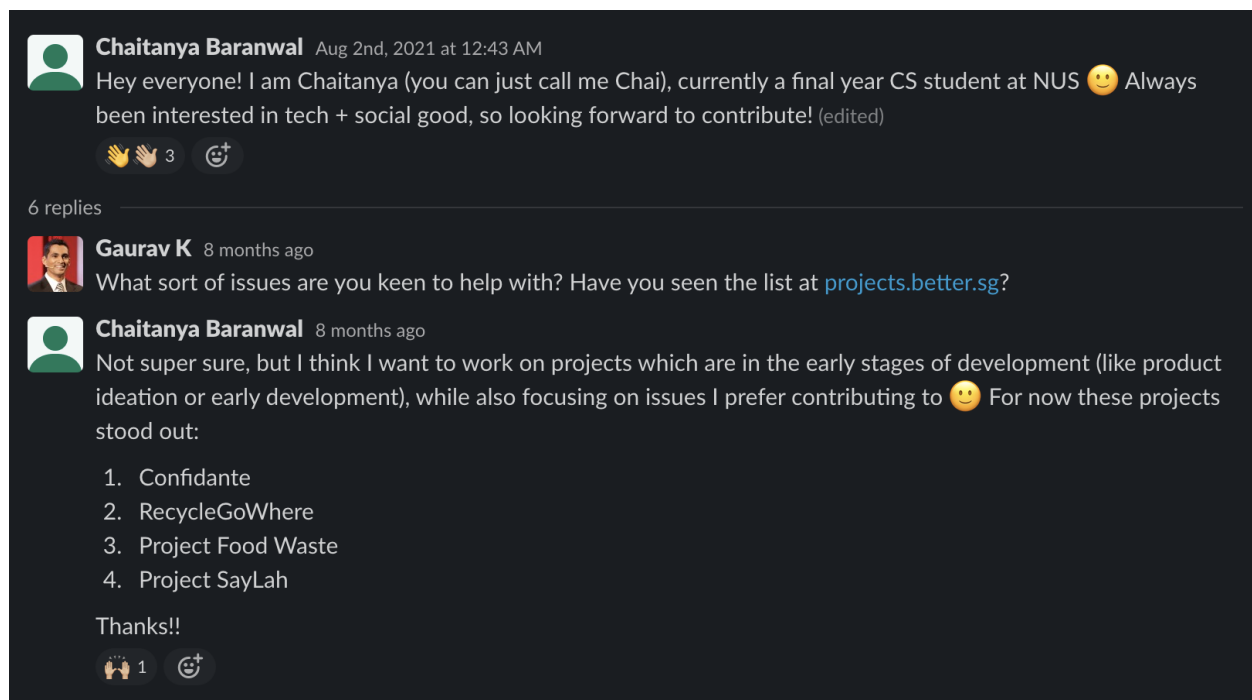


Fig. 4: Expressing interest in multiple domains of tech-for-good

Resolving this lack of domain-centric thinking in someone used to concepts as focal points requires having experience in a diversity of domains, as well as cognizance that domains and concepts are inherently related. Firstly, having a diversity of domain experiences helps isolate characteristics – such as target community or technical novelty – one would like in their careers,

making it easier to subsequently find better-suited careers. Taking CS has actually helped me in this diversification, since I can always use my knowledge in some way to solve problems in whatever domain. Fig. 4 is my introduction to the better.sg community, which is a volunteer organisation handling several tech-for-good projects. The projects I list down as personally interesting are across diverse domains – from SayLah (helping people in the autism spectrum with speech) to RecycleGoWhere (encouraging recycling). Beyond diversification of experiences, one must also keep in mind that concepts and domains are not mutually disjoint. They exist in a dynamic relationship – each constantly updates the understanding of the other, helping the individual create new knowledge sets to make more informed career choices. The domains to which concepts are applied can reveal new insights into the concept, such as its possible uses or a property that might manifest outside the particular domain. A good example of this relationship is in my Learning Inside and Outside of Classroom (LIOC) post. Developing a ranking system using concepts in graph theory and the *PageRank* algorithm led to a new insight about graphs – that they can rank relative importance of entities independent of numerical scores. The applications of this concept exist outside of just ranking systems, such as determining the authenticity of literature or predicting traffic, thus extending the knowledge base on graph theory applications. The same goes vice versa: concepts applied to a domain can lead to new insights about the domain, such as additional sub-problems which were ignored or new ways of breaking down the problem. After *PageRank* became popular in ranking web-pages, additional problems were discovered when people started to ‘game’ the *PageRank* rankings. As a result, newer algorithms have been developed which aim to solve this issue¹, advancing the field of internet search. Different concepts reveal additional insights about a domain or the domain reveals insights about concepts which are transferable to other domains. Ultimately, this helps individuals gain deep appreciation of different domains and navigate their career paths better.

This essay talks about two different focal points of approaching career decisions – one placing concepts while the other placing domains as their focus. I talk about the internal tension and uncertainty that arises through being exposed to both approaches, as well as strategies one can employ to overcome this tension.

Word count: 1428

¹ One such example is MarketRank: <https://dkb.io/post/market-rank>

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