



Musings on Getting the CAREER Award: the Many Ways I Failed and How I (Eventually) Succeeded

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Caveat Emptor

- Advise Paradox: Advise (including mine) is usually well intentioned but may not be directly applicable
 - “Selectively filter” advise
 - This is particularly relevant pre-tenure, especially for CAREER



Intended Audience

- Since this is the first awardee talk, let's set the stage
- Everyone here is/has been:
 - Highly successful PhD students
 - Likely won fellowships, best papers, and/or other awards
 - Been hired as an Assistant Professor
 - (Public universities only) Found extended family can look up your salary
- This transition is easier for some than others
- “The difference between being a grad student and a professor is writing non-fiction vs. fiction” – Mark Hill
 - Implication: writing grants is a new/different skill (and it's **harder**)



Intended Audience (Cont.)

- When I attended this workshop, I found it difficult to take actionable feedback from winner's talks
 - If you are feeling this way, this talk is for you
- My focus:
 - Less on the details of my successful CAREER proposal
 - Research ideas in my proposal likely only relevant to small subset of you
 - More on the process to writing a successful CAREER proposal ... and the lessons I learned along the way



The Role of Randomness

- Sometimes the CAREER award process can feel like this:

```
int getRandomNumber()  
{  
    return 4; // chosen by fair dice roll.  
             // guaranteed to be random.  
}
```

[Source: XKCD]

Hopefully my talk will give you some tools to reduce this randomness
... or at least suggest what not to do



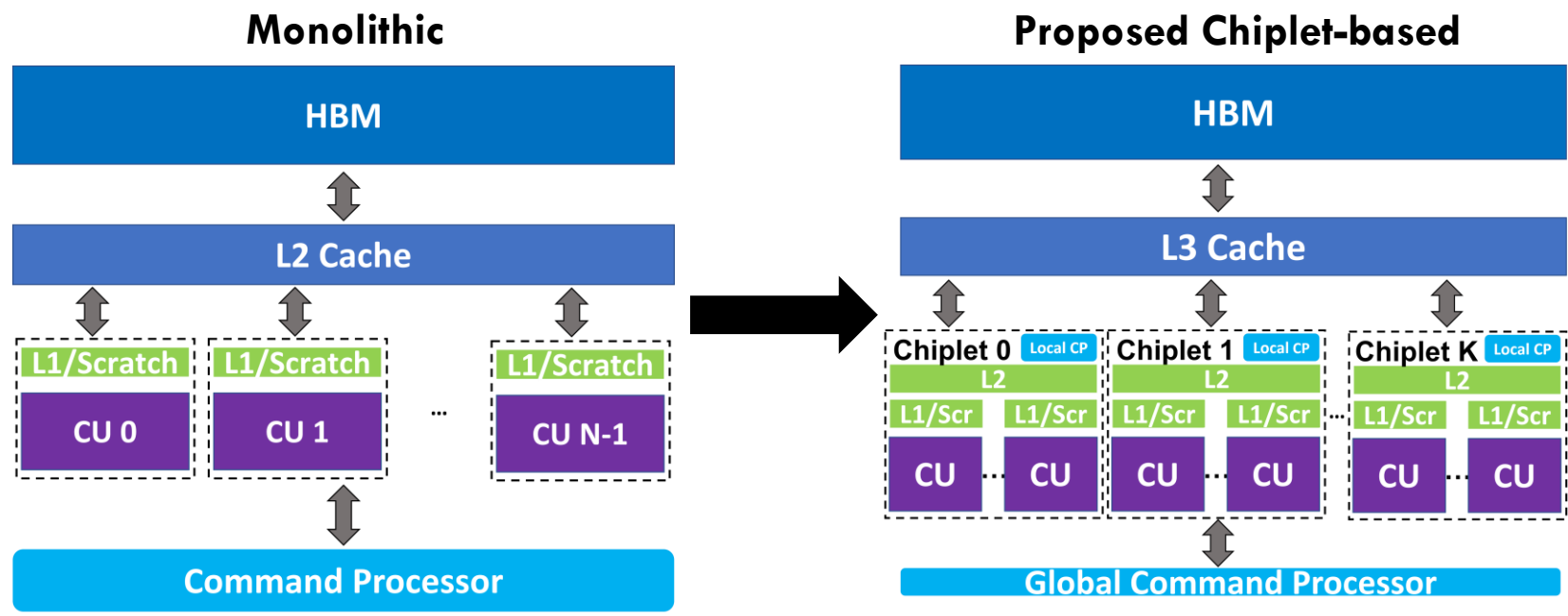
My Story

- Round 1: Originally submitted CAREER in Summer 2020
 - Soundly rejected
 - Reviewer C's comments sometimes still haunt my dreams
- Round 2: Submitted again in Summer 2021
 - Better feedback, but still ranked as low competitive
- Round 3: Submitted in Summer 2022 and awarded

Takeaway: you **can** recover if you don't get the CAREER the first time
... but you need to **honestly** consider and address the feedback



Brief Aside: My Research Area



Monolithic hardware designs reaching size limits

To continue scaling performance, turning towards chiplet-based designs

Challenge: chiplets add more hierarchy, which heterogeneous systems abhor

My work: redesign control plane for chiplet-based heterogeneous systems



In Hindsight I Made a Lot of Mistakes:

1. Didn't Get (Enough) Early Feedback
2. Not Properly Motivating Importance of Work
3. Not Structuring Research Components Logically
4. Word Choice Negatively Impacted Reviewers
5. Seduced by Buzzwords
6. Insufficient Preliminary Data
7. Connection with Industry Not Sufficiently Spelled Out
8. Was Unclear How Broadly Applicable Research Was
9. Not enough detail in Evaluation Plan

80-90% of my fixes were here

I will present these as distinct, but they are all related



Getting Early Feedback

- Most Workshop Common Question: “*how do I know if my research idea(s) are ‘good enough’?*”
 - Unless you work in my sub-area, I probably don’t know
 - But who does know?
 - Assistant Professors in your area who already got the CAREER award
 - Your advisor
 - Senior faculty in your department
 - Your PM (meet with them, but expect higher level feedback about fit)

Mistake #1: I was too protective about my research ideas



Getting Early Feedback (Cont.)

- What I did differently the third time:
 - Sent my proposal to as many people as I could
 - Some didn't respond (remember: all professors are busy)
 - Some only read summary and/or motivation (still useful, especially if they are not in your sub-area)
 - Others read the whole thing

Suggestion #1: *Actively seek out as much feedback as possible*

Encourage them to be brutally honest, then fix things

They will see problems you aren't experienced enough to see



To Get Early Feedback, Manage Your Time

- Challenge: all of us are very busy
 - Seemingly everything is urgent
 - Frequent class/research/service deadlines
 - ...

Mistake #2: I started too late and couldn't get feedback

Suggestion #2: send a draft at least a couple weeks before deadline

Doesn't even need to be a full draft – can just be Summary and Motivation

Summary and Motivation most important anyways (more upcoming)



Properly Motivating Research

- In my first two versions I did not sell the work properly
 - In particular I used “incremental” wording (more later)
- Biased reviewers towards work seeming incremental
 - Reviewers (like you) are busy people
 - First two pages (motivation) are most important on convincing them your work is important

Mistake #3: Improper motivation did not sell work well

Solution #3: You **must** sell them on your grand vision here

I iterated on this **many** times with those I got early feedback on



Structuring Research

- “Traditional” Proposal Structure: **Tree**
 - Key Insight/Idea
 - Idea A → Idea B → Idea C → ...
 - Each research idea leads directly to the next one

Mistake #4: My CAREER proposals ideas did not fit this format

Instead, I had a key insight that would solve many different problems...



Structuring Research (Cont.)

- Associate Professor in my department: “There are other ways to structure a proposal”
- What worked for me: “**hammer**” model
 - As in: I have a hammer, I’m going to apply it to many problems
 - Hammer Structure:
 - Apply Hammer to A
 - Apply Hammer to B
 - ...

Suggestion #4: Pick a format that suites what you are doing

Reviewers can tell if you are trying to force things
“Relentlessly on message” – how does each piece fit into overall story



Word Choice Matters a Lot

- (Related to properly motivating work)
- CAREER program's focus: long-term, major steps forward
 - Implication: incremental work unlikely to be funded
 - To contradict previous panel: when I included incremental work as “first step” it got crushed by reviewers (became a target for criticism)
- Thus, word choice is important:
 - “extend, build upon, smarter” ... can sound incremental

Mistake #5: I was accidentally using incremental sounding words

Suggestion #5: Use words that do not bias work to seem incremental

This greatly improved my proposal with very small changes



Buzzwords: Hype or Reality?



Quantum computing,
machine learning,
robotics,
security, ...



Mistake #6: I tried to adapt what I was doing fit the hot topics (ML)

Suggestion #6: Only pursue the hot topics if they fit your work

Reviewers can tell if you are trying to force things

Make sure to explain qualifications for doing the work



Getting Preliminary Data

- Theory: sell vision of your future work
- Reality: need to provide some evidence your vision is good (beyond the theory)
- *Sidenote: This differs somewhat with sub-area*
 - Ask others in your sub-area for sub-area specific advise

Mistake #7: I didn't have enough preliminary data

Suggestion #7: Provide preliminary data for at least first couple parts

Preliminary data **does not** mean the research is done already

Can use Python, analytical models, etc.



Connections with Industry

- Many of us work on problems industry wants to adopt
 - My case: company wanted to adopt my research in future products
- First two tries: got letter(s) of collaboration, discussed in the proposal
 - In theory “tech transfer” makes work “more likely to succeed”
 - Reviewers did not feel the same way

Mistake #8: Reviewers wanted more details about industry collaboration

Suggestion #8: Need a detailed plan about how industry will adopt work

1-2 paragraphs → show you’ve thought about this



Broader Applicability of Research

- CAREER awards focus on long-term impact
 - Thus, need to make sure to sell grand vision broadly

Mistake #9: I focused specifically on how many research worked on GPUs

Reviewers: GPUs not hot anymore – does this work on accelerators too?

Suggestion #9: Sell the work as broadly as possible (within reason)

Extended each research section to discuss different accelerators



Evaluation Plan

- CISE CAREER proposals must include an evaluation plan
 - Somewhat like a paper methodology
 - But also needs to include “metrics of success”
 - For me: this meant performance, power, network traffic targets

Mistake #9: I focused on what benchmarks I'd run, not measurements

Reviewers: great ... but what are “metrics of success”?

Suggestion #9: Provide clear metrics of success, appropriate details

Get feedback from your PM or others in your area on appropriate metrics



My Suggestions

1. Get Early, Brutally Honest Feedback from People You Trust
2. Not Properly Motivating Importance of Work
3. Pick an Appropriate Structure for your Research
4. Use Words that Sell Your Grand Vision
5. Only Pursue Buzzwords if They Fit
6. Provide Preliminary Data To Demonstrate the Validity of your Ideas
7. Explicitly Discuss Research Connection with Industry
8. Explain How Ideas Apply More Broadly
9. Provide Sufficient Evaluation Details, Including Success Metrics



Useful Resources

- <https://pages.cs.wisc.edu/~markhill/grant-tips.html>
 - “SMART” model is particularly useful
- NSF tips: <https://beta.nsf.gov/science-matters/nsf-101-four-tips-applying-nsfs-career-program>
 - More broad, but still useful
- Various professors have posted their prior CAREER proposals (and/or tips) online