

Writing the First 2 Pages of an NSF Proposal¹

Presented During the NSF/ASEE CAREER Writing Workshop

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May 12, 2023

¹Heavily “borrowed” from Simon Peyton Jones’ presentation titled “Writing a great research proposal”, Microsoft Research, Cambridge.

What Makes a Book Great²?

- ▶ A strong opening
- ▶ Compelling characters
- ▶ An absorbing story
- ▶ Sharp dialogue
- ▶ Unique style

Think of the Proposal as a Short Story

You are writing a short story. Make it compelling!

²<https://www.masterclass.com/articles/the-elements-of-a-good-book>

Why are We Even Talking About This?

- ▶ Your proposal competes with many others (count on a 10% success rate or lower)
- ▶ You are writing for a panel of “experts” with limited time
- ▶ Weak first 2 pages will create the wrong dipole between reviewers and your proposal. **Reject!**

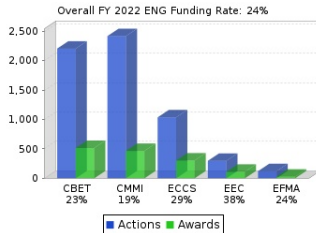


Figure: NSF ENG Funding Rates FY22

Before You Begin, Know This:

- ▶ Even a strong proposal goes into a “lottery,” but a weak one is certainly dead on arrival
- ▶ Many research proposals are weak
- ▶ Many weak proposals have flaws that can be fixed without major overhauls.

A CAREER proposal is exactly that:

i.e., your medium- to long-term career plan built on top of an interesting and important scientific problem.

Brief Outline

Before You Begin, Know This

The Vague Proposal

The Aspirational Proposal

The I'll-Work-on-It Proposal

The Ideal Proposal

More On Starting an NSF Proposal

Why Knowing/Writing For Your Audience is So Important?

- ▶ With luck, your proposal will be read carefully by one or two experts. You must convince them.
- ▶ It will certainly be read superficially by non-experts in the panel... You absolutely must convince them too.
- ▶ Some influential readers will give you a few minutes at most.

The Vague Proposal³

- ▶ I want to work on affordances of immersive interactions that impact the design process.
- ▶ Give me money.

You unconditionally need to identify the scientific problem carefully!

This includes motivation, gaps, approaches, risks, and impact.

³The descriptions of the topics mentioned here are made up. I am focusing on the way they are described and NOT on the merit of the ideas.

How to Identify the Problem?

- ▶ If you already have an idea for a project, congratulations, you have already made a huge step.
- ▶ What **IS** the problem?
- ▶ Is it an **interesting research** problem?
- ▶ Is it an **important research** problem? That is, why would anyone care once you solve it? (NSF-speak: “impact”)
- ▶ Can you identify any “customers?”

Suggestion

Don't be afraid of using a **motivating example** AND **figure right off the bat** to help you motivate and explain the problem AND the gaps.

Use an example that your audience can relate to.

The Aspirational Proposal

- ▶ I want to develop **novel** modes of interaction for immersive interactions that will positively impact design process by ... **with specifics**.
- ▶ **Give me money**.

Climbing The Mountain

- ▶ Easy to identify an impressive mountain.
- ▶ Showing why the mountain should be climbed is harder.
- ▶ Finding paths that can take you up the mountain is even harder.
- ▶ Though, these are not enough: you must convince your reader that you stand some chance of climbing the mountain.

Novelty is Not Sufficient

Make sure that reviewers can visualize the mountain and its importance, and that you draft possible paths. But

- ▶ You absolutely must say what is the idea that you are bringing to the proposal. “Where’s the beef?”
- ▶ Explain firmly (although with modesty) why you are equipped to carry out this work.

Novelty is Not Sufficient, continued...

- ▶ Give the real technical “meat” such that non-expert readers could (without reading your, without a doubt, excellent papers) have some idea of what the idea is
- ▶ Offer objective evidence for your promising idea:
 - ▶ Preliminary results and prototypes
 - ▶ Publications and patents
 - ▶ Applications and collaborations
- ▶ Many grant proposals are buzz-word-compliant, but lack almost all technical content. **Reject!**
- ▶ Technical content does not imply using equations, including PDEs and ODEs, which are RARELY your friends in a proposal!

Suspicious Phrases

- ▶ “Explore...”
- ▶ “Gain insight into...”
- ▶ “Develop the theory of...”
- ▶ “Study...”

One problem with all of these...

... is that there is no way to distinguish abject failure from stunning success...

Better Phrases

- ▶ “We seek to address three formidable technology and knowledge gaps inhibiting the industrial-scale manufacturing of X: 1) Gap 1; 2) Gap 2; and 3) Gap 3. These gaps will be filled by developing a truly powerful and novel approach relying on ...”
- ▶ “Despite the extremely important Challenge 1, we seek to demonstrate that it is possible to create flexible devices that perform X, Y and Z... by using Approach 1...”, that will be validated with our Collaborators 1 in this particular way.

More convincing success criteria...

... involve those “customers” ...

The I'll-Work-on-It Proposal

- ▶ Here is a (well-formulated, important) problem
- ▶ Here is a promising idea (evidence included)
- ▶ I have the right background (evidence included)
- ▶ I'll work on it
- ▶ Give me the money.

A Key Question

How would a reviewer know if your research had succeeded?

As a non-expert reviewer, I may not have the foggiest idea of what success means for YOUR problem.

The Ideal Proposal

You have to **say all this in a 1-page Summary** and **add details in the first 2 pages** of the intro.

- ▶ Here is a (well-formulated, important) problem
- ▶ I have a promising idea (evidence included)
- ▶ I have the right background (evidence included)
- ▶ Here is what I hope to achieve (i.e., destination) and how I'll know if I have succeeded.
- ▶ Here is a high level plan of how I'm going to get from my idea to that destination. The details go to the description.
- ▶ **Give me the money. Please.**

Plus, for a CAREER proposal:

Summarize your long-term CAREER plan AND carefully think about the educational activities as well as about their **MEANINGFUL** integration with your research.

More On Starting an NSF Proposal

Convey your enthusiasm for your field

I have this amazing idea that's going to change the field/world. All I need is this grant to make it happen.

Convey your enthusiasm about educating the students

Ultimately, this is one of the key reasons why we are in academia.

Make sure you know your field

and you show it through a careful summary and evaluation of relevant prior art.

More On Starting an NSF Proposal

- ▶ Ask others to read your proposal critically. Definitely do this for the first few pages of your proposal, which is where you set up the “story.”
- ▶ Revise, and ask someone else
- ▶ Iterate

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for i in sequence:  
    repeat(all of the above)
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More On Starting an NSF Proposal

Planning Should Dominate the Process.

Personally, I spend probably 50% of the total proposal writing time (i.e. months) in planning alone.

Every Idea Can Be Presented from Multiple Different Angles

It is the PI's job to identify AND select the most "favorable" angle.

The 3 Minute Test

Unless you can excite a non-expert about your problem in 3 minutes or less, you have probably not thought sufficiently about how to present your idea.

More On Starting an NSF Proposal

The First 2 Pages of a Proposal

If an NSF proposal does not convey the idea, the novelty, the contribution, and the impact in the first two pages AND in a way that can be understood by non-experts, it will have a slim-to-none chance of going through.