10 tips for writing a proposal

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A bit of background: Jim

- grad school @ Columbia after liberal arts degree in physics, following my girlfriend (now wife) to NYC
- Columbia -> UMass: knew I wanted to teach, to live “in the country”
- 4 sabbaticals: IBM, INRIA, U. Paris, UMass
- research: computer networks. IEEE, ACM Fellow
- textbook; ACM education; IEEE/CS education medal
- Dept. chair, dean
- ~70 grants, awards ( various sizes, sources)
A bit of background: Susanne

- grad school @ Penn State after a Dipl. Ing. In Vienna, Austria (following no one)
- Penn State -> Purdue; Purdue solved my 2-body situation (was their opportunity)
- research: algorithms, query processing, computer science education
- Department Head, Division Director CCF/CISE/NSF
- CRA, CRA-W, CRA-E
- Funding sources: NSF, ONR, AFOSR, Darpa, industrial sponsors
1: Pick good problem(s)

- why is the problem important?
  - what happens if you do not solve this problem?
  - why should anyone care?
- new fundamentals/principles involved?
  - universal truths (best) versus point solutions (not as good)
- a problem area with “legs”?  
  - once you’re done, is story over, or is this fundamental work leading to lots of future work?
  - are you setting a foundation?

A fool can ask more questions in a minute than a wise man/woman (or a Yoda) can answer in a lifetime.
2: Every proposal tells a story

- what is the “elevator pitch” of your proposal (reviewers, PDs)?

- story is *not* mechanics of what you will do, but rather
  - what you will show, new ideas, new insights
  - why interesting, important
  - power of “story” may differ between program

- why is story of interest to others?
  - universal truths, hot topic, surprises or unexpected results

- know your story!
3: **What** will you do, and **how** will you do it?

- basic questions all reviewers will ask
- so *ask and answer these questions* for the reviewers in your proposal

**what** – questions to be addressed

**how** – methodology to address questions
4: Specific research questions

- clear problem statements: pose questions, show initial results, demonstrating methodology
  - questions alone aren’t enough (anyone can pose questions – how will you address them?)
- some near-term problems that you have an idea how to attack
- list longer term problems that you may only have vague idea of how to solve
  - showing longer term issues is important
5: Initial work: must be done before proposal

- initial results demonstrate feasibility
  - illustrative, explanatory to reviewer
  - provide intuition about what you will do
- but if the problems are basically solved already, then it’s not proposed research
- illustrate approach(es) to solving problems
  - show you possess right skill set
6 Past work

- be specific about past related work, how proposed research differs
  - reviewers are knowledgeable, aware of past work [sometimes did the past work you are citing!]
  - what is the value added of proposed work (not just difference)

"What Descartes did was a good step. You have added much .... If I have seen a little further it is by standing on the shoulders of Giants."

Sir Issac Newton, 1676
7a Introduction: crucial, formulaic

- *if reviewer is not excited by intro, proposal is lost*

- recipe:
  - **para. 1:** motivation: broadly, problem area, why important?
  - **para. 2:** narrow down: what is problem you specifically consider
  - **para. 3:** “In this proposal, we …”: most crucial paragraph, tell your elevator pitch
    - bulleted list, `\bf` or `\em` initial text of major contributions
  - **para. 4:** how different/better/relates to other work, at high level
  - **para 5:** summarize contributions at higher level, long-term 10K ft view of contribution: change the world!
  - **para. 6:** … remainder of proposal structured as follows …
7b Broader impact

- important review criteria: will be explicitly addressed in proposal evaluation

- know what a broader impact is:
  - [http://cisebroaderimpacts.org/](http://cisebroaderimpacts.org/) - CISE-specific wisdom/examples of broader impacts

- critical for large- (and medium-) sized proposals
  - poor broader impacts can sink a proposal
  - smaller proposals: BI impacts tend to be more formulaic

- leverage institutional resources/programs
  - you don’t have to do it alone and it can be an idea/effort proven to work
8. Submit to a program funding the research you propose

- understand goals of program/solicitation
  - ask people who know, don’t assume or guess
  - essential for cross/special programs
  - what/who has been funded recently
  - communicate with program directors

- if your research fits into more than one core program, communicate with relevant program directors before the submission
  - proposals don’t always get moved or shared
9. Know the review process

- proposals can get sorted and assigned to panels based on the information in the summary
- reviewers may read 10-15 proposals (lots of work, tiring)
  - interesting, fun/pleasant to read proposals a rarity
- reviewers will typically be panelists present at NSF (virtual panels becoming common)
- rank proposals and bin: highly competitive, competitive, (low competitive), not competitive
10. Put yourself in place of reviewer

- **less is more:**
  - “I would have sent you less if I had had time”
  - *take the time to write less*

- **reviewers shouldn’t have to work**
  - won’t “dig” to get story, understand context, results
  - need textual signposts to know where ‘story” is going, context to know where they are
    - good: “e.g., Having seen that … let us next develop a model for …. Let Z be …. ”
    - bad: “Let Z be”

- **what does reader know/not know, want/not want?**
  - write for reader, not for yourself
11. Put yourself in place of reviewer

- page upon page of dense text: 
  
  \textit{no fun} to read
  
  - avoid cramped feeling of tiny fonts, small margins
  - create openness with white space: figures, lists

- provide enough context & information for reviewers to understand what you write
  
  - no one has as much background/content as you
  - no one can read your mind
  - define all terms/notation
12. Master the basics of organized writing

- paragraph = ordered set of topically-related sentences
- lead sentence
  - sets context for paragraph
  - usually ties to previous paragraph
- sentences in paragraph should have logical narrative flow, relating to theme/topic
- don’t mix tenses in descriptive text
- one sentence paragraph: warning!

"No tale is so good that it can't be spoiled in the telling"
Proverb
13. Write top down

- computer scientists (and most human beings) think this way!
- state broad themes/ideas/questions first, then go into detail
  - context, context, context
- even when going into detail … write top down!

The Elements of Style
by William Strunk E. B. White
(50 years old – and still a classic!)

Writing for Computer Science
by Justin Zobel
14. Good proposal writing takes time

- give yourself time to reflect, write, review, refine
- give others a chance to read/review and provide feedback
  - get a reader’s point of view
  - find a good writer/editor to critique your writing
  - you may get contradictory advice
- starting proposal two weeks before deadline, while ideas/results still being generated: non-starter
- get a “red team” review a week before it’s due
Learn from Declinations

- it’ll happen now and then, for the rest of your professional life
- learn from a declination
  - Why was paper/proposal rejected?
  - What did/didn’t reviewers see/like?
  - talk to the program director
- ….. but don’t write assuming the same reviewers will review your proposal (paper). They won’t!
Perspective of an NSF DD on junior PIs

- successful PIs:
  - choose a good problem related to their expertise but not continuing the PhD research
  - get mentoring and help in preparing a proposal
  - are enthusiastic about research

- junior PIs: likely to get benefit of the doubt in core programs
  - in larger efforts, a junior PI is generally not a good idea

- if a proposal is declined
  - getting verbal feedback from the program director is crucial: helps understand the reviews
  - don’t take a declination personally: many good proposals don’t get funded

- submit a career or a small core proposal?
More words of wisdom... (from earlier discussions)

- process of writing improves the research!
- read the solicitation, know the proper home for your proposal
  - know special preparation and evaluation criteria
  - talk to cognizant program manager
- have a really good (required) one-page summary upfront (intellectual merit, broader impacts)
  - all reviewers will be asked to answer these questions
- use an example that shows richness (but simple enough for reader to understand), threads through proposal to provide unity/common thread
More words of wisdom…

- volunteer to be a proposal reviewer
  - better yet: have someone send your name to the right person
  - you learn by seeing the process
- teaming up with a more experienced researcher on a first proposal can be a good start
- generating proposals: great idea (great) versus “there’s deadline” (harder)
- (new words of wisdom go here)
Take home messages:

- choose your problems and program carefully
- be bold (and/or portray yourself as bold): remember the big picture, vision
- present a clear plan for research, with preliminary work, mastery of material
- write extremely well: put yourself in place of reviewer
- advice/feedback: from mentors, PMs before submission, from PM if declined