HOW TO WRITE A GOOD PROPOSAL: TIPS, INSIGHTS, AND PERSPECTIVE

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Thanks to Jim Kurose and Mary Hall for sharing earlier slides
NANCY AMATO

• Professor, CSE, Texas A&M (since 1995)
  • Past Chair, Council of Principle Investigators
  • Interim Department Head (2013-2014)
• Research – Applied Algorithms
  – Motion Planning, robotics, computational biology & geometry
  – Parallel & distributed computing, parallel algorithms
  – Maintain fairly large research group: 3 postdocs, 12 PhD, 2 MS, 4 ugrads (6 HS in summer)
• Funding sources
  – NSF, NIH, DOE, NATO, IBM, Samsung, Google
• Related activities
  – Peer reviewer for NSF, NIH, DOE, and “NSF-equivalent” for other countries (Canada, Sweden, Italy, Israel, Ireland, Hungary, EU, …)
• Other Stuff
  – Bernese Mountain Dogs – currently Fred & Wilma
  – Enjoy travel, reading on the beach, eating
  – Recent highlights: bucket trip to Machu Picchu & diving!
SUSANNE HAMBRUSCH

- Professor of CS at Purdue
- Department Head (2002-07)
  - Write proposals outside ones area
  - Fundraising; new building
  - Hire & mentor junior faculty, promotions
- Division Director (CISE/CCF, 2010-13)
  - Developed new programs (XPS, Algorithms in the Field)
  - Sign off on final proposal decisions
- Funding sources
  - NSF, ONR, Army, DARPA, Microsoft, Google, State Farm
- Research interests
  - Analysis of algorithms, CS education, parallel computing
- CRA Vice-Chair, CRA-E co-chair
- Wonder about large class sizes at your institution?
  - CRA’s [Generation CS Report](#)
  - NAS Report on Growth of [CS Enrollments](#)
ADVICE FROM SUCCESSFUL RESEARCHERS

Mechanics…

• READ THE SOLICITATION!
• Send your proposal to the appropriate program.
• Spend time writing a few good proposals.
• Collaborate with experienced and successful researchers; it can be a great learning experience.
• Be open and responsive to negative comments and reviews. Turn them into concrete actions for the next version.
• Never give up, never surrender: if you believe in your proposal, it will (eventually ...) get funded.
• Top researchers get proposals rejected. Don’t be discouraged when it happens to you.
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The Story!

• Tell a good and convincing story.
• Find an interesting and important direction; identify a unique perspective that relates to your expertise.
• Be bold and ambitious! Choose research problems that can have broad impact outside your research community.
• A creative idea with high potential impact is always preferable to a dressed-up incremental idea - even if the former is not as guaranteed to succeed.
• Be excited about your idea: don’t propose something you aren’t passionate about just because you think it will “sell” better.
1: Pick good problem(s)

- why is the problem important?
  - how does current context make this problem timely?
  - what happens if you do not solve it?
- new fundamentals/principles involved?
  - universal truths (best) versus point solutions (not as good)
- a problem area with “legs”?
  - is this fundamental work leading to lots of future work?
- why is this the right problem for you to solve?
  - balance between experience and new directions

A fool can ask more questions in a minute than a wise man/woman (or a Yoda) can answer in a lifetime
1b: When collaborating, assemble a strong team

- What expertise is needed to address the problem?
  - Make sure your team covers all the bases
- Recruit top researchers to your team
  - They will strengthen your proposal and project
  - You will learn from them
- Be careful when collaborating with less successful colleagues
  - Guilt by association…
2: Every proposal tells a story

- story is *not* what you will do, but rather
  - what you will show, new ideas, new insights
  - story pitch may differ between programs and agency
- why is the story of interest to others?
  - universal truths, hot topic, surprises or unexpected results
- practice your “elevator speech”
  - reflect in summary and intro
3: **What** will you do? **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, demonstrate methodology
  - questions alone aren’t enough
  - 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 for multi-year efforts (e.g., CAREER)
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 they did the past work you are citing!]
  - Establish current state of the art
  - 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
7: 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
8: Introduction

- If reviewer is not excited by intro, proposal is lost

- Recipe to follow:
  - para. 1: motivation: broadly, problem area, why important?
  - para. 2: narrow down: what is problem considered? what is the current state of the art for solving problem? why is it insufficient?
  - para. 3: “In this proposal, we ....”: most crucial paragraph, tell your elevator pitch; make it easy to read
  - para. 4: how different/better/relates to other work; brief
  - para. 5: summarize your contributions at higher level, long-term 10K foot view of contribution: change the world! Brief summary of high level research plan
  - para. 6: ... remainder of proposal structured as follows ...
  - figure: high-level figure that establishes a mental framework for proposed project can also go in this section
9: 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 a proposal two weeks before deadline?
  - won’t generate great ideas
  - difficult to tell a cohesive story without iteration
10: 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 program, communicate with relevant program directors before the submission
  - proposals don’t always get moved or shared
11: Know the review process

**NSF’s merit review process**
- proposals sorted and assigned to panels based on the summary
- A reviewer may read 10-15 proposals
  - lots of work, tiring
- reviewers will either be panelists present at NSF or participating in a virtual panels

**Other agencies**
- peer review vs. internal review
- may be less transparent
12: 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; don’t overwhelm with details
  - avoid redundancy

- reviewers shouldn’t have to do extra work
  - they won’t “dig” to get story and understand context
  - 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”

- write for the reader, not for yourself
13: Again, put yourself in place of reviewer

- page upon page of dense text: **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
14: Learn from Declinations

- Declinations happen to *everyone*; get used to them
- Learn from a declination
  - *Why* was paper/proposal rejected?
  - *What* did/didn’t reviewers see/like?
  - Contact the Program Director and set up a time to call (prepare questions)

- ..... but don’t revise assuming the same reviewers will review your proposal.
ABOUT NSF PROPOSALS
INTELLECTUAL MERIT AND BROADER IMPACT CRITERIA

All NSF proposals are reviewed according to:

- **Intellectual Merit** encompasses the potential to advance knowledge.

- **Broader Impacts** encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes. Examples of weak BI:
  - “My research results will be my broader impact.”
  - “I will train my graduate students to be like me.”
  - “I am teaching seminar courses.”

Impact on diversity, mentoring, K-12 outreach is stronger.

- read the proposal guide: PAPPG
HOW IMPORTANT IS THE BUDGET?

- Read guidelines carefully. Communicate with your grant/business office
- Special programs can have different budget requirements
- Limits are strictly enforced
  - $505K on a $500K limit: expect return without review
- Overhead and RA costs differ by institution
  - You don’t have to meet the upper limit
- NSF reviewers are asked to not evaluate the budget
WAYS TO JUMP-START PROPOSAL WRITING

- Be a proposal reviewer
  - have someone send your name to the right PD
  - you learn by seeing the process
- Team up with a more experienced researcher on a first proposal
  - but don’t lead a big proposal effort
- Read proposals others in your area have written
  - *ask:* many people will give you a copy
- Attend proposal-writing workshop
  - this one or ones at your institution
  - NSF’s [Career Proposal Workshop](https://www.cra.org/events/career-proposal-workshop/), April 9, 2018
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QUESTIONS?