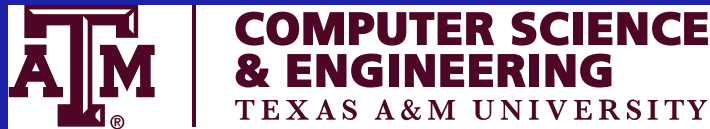


HOW TO WRITE A GOOD PROPOSAL: TIPS, INSIGHTS, AND PERSPECTIVE



Nancy M. Amato
Department of Computer
Science and Engineering



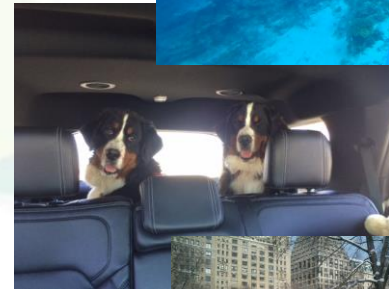
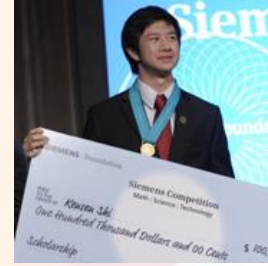
Susanne Hambrusch
Department of Computer Science

2018 CRA Career Mentoring Workshop
Thanks to Jim Kurose and Mary Hall for sharing earlier slides



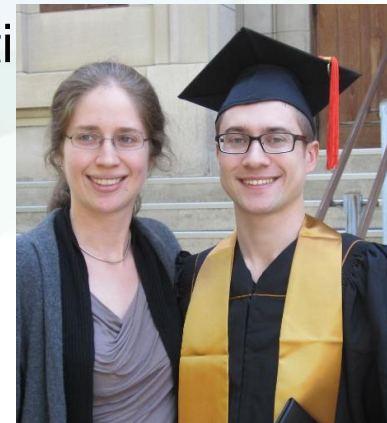
NANCY AMATO

- 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.

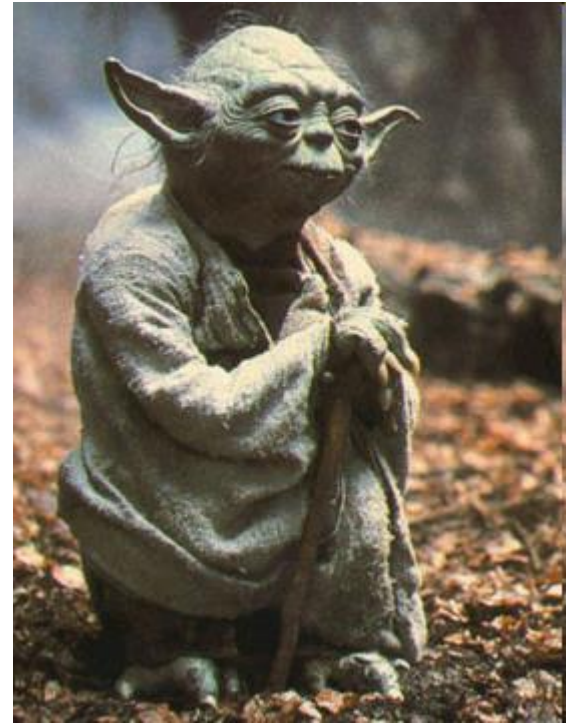
ADVICE FROM SUCCESSFUL RESEARCHERS

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

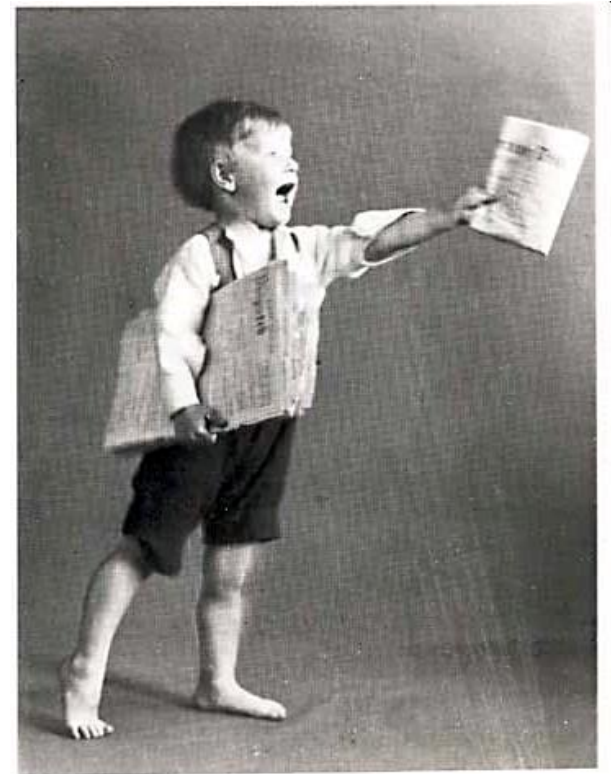
1b: When collaborating, assemble a strong team

- ❖ 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



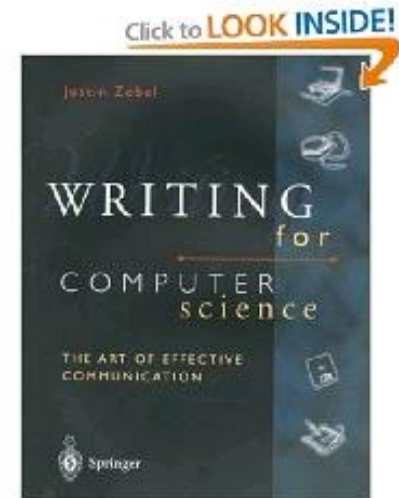
"What Descartes did was a good step. You have added much If I have seen a little further it is by standing on the shoulders of Giants."

Sir Issac Newton, 1676

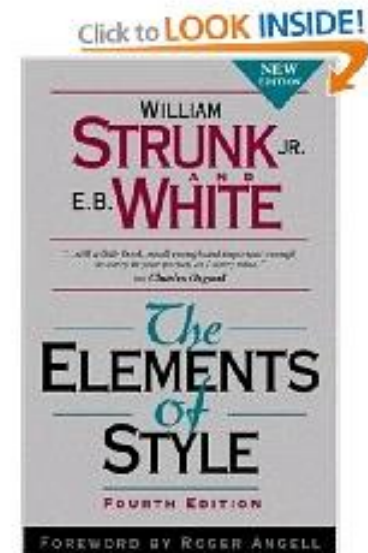
7: Write top down

- ❖ 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

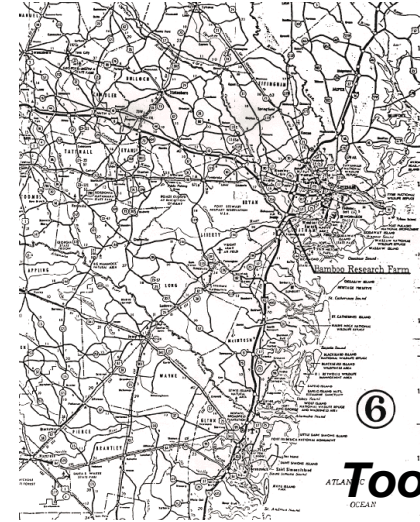
13: Again, put yourself in place of reviewer

❖ page upon page of dense text:
no fun to read

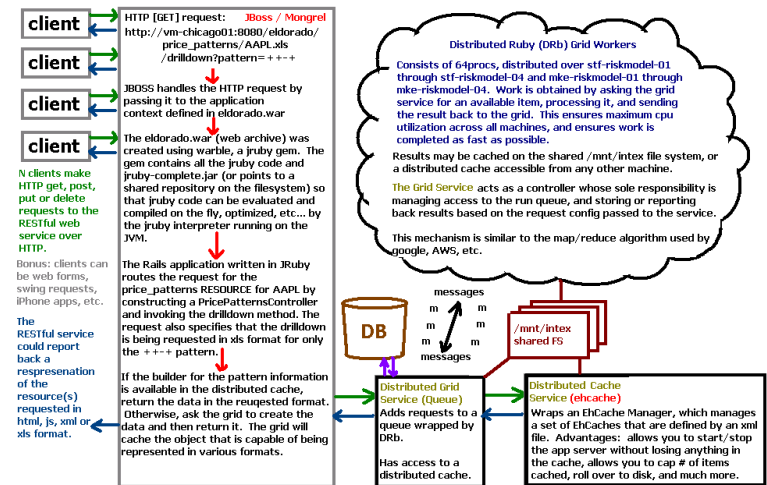
- avoid cramped feeling of tiny fonts, small margins
- create openness with white space: figures, lists

❖ 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

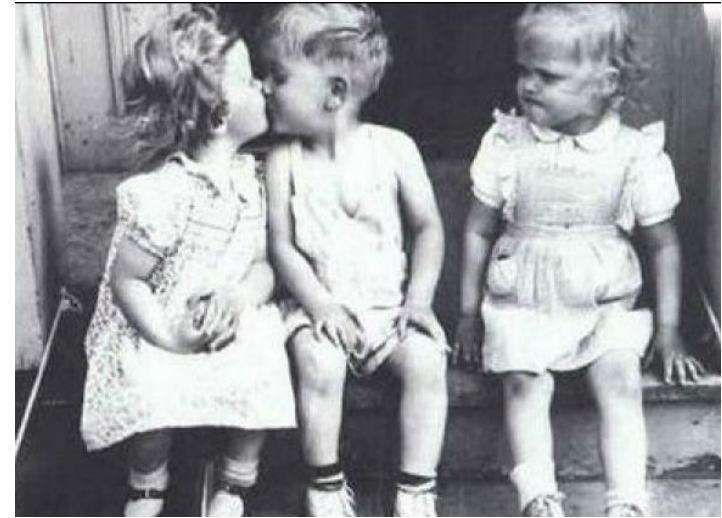


Too much detail!



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](#), April 9, 2018

ADVICE FROM SUCCESSFUL RESEARCHERS ON WRITING RESEARCH PROPOSALS

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.

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 an incremental idea encased in glossy advertising 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.



QUESTIONS?