Proposal Writing Tactics

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Senior Projects

adapted from Al Davis' CE Senior Project course

and Bill Thompson's CS7010 course materials

Proposal Writing Tactics

- Topics
  - Motivational nugget
  - Purpose of a Proposal
  - Tactics for writing a good proposal

Personal Benefits of Writing

- Some simple facts
  - we hold written documents to a higher standard than either thoughts or speech
    - good writing won't make up for bad ideas
    - writing down an idea will often force you to make it better
      - bad organization is easier to see
      - holes in the argument become more apparent
    - often writing down a bad idea will make it go away
    - a clear and complete presentation exposes weaknesses
  - writing often occurs over a longer period of time and is state preserving
    - unlike thoughts which morph
    - or speech which is even more ephemeral
    - good writing often evolves
      - one of the points of this lecture is to think about it as a process

Writing as Communication

- Nuances vary with document type
  - notion of permanence
    - research papers, specifications, standards
    - historical documents
  - making things “official” and binding
    - laws
    - contracts
  - augments the human memory
    - record of decisions and reasons
    - clarifies what was planned
  - advertises intent
- Your project proposal
  - has aspects of all
    - records, clarifies, has permanence, and is in essence a contract for your grade

Writing Skills

- No silver bullet
  - writing well requires practice
  - writing well requires discipline
- Necessary and largely sufficient conditions
  - a good idea
  - a good story
    - it must be clear
    - it must be organized
  - a technically correct presentation
    - if you can't write clearly and correctly no one will read or care
      - proposal failure since you didn't sell your idea
    - this is true at each grain size
      - clauses, sentences, paragraphs, subsections, sections, . . .
      - they ALL have to make sense and be organized

Academic Research / Project Proposal

- Serves multiple purposes
  - solicit advice and interest from advisor
  - establish a contract with a sponsor/advisor/company
    - true for dissertation and external research proposals
  - review credibility before committing resources
    - both time and money
    - the biggest role for this particular course
  - BUT there is a personal benefit
  - help you thoroughly think through a problem before committing resources
    - saves both time and money
    - often the least recognized benefit
    - often the most important benefit

Tactics: From Ideas to Publication

1. Focus:
   - What is the key idea?
2. Pre-Proposal:
   - What is the key idea?
   - Why is it interesting?
3. Proposal:
   - What is the key idea?
   - Why is it interesting?
   - How will it be done?
4. Paper
   - What is the key idea?
   - Why is it interesting?
   - How will it be done?
   - How well did it work?

Statement of Focus

- Writing a good one is very hard
  - need a single sentence that captures the essence of the idea
  - need a clear hook to capture the reader's attention & imagination
    - lead with the idea?
    - lead with the background?
    - lead with the relevance?
  - no pat answer – try it multiple ways and see what works
    - ideas influence the organization
    - personal style also contributes
      - bottom up or top down:
        in the beginning there was a hydrogen atom . . .
- You may need to
  - consider several ideas
  - write focus statements for each until a winner emerges

General Tactics

- The following tactics
  - attempt to cover both BS theses and Senior Project proposals
  - hence is a bit general and not particularly format specific
- The focus, pre-proposal, proposal steps
  - still apply
  - we're now just going to discuss some more specific approaches

Proposal as Information

- Make sure the following questions are answered
  - what is the problem?
  - what existing work relates to this problem?
  - why is the problem significant?
  - what strategy is being proposed for attacking this problem?
    - what is the thesis that forms the core of this proposal?
    - what will be done to support the validity of this thesis?
  - why is this a good strategy
    - do preliminary results support this strategy?
  - what will be the original contribution of this work?
- Note:
  - project, thesis, or industry will interpret these criteria slightly differently

A Good Proposal Must Be:

- written concisely
- clear
- interesting and attract the audience attention
- informative and demonstrate your understanding of the proposed project and its issues

Elements of a Proposal

- Abstract
- Introduction
- Background
- Proposed Work
- Schedule
- Required Resources
- Summary
- Bibliography

Abstract

- A brief summary of the proposal
  - the nature of the problem
  - importance of the problem
  - objectives of the research of effort
  - outline methodologies to be used
  - the hoped for accomplishments
- A note on brevity
  - if you can't write an abstract in a few sentences

    $\models$ you probably don't really understand your idea very well

Introduction

- Content
  - a few paragraphs describing the problem and the proposed research
- Not a summary
  - don't duplicate the abstract!
- You must convince the reader that
  - the problem is interesting
  - you have defined the problem sufficiently will that results are likely
- Opening paragraph
  - is the most important
  - it must capture the readers interest
    - without resorting to hyperbole
      - remember we're engineers not sales people
    - without exaggerating or making unsupportable claims
      - they just start the bogon alarms in the reviewer's mind

Introduction Presents the Thesis

- Focus on the idea and the problem
- Common errors
  - describe the problem and just say you'll solve it
    - method and prior results missing
  - describe the technique without the problem
    - I'll build a system to do x
    - note: for a project this may be okay
      - it is preferable to have a problem to solve
        that is what engineers do!

Goals and Objectives

- Often organized to correspond with milestones
  - emphasize what is to be accomplished
    - not how it will be done
    - often appears with other sections
    - part of the introduction for high level goals
    - part of the schedule for more detailed goals
- BEWARE
  - poorly defined objectives are a common trait for efforts that are doomed from the start
  - don't spend time on the project/research until you are clear about the goals!

Background

- Review of previous work
  - related to your topic, work that you use, or alternate approaches
    - contrast and compare them with your work
  - organize into logical groups
  - need not be exhaustive but MUST be representative
    - work cited should be:
      - pertinent
      - correct
      - able to demonstrate your knowledge of the field
- Proper length
  - too short $\models$ writer is either lazy or uninformed
  - too long $\models$ writer may not understand the problem clearly

Proposed Work

- Various organizations work
  - specific aims
    - outline the activities
    - describe specific steps
    - emphasize how the goals will be achieved
  - Demonstrate
    - you have defined your problem well
    - you have a clear understanding of how to attack it
  - Rationale
    - why should this work be done at all
    - why should it be done the way it's being proposed
      - important when several approaches are possible
  - Originality
    - what's different about the proposed effort
      - required for Ph.D. dissertations

Proposed Work (cont'd)

- Plan of Work
  - steps of your intended solution
    - integrated with aims but more specific and more procedural
    - what will be done and how
  - appropriate level of detail
    - this is a tough one to decide
    - provide enough so your reader knows:
      - you have thought through your problem
      - you have already developed an approach which has a reasonable chance of success
    - excessive detail won't be read
      - when the page budget is fixed you lose on this one

Proposed Work (cont'd)

- Preliminary results
  - best way to demonstrate credibility
- Downside
  - weakens creativity claims
  - is the proposal just an evolutionary work since the original part has already been done?
- Options
  - present preliminary work as seed work to provide proof of concept for the approach
  - preliminary work responsible for the development of of the current thesis

Proposed Work (cont'd)

- Illustrations are very useful
  - provides succinct overview
    - problems, approach, sample results
  - shows how various tasks fit together
    - shows temporal dependencies
    - shows task parallelism
      - critical for multi-person projects

Three Levels of Detail

- Goals and Objectives
  - declarative and high level
- Specific Aims
  - declarative but specific
    - what needs to be done
- Plan of Work
  - procedural and with operational details

Schedule

- Shows work flow
  - in a temporal sense
  - often done graphically
    - GANT chart
- Demonstrates
  - organization and understanding of project tasks
- Estimated start and completion dates
  - good ones also include specific resource usage
- Realize
  - scheduling things accurately requires LOTS of practice
  - in academia we usually don't do this well
    - so be conservative

Project Demonstration

- How will the work be evaluated
  - what constitutes success
  - what criteria or tests must be met
    - how do you test that they have been achieved
    - stay away from subjective measures
  - best is a scientific *metric*
- Note
  - very few proposals do a good job on this
  - distinguish yourself from the mutts and nail this one

Required Resources

- Proposals have a budget
  - the necessary resources need to be described and justified to make the budget acceptable
    - people, parts, space, test equipment, etc.
  - inherently more complicated in EE land due to electronics requirements
  - need to distinguish between standard resources that are available at your institution vs. project specific need that need to be acquired in order to make the project succeed.

Summary

- Makes sense for a proposal
  - what will be the significant contribution of this work
    - significance of the research is the focus
    - emphasize original contribution
    - for Senior Projects
      - also can emphasize the educational value
      - e.g. you want to develop skills in doing X
    - make sure you don't duplicate the abstract and introduction
- Probably doesn't make sense for many projects

Bibliography

You should include an Acknowledgment section before the Bibliography if individuals provided **direct** support in terms of funding or technical help to complete the project.

The bibliography contains related work and indirect information you received through publications.

- Complete list
  - of references cited
    - web references are OK
    - published references are preferred