

# Cybersecurity Research Seminar Fall 2015

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#7: Paper Writing Tips & Tricks

# Class #7

## Tips for Writing a Good Technical Paper/Report

# Questions

- What is the goal of the paper?
- What is your story?
- How to tell it clearly, simply, effectively, etc?
  - Some basic guidelines

# Goals

- What is the goal of your paper?
  - Summarizing or detailing the results of a project
  - Communicating your problem, approach, results, etc. to someone else
  - Clarifying your research and process

# Project Output

- Papers are seen as an output of a project
  - That doesn't mean to do all the writing at the end
  - Don't just focus on the results
  - Writing and thinking are tightly coupled

# Written Communication

- Results not communicated well aren't very valuable
  - Moreover, a well-written paper with weaker results may be far more valuable than a poorly written paper with strong results
  - Essentially, the writer has to make it easy for the reader to listen and understand what is being said

# Writing for Clarification

- Since writing and thinking are coupled, writing your thoughts, ideas, approach, etc. during the process can lead to improvement
  - Taking the effort to try to explain yourself often exposes gaps or weaknesses
  - Another major reason why waiting to do any writing until the end of a project can be disastrous

# Story

- A lot of these things can be simplified / supported by having a good story for your work
  - Every paper should tell a story
  - The story can (and usually does) change over the course of the project
  - Not only does the story shape the paper, but it can also shape the trajectory of the project



# Story Composition

- The art to paper writing is largely independent of the technical / non-technical nature
  - All of the major factors of composition from literature apply to writing a technical report, but how it's executed may be a bit different
    - Note: composition, not grammar
  - Most importantly: the “flow” of the ideas can make or break a paper, especially when things get very technical
  - Big picture → smaller pieces → fitting the pieces together → emerging big picture

# Composition Tips

- Start by formulating / understanding your big picture story
  - Similar in spirit to thinking about the pitch or commercial idea we discussed earlier
- Plan an outline that follows your story, then add depth iteratively
  - Start with section outline, then subsections, clusters of topic sentences, then finally full paragraph text
  - Outline → “deep outline” → “fat outline” → paper
  - Going directly to full paragraphs often doesn't go where you want it to go, leads to poor flow

# Budgeting in the Outline

- Somewhere in the outline phase, after main ideas are set out but before full text is written:
  - Assess how much of your paper each section deserves
  - Some parts are more important, some just require more pages for content
  - This allows you to allocate text appropriately, figure out what content to cut, etc.

# Signposts

- The outline is valuable for the reader as well
  - Instead of just using the outline to map your story to your paper, use it to help the reader navigate the story
  - “Signposts” help point to lead the reader in the right direction, instead of leaving them to reach the same conclusions that you did
    - Explaining how the sections of your paper relate to the story
    - Transitioning from one topic to the next
    - Highlighting key ideas, points, phrases
    - Relating results back to the original goal

# Conventions

- Different disciplines, communities, venues, etc. have different conventions - following them is good
  - Once readers are comfortable with something, it's easier for them to follow and better for you
  - Most of these are subtle-but-important details:
    - Related work at the beginning or end
    - Passive or active voice
    - Styles of figures and tables
    - Mathematical styles

# First Impression

- Readers will form a first impression of your paper from the title, abstract, intro, and figures
  - These are key components that deserve special attention
    - And set the expectations for the rest of the paper...
  - The introduction is a summary of your story and is probably the most important part of the paper
    - If people don't understand the story or follow the introduction, they'll stop reading

# When to Write the Intro

- Writing the introduction first:
  - Some writers start with the introduction, to map their story to the work that they are doing / have done
- Writing the introduction last:
  - Some writers finish with the introduction, to appropriately reflect what is in the rest of the paper
- Writing the introduction first and last:
  - Drafting the introduction first helps capture the story - motivation, challenges, prior work, approach - then filling it in later captures and reflects the rest of the paper
  - The final version often won't look like the original

# Formulaic Introductions

- Most communities have standard formulas for what an introduction should look like, e.g.:
  - Paragraph ~1 gives the motivation and context for your problem area
  - Paragraph ~2 narrows the paper to your particular problem considered in the paper
  - Paragraph ~3 highlights the key contributions, general approach, etc. into a sales pitch
    - Bullet points are often useful here
  - Paragraph ~4 frames above against related work
  - Paragraph ~5 provides a (non-redundant) outline



# A Compelling Abstract

- The abstract is almost always written last
  - It captures the most important points from the story in a clear and clean way
  - Often includes a few “take-away” bullet points that come from the approach, results, or conclusions

# A Descriptive Title

- A title itself can make or break a paper, depending on who is reading it
  - Avoid short, generic titles, e.g., “On Cloud Computing”
  - Use keywords and/or buzzwords with enough detail to show some uniqueness in your work
  - Use descriptive modifiers to hint at contributions and story-lines (e.g., noting an approach is “Efficient” means you care about performance, not just security)
  - Don't be afraid to have a two-line title or a subtitle

# Write for Readability

- There's a really big difference between writing that is correct and writing that is easy to read
- There are tons of guidelines about what makes something easy or difficult to read
  - Use short, easy-to-read sentences instead of multiply-compound sentences
  - Don't use complicated words when simple words will do (this is especially important if your community is international), e.g., “utilize” → “use”
  - “Omit needless words” - in a nutshell, don't use  $N+k$  words when  $N$  will do

# Precision of Results

- A general rule of thumb in describing an experimental approach is that it should be detailed enough to be repeated
  - Detailed descriptions of context, assumptions, setup, tools, data, algorithms, etc. - this should be purely factual but stay relevant to the story
- Avoid being vague
  - Don't say something is “more efficient”, say how much more efficient and back it up with data / figures

# Figures

- Figures are important and can be very helpful, but they serve a different purpose than in a presentation
  - Figures often serve as a summary of a block of text or as illustration of a key concept
  - Tables, graphs, etc. also provide snapshots of data or results that you don't want to express textually
    - You may still want to summarize the data/results in text
- More on “good” figures in a later session

# Other Important Stuff

- I didn't touch on any standard writing stuff, but it's implied
  - Use good grammar, proper usage, consistent tense, consistent terminology, etc.
  - Bad language skills can impact a good story with good results

# Length Limits

- Most venues impose page limits on papers
  - Common in conferences, journals, course project reports, and just about everywhere
  - Most of them are reasonable, but require some thought

# Writing for Length

- Write it all, then cut it down
  - Some writers prefer to write their entire paper (within reason), then cut down content to fit the page length
- Write within the bound
  - Some writers prefer to tightly constraint themselves within the allotted pages
- Somewhere in between (most of us are here)
  - Write a complete draft that follows a planned, budgeted outline (hopefully will get you close to the limit)
  - If under the limit, ok
  - If over the limit, reduce unnecessary content



# Common Formats

- If you read enough papers, you'll quickly identify the common formats and lengths
  - IEEE, ACM, and other societies / communities have standard styles or templates
    - E.g., IEEE 2-column, ACM 2-column, draft single-column double-space, plain LaTeX article, etc.
  - Most conferences specify a style and a page limit
    - E.g., 9 pages in IEEE 2-column, 15 pages in ACM 2-column, 35 pages in draft single-column double-space, etc.
  - These are largely imposed for desired scope and level of detail (e.g., journals have more detail than conferences)
  - In most cases, these are upper bounds

# A Few Pointers

- The best way to learn how to write good papers is to read good papers
  - Some particularly good writers in areas of CS include Jennifer Rexford and Nick Feamster
  - Read a few of their papers, and you'll quickly see why

# Questions?