INFO5993

Research Methods

Research – Components and Process

Research Publications – Types and Quality Metrics

Possible References

- Booth, W.C. , Colomb, G.C., Williams, J.M., The Craft of Research, 3rd edition (Chicago University Press), 2008.
- Graziano, A.M., Raulin, M.L., Research Methods: A Process of Inquiry, 7th edition (Allyn & Bacon), 2009.
- Blum, M., Advice to a Beginning Graduate Student, http://www.cs.cmu.edu/~mblum/research/pdf/grad.html.
- Leone, M., Advice on Research and Writing, http://www.cs.cmu.edu/~mleone/how-to.html.
- Previous colleagues who taught this course: Peter Eadas, Alan Fekete, Mary Lou Maher, Joseph Davis, and others
- Other acknowledgements and credits: friends, mentors, heroes, current and past students, research collaborators, other distinguished scientists (David Patterson, Manuel Blum, Gian-Carlo Rota, Enrico Fermi, Richard Hamming, Zahir Tari, and many more.)

Topics Overview

- Introduction to research – definition, components, process, how to find a research question
- Types of research publications, quality metrics
- Literature review, how to search for relevant publications
- Writing a literature review and research proposal
- Oral presentation skills
- Research methods in IT (statistical analysis, mathematical analysis, algorithm analysis, simulation, qualitative analysis, etc.)
- Ethics. Avoiding plagiarism. Intellectual Property.

Definition of Research

(1) From the Merriam-Webster dictionary:

- 1**:** careful or diligent search
- 2**:** studious inquiry or examination; *especially***:** investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws
- 3**:** the collecting of information about a particular subject

(2) Booth, Columb & Williams, "The Craft of Research":

- "Research is gathering information that answers a question and so solves a problem."

Is This Research?

- To understand political decisions, a journalist finds out who contributed to election campaign fund
- To buy a laptop, a student compares various brands, configurations and prices
- To help companies stay competitive, a market researcher collects and interprets information
- To fix a computer, a technician finds out what procedure to use

Academic Research

- In academic research, you must not only answer a question, but you must find something new and interesting
- You join a community of researchers
  - You must advance the collective understanding of this community
- Each community has a cumulative tradition with a set of interesting questions, tools and methods, practices, a style and language for writing up the research
  - Research is a conversation and ongoing social activity!
- You need critical and careful reading of published research
  - to learn what the community already knows
  - to fit your work into the community
  - to be prepared for your own work to be evaluated

The Research Process

- What is research?
- Key components
  - A question of interest
  - A claim
  - Evidence
  - Argument (link evidence to claim)
- Systematic application of one or more research methods

A Research Question

- Every piece of research should address a question of interest to the community (providing high quality answers to **non-trivial** questions).
- Each community has traditional questions:
  - What happens? Why does it happen? How should one do something? What something should one do?
- Many questions fit into an on-going agenda, e.g.
  - Distributed Systems foundations – designing better systems, clouds, data centres, dedicated systems, etc.
  - Tradeoffs between Performance, Reliability, Power, and Security of Future Manycore Architectures?
  - The Role of Computer Architecture in enabling 21st Century IT Infrastructure: from sensors, to clouds, to data centres, to mobiles, to embedded, etc
  - …
- For example, see a recent Journal or Conference Call for Papers

A Claim (Contribution)

- Every piece of research makes a claim (the "contribution")
  - this should answer a question of significance
- Claims can be very diverse, among fields and within fields
- This is what happens
  - eg how often is data corrupted when using weak concurrency control
- This is why something happens
  - eg what key factors lead to project success in open-source development
- This is a better way to do something
  - eg efficiently recalculate a graph layout after a change to topology

Evidence

- You must back up the claim
  - evidence can be very varied, for example
    - a **prototype** implementation to show that a system can be built to achieve claimed functionality and experimentation using the prototype
    - A **controlled experiment** to test the causal relationship between one or more independent variables and a dependent variable
    - A **simulation model** which is executed to show a system has certain properties
    - **Measurements** of a running system to show it has good performance
    - **Observations** or **data gathering** of variables of interest in an organization to test conjectures
    - A **mathematical proof** to show that some process has desired properties
- Each research method is defined by the **sort of evidence** that it can produce
  - each community has its own standards of quality and reasonableness

There are as many scientific methods as there are individual scientists.
Percy W. Bridgman……*On "Scientific Method"*

Argument

- You should show that the evidence you offer supports the claim you made
  - It's essential that you deal with natural or obvious objections to the correctness or importance of the work
  - that is, you must think like your readers, and anticipate their reactions
- In systems work, this is often called an "evaluation" of the design

Research Paper - Example

- Identify the
  - Research question
  - Claim
  - Evidence
  - Argument

Some Types of Claim and Argument I

- This system design leads to better performance on some metric
  - make sure you limit how much worse this makes other metrics (such as cost!)
  - make sure your measurements are fair (don't compare with "strawman" design but with state-of-the-art)
- This system design offers better functionality for some uses
  - make sure you show it can be implemented with adequate performance

Some Types of Claim and Argument II

- This behaviour can be explained by this theory (and related hypotheses)
  - make sure you don't have confounding factors such as level of experience, or method novelty, or subject expectations.

- This is what happens
  - make sure you don't interfere too much with what happens when you gather data, or misinterpret it due to observer expectations

Common Mistakes

- Gather lots of data without a focussed question or method
- A collection of facts is not a contribution!
  - it must reveal some pattern or understanding that you make explicit
- Build a system without a focused question or planned evaluation
  - eg let's see how to use aspect-oriented programming in a sensor network
- An innovative system by itself is not a contribution!
  - it must be a worthwhile innovation in a sense you make explicit what the innovation delivers!
    - eg better performance, better functionality

Negative Results

- Sometimes, you don't get the result you hoped for
  - You gather data that does not reveal any pattern or understanding
    - e.g. no factor seems to correlate well with project success
  - You design a system that turns out to be worse than the state-of-the-art
    - e.g. your machine learning algorithm runs slower than expected

- You can still salvage a thesis
  - Try to find some way to contribute to our understanding, or suggest fruitful directions for further work
    - e.g. what features of the algorithm make it slow
  - Make sure the problem is intrinsic, not just your bad coding, experiment design, etc.

Ground-Breaking Work

- Very rarely, a piece of research will establish a whole new agenda for a field, or even a new field
  - the contribution can be as much in the possibilities for further work, as in the result itself!
- In some sense, this is work that asks a new type of question, or introduces a new method
- We don't recommend this for Hons/MIT/MSc/PhD
  - save the idea till you have time enough, and flexibility enough to deal with inevitable digressions/difficulties

Great scholars do not solve problems; they create them.

-Albert Einstein

Idealised Research Process

- Question
  - Find a question to seek an answer for
- Method
  - Choose an appropriate research method and make flexible plans
- Evidence
  - Gather the data, do the experiment, build the prototype etc.
- Contribution
  - Analyse, interpret, and conclude
- Argument
  - Write the report
  - Importance of "writing" (aided by thinking from the point of view of your readers)

Actual Research Process

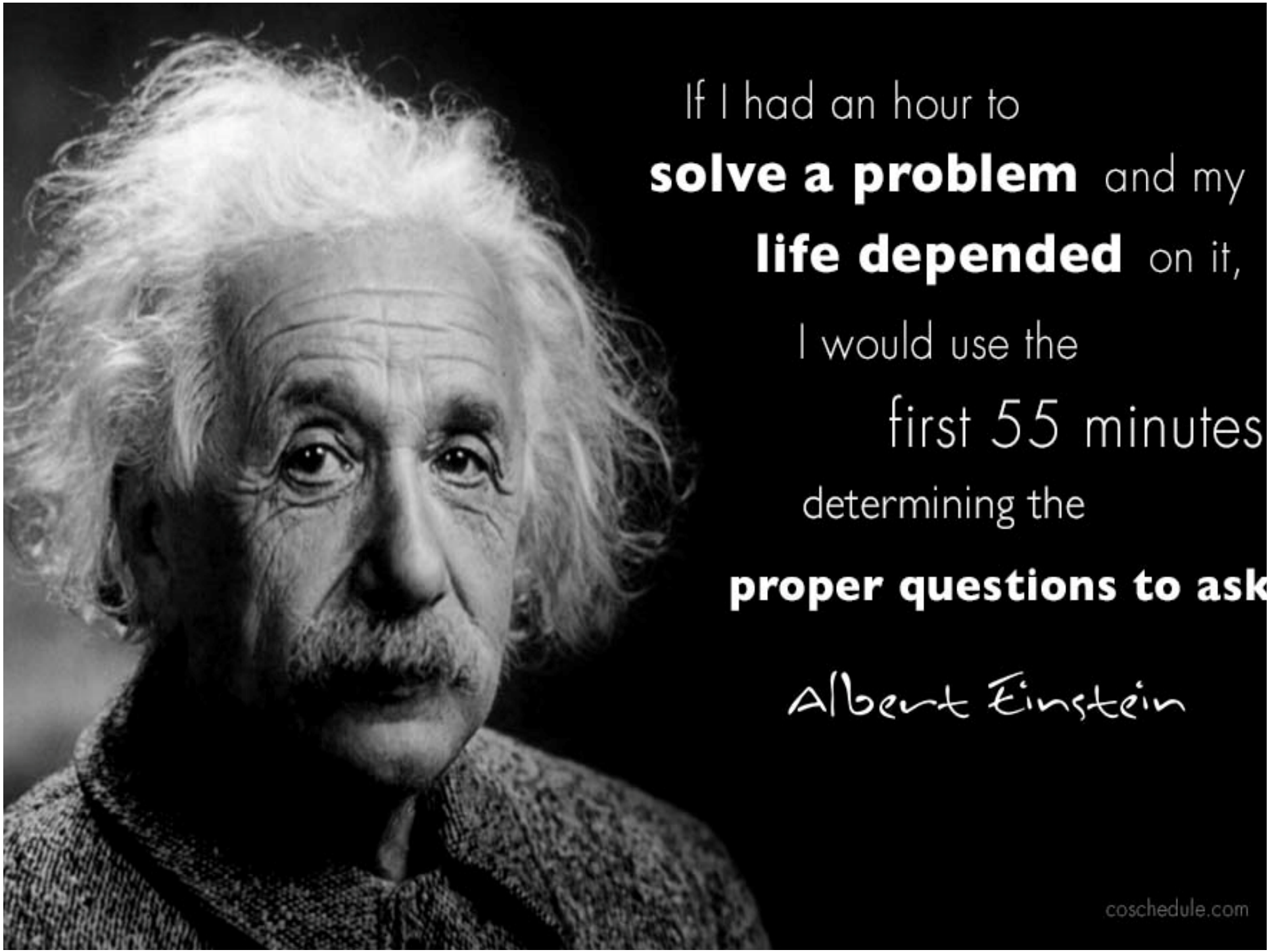
- Research is a non-linear process!
  - it is normal for an argument to lead to changes in the claim
  - it is normal for the process of gathering evidence to lead to changes to the claim
    - sometimes one refines the claim
      - eg limit the scope (from "this has higher throughput" to "this has higher throughput if the contention rate is low")
    - sometimes one must change the claim entirely
  - sometimes while gathering evidence, one finds new questions which look worth answering!
- New claims or questions need further evidence, revised plans, maybe even different methods

Computing Sciences Accreditation Board, Inc.

https://en.wikipedia.org/wiki/CSAB_(professional_organization)

Computer Science is the body of knowledge concerned with computers and computation. It has theoretical, experimental, and design components and includes:

- **Theories** for understanding computing devices, programs and systems.
- **Experimentation** for the development and testing of concepts.
- **Design methodology**, **algorithms and** tools for practical realization.
- **Methods of analysis** for verifying that these realizations meet requirements.


If I had an hour to
solve a problem and my
life depended on it,
I would use the
first 55 minutes
determining the
proper questions to ask
Albert Einstein
coschedule.com

Finding a Question

- Especially when you are learning to do research, it may be already chosen for you by supervisor
  - or supervisor may suggest an area, and leave you to find the question
- A question may arise naturally from some previous work
  - incremental "delta" research
- A question may come from the interaction of previous works
  - eg reconcile apparent contradictions
- A question may arise due to new technology
  - eg how to use new hardware
  - eg revisit design choices as speed, bandwidth, cost etc change
- A question may come from just simple curiosity

Suitable Research Questions

- Main Considerations:
  - **Specificity and answerability**– can the questions be answered through research?
  - **Scale and Scope** in relation to needs and available resources.
  - **Resource Adequacy** in relation to available time.
  - Often start with **broad** topic space, then narrow down to a **specific** question

Tips for Finding Research Questions

- Try the research topic generator
  - http://www.cs.purdue.edu/homes/dec/essay.topic.generator.html

Tips for Finding Research Questions (2)

- Read the papers your supervisor gave you
  - follow the references, check the web pages of the authors
  - read carefully the "Future research" sections
  - write down your ideas!!
- Find the top journals and conferences in your field
  - scan the call for papers and associated workshops for hot topics
  - scan the conference proceedings to identify important topics, key people and research groups. Check their web pages.
- Find review (survey) articles

Tips for Finding Research Questions (2)

- Pick a rough idea that interest you and your supervisor
- Do a literature review, find 5 problems
- Write them up in short paragraphs with references
- Take those to your supervisor, pick one
- Repeat until the topic is sufficiently narrow

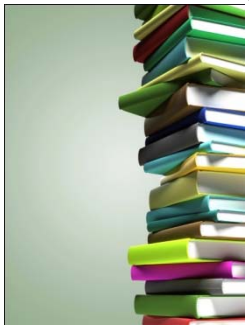
Callahan, 2001

Describing Your Research Problem

- You need several clear, concise and succinct statements of the research problem of different lengths
  - e.g. one minute (elevator) pitch
  - e.g. ten minutes introduction to full seminar

- Issues you must deal with:
  - Can it be understood by others without too much background?
  - Does it demonstrate a good understanding of the research community?

The Literature



- Literature can help in finding a research problem
  - identify clear "next step" or "gap"
- It can also help you solve a problem
  - show how the field works (so you fit in)
  - provide evidence you can quote without repeating the work
  - provide the motivation to show importance
    - eg our performance is better than that of [Cite]
    - eg [Cite] defined the following concept, about which we prove …
    - eg [Cite1, cite2, cite3] have all worked on systems like this.
- Critical (yet generous) reading.

Reading the Literature

- Keep an annotated bibliography from the start
  - Complete bibliographical reference (including pages, dates)
- Detailed notes on each work
  - even if it seems irrelevant to your thesis
  - what is claim, what evidence, what argument, any doubts?
- Don't rely on second hand summaries! Go to the original source always!
  - Get attributions right in your own writing
    - (don't just accept citations from other work, even with full reference!)
- Use comments and keywords to organise your thoughts.

Why Review the Literature ?

- Demonstrate that you know the field
- Justifies your research, provides the rationale for the research
  - how does your work differ from previous work
  - how does your work connect to previous work
- Allows you to establish the conceptual framework and methodological focus

Organising the Literature

- Isolate issues and highlight the findings and contributions that are central to your research
- Group together papers that deal with a common or related theme or issue
- Use diagrams, tables, concept maps to organise the materials
- Try out different structures for organising; they should be most relevant to the goals of your research
- Chronological order is not particularly useful
  - but citation chains are useful

Guide to Research Literature

- Types of publications
  - Conference and Workshop papers
  - Journal papers
  - Technical reports
  - Monographs
  - .....

Conference Papers

- Call for papers - ~1 year before meeting
- Paper submission - ~4-8 months before meeting
  - Page limit e.g. 8 pages
  - Details often omitted (proofs, design technicalities)
- Program Committee reviews the papers
  - Criteria: significance, originality, soundness, readability
- Final version for proceedings due ~3 months before meeting
  - revise by author in light of reviews
  - but not checked again
- Annual or bi-annual conferences

Selection Process

- Typically 3 reviewers

- Acceptance rate – varies
  - Some 10-15%, others 50%

- Some review "blind" (author details not shown to reviewers), others do not

  - Example – a reviewer's form

  - Ask your supervisor for guidance about which are the reliable and important conferences in your field!

Standard of Conferences

- Identify the top conferences in your area
  - Ask your supervisor
- CORE ranking (sometimes inaccurate)
- Affiliation (ACM, IEEE, SIAM, IET, etc..)
  - ACM Digital Library
  - IEEE Xplore
  - .....
- Acceptance rate and review process

“I regret to inform you…”

- When a submission is not accepted by a conference
- The author should use the reviewer’s comments to revise and improve the paper, e.g.
  - if reviewer misunderstood something, author explains it more clearly
  - if reviewer points to missing citations, author adds them
  - If reviewer is not convinced, author can do more experiments
- Then submit revised paper to another conference in the same community
  - Often the resubmission is to a lower prestige conference
  - Submit to the same conference next year? Not often – IT changes rapidly

Workshop Papers

- A workshop is typically a smaller meeting than a conference
- Sometimes workshop papers are just like conference papers
- Other workshops are more preliminary
  - can publish a position paper (draft of an idea without evidence, or proposal for future work)
  - less rigorously reviewed, the goal is mainly to allow the community to meet

Journal Articles

- Typically longer than a conference paper
- Often based on a conference paper with additions, corrections and improvements
- Refereed by
  - at least 3 reviewers, experts in the field
  - they spend months on the paper checking details, etc.
- Decisions: accepted, accepted with minor revisions, major revisions and resubmission, rejected
  - Revisions, refereed again
  - Accepted, published after several months (journal issues have limited capacity)
- Time from submission to publication varies, typically 1-1.5 years but may be 3-4 years (although these days this time is getting shorter)

Standard of Journals

- Many journals in each area with different standards
- Typically IEEE Transactions and ACM Communications are some of the top-ranked journals
  - Not all IEEE Trans. and ACM Comm. are top journals
- Check CORE ranking (not always accurate though- check with your supervisor)

Ask you supervisor which journals are the top-ranked and most important in your area!

Technical Report

- Issued by the author's department, with a number and date
- May be based on a conference paper
  - Longer, includes all the boring details that are omitted from the conference paper due to space limitations
- Used to establish priority
  - E.g. produce TR before submitting to conference or journal + conference and journal papers may get rejected

- Find the School of IT's TRs!

PhD or MSc Thesis

- Very extensive account
  - Show much of the research process
  - Extensive survey of the literature
  - Very complete evaluation of the work
- The goal is to establish that the author is ready to become independent researcher
  - i.e. PhD and MSc provide research training
- Typically checked by 2 or 3 reviewers

Monograph

- A collection of selected papers from a conference or workshop
  - A bit more checking than for the conference/workshop
- An author can offer a coherent and unified account of a whole research topic
  - often combines their own results with other people's
  - Revisits several papers using unified notation, better exposition, better literature review, etc.
  - Publisher may get reviewers but their focus is "will it sell" not "is it correct"

Forward and Backward Search

- papers referenced by this paper (backward search)
- other papers written by authors of the paper
- keyword searches using keywords from this paper
- Papers that have cited this paper (forward search)
- Iterative use of above on new good papers found.

Using Search Engines (e.g. Google)

- Googling keywords can be useful - but can also generate a lot of useless material. You MUST evaluate what you find this way!
  - is it published in a peer reviewed forum.
  - is the publication venue high quality.
  - is the author generally respected.
- Wikipedia entries may have useful pointers to key works.
- Use Google Scholar
  - to check citations (of specific paper or author generally)
  - advanced search to limit by publication source
  - limit by year of publication
  - etc.

Warnings

- Quality of conferences and journals varies, and this is reflected in the checking of the papers
  - Read papers with a critical eye!
- Some communities are very clique-dominated
  - Unpopular opinions are not welcome
  - Clique leaders can publish anything, even half-baked ideas without evidence

Fake Conferences and Random Papers

- http://pdos.csail.mit.edu/scigen/
- A random paper accepted to a journal?

The Research Community

- A community has conferences and journals of high prestige which they read and publish in
  - They meet often, and each knows (more or less) what others are doing
  - You must place your work in the context of a community
- Divided geographically
  - Europe vs America vs Asia

Quality Metrics

- How important is an article? How influential is an author?
- Based on citation analysis - number of times a paper or author is cited
  - How to calculate citations – Google Scholar + other software
- Assumption: important authors and articles are cited more often than the others
  - Increasingly used by governments, funding bodies, promotion committees to evaluate the quality of author's work
- Some drawbacks
  - Citing errors – authors with the same names are not separated
  - Cliques (friends, colleagues) cite each other in turn to build their citation index
  - Negative citations are included (citations to incorrect results)

Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted.....Albert Einstein

ISI Citation Database

- Very popular, established in 1960, contains >40million records, contains
  - Arts and Humanities Citation Index (A&HCI)
  - Science Citation Index (SCI)
  - Social Sciences Citation Index (SSCI)

- However
  - it does not index a large number of journals
  - ignores open-access journals
  - does not index conferences

"Read the Rise and Rise of Citation Analysis" by L. Meho!

Journal's Impact Factor

- Journal impact factors
  - Used to determine the importance of a journal
  - E.g. journal impact factor for 2007 =

$$= \frac{\#\text{ citations in 2007 to articles published in the journal in 2005-6}}{\#\text{ articles published in the journal in 2005-6}}$$

Check CS journal impact factors on ISI Web of Knowledge!
(electronic journals > J > Journal Citation Report)

CORE's ratings

- Computing Research and Education Association of Australasia (CORE)
  - Australia and New Zealand

- Ranking of journals and conferences in CS – not finalised

  http://www.core.edu.au/

Author's Citation Indexes for Measuring Impact (1)

- total number of citations
- h-index
  - proposed by J.E. Hirsh in 2005:

"A scientist has index h if h of his/her Np papers have at least h citations each, and the other (Np-h) papers have no more than h citations each. "

- What is the h-index?

Paper 1: 20 citations
Paper 2: 15 citations
Paper 3: 8 citations
Paper 4: 4 citations
Paper 5: 3 citations
…

An h-index of 4 means that there are at least 4 papers cited at least 4 times each.

Author's Citation Indexes for Measuring Impact (2)

- g-index
  - Proposed by L. Egghe 2006:

  "Given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the (unique) largest number such that the top g articles received (together) at least g*g citations."
  - improves h-index by giving more weight to highly cited articles

- Several variants of h-index and g-index

Calculate the g-index for the example from the previous slide!

h-index

A

h-index?

B

Rank	# cit.	R^2	$\sum$cit
1	5	1	5
2	5	4	10
3	5	9	15
4	5	16	20
5	5	25	25
6	5	36	30
7	5	49	35
8	5	64	40
9	5	81	45
10	5	100	50

Rank	# cit.	R^2	$\sum$cit
1	100	1	100
2	50	4	150
3	50	9	200
4	50	16	250
5	5	25	255
6	5	36	260
7	5	49	265
8	5	64	270
9	5	81	275
10	5	100	280

Publish or Perish

- http://www.harzing.com/resources.htm#/pop.htm

- Perform a citation analysis of your supervisor's publications! What are the limitations of
  - citation analysis in general?
  - g- and h-indexes as citation metrics?

Finding a Good Research Problem (1)

- This is the mark of a great researcher.
- The solution of such problems helps us in seeing the world in a new way.
- Sometimes researchers begin a project without being clear about what their problem is. (hope to define a puzzle more clearly).
- When you find a new problem or help re-define or clarify an old you are making a great contribution to your research community.
- Disproving a plausible hypothesis that one set out to prove.
- Don't be discouraged if you cannot formulate your problem at the start of your project. Few of us can ☺.
- However, thinking about the problem early in your degree will save you a lot of time later on. This also puts in you in the right frame of mind for advanced research.

Finding a Good Research Problem (2)

- Talk to your supervisor, mentors, researchers, other students, etc.
- Note, when you ask your supervisor and you get an idea please don't be limited by the suggestions he/she provides. You always should strive to do more.
- A supervisor wants you to use his/her suggestion to start you thinking and not to end it!!
- Look for problems as you read.
- In your reading sources you look for contradictions, inconsistencies, incomplete explanations.
- Make sure you are reading correctly and not "misunderstanding" what the authors are saying.
- Read the last few pages of your sources carefully. More questions and serious issues are normally embedded in these pages.

Finding a Good Research Problem (3)

- Experienced researchers always strive to work on new problems.
- A bigger goal would be to work on a problem that no one knew they had.
- However, the problem is not worth solving if others don't feel it should be solved (you need to work on problems that others care about).
- Of course, for a student no one expects you to do the above but you need to practice enough so that you are able to.
- Research is not about accumulating and gathering facts but it is about formulating questions that are worth answering—down the road you will be able to find problems that others think are worth solving. (not that I don't agree, but I don't care)

Manage the Problem of "Inexperience" (1)

- This is an unavoidable problem since all senior and distinguished researchers start from being students and junior researchers.
- We feel very anxious when we start working in a field whose basic rules we don't fully understand (tacit rules that experienced researchers know).
- Uncertainty and anxiety are natural feelings.
- Get control over your topic by writing about it along the way. Write summaries, critiques, questions, etc.
- Break the tasks into manageable (mutually supportive) steps.

Manage the Problem of "Inexperience" (2)

- Once you formulate your problem, you will be able to draft and revise more effectively.
- Count on your supervisor(s).
- Set realistic goals.
- Recognize your struggle for what it is—a learning experience and a character builder exercise.

How to Read Papers

- Reading paper is not like reading textbooks (you read papers to obtain new ideas).
- Quickly understand the problems, assumptions, main idea and the proposed solution (high level reading).
- Spend more time to analyse the paper critically, find new ideas, and perform research which will surpass earlier work.
- Well written papers are normally well structured. (reading the high level sections during the first pass).
- While you read a paper you should be:
  - Critical thinking: What is wrong with the paper, are the assumptions reasonable, is the problem ill-posed, does the solution have any technical flaws.
  - Creative thinking: What else can be used to solve the same or the broader problem, Can I do it differently (or even better).

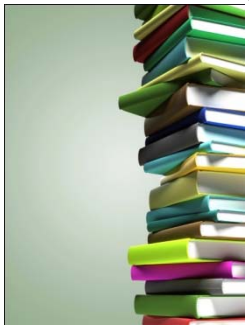
Getting New Ideas

- Scientific method: hypothesis, sequence of experiments, prove/disprove hypothesis, document.
- An old formula that stood the test of time! However, to come up with new ideas is a little more complex.
- Some people read the "future works section" in papers, there are problems with this approach.
- When you are reading papers make sure you write down any ideas/questions you might have.
- Passion and interest in the subject, your technical strength, how new the topic is, your supervisor's opinion.

Are you on the Right Path

- Discussing your work with your supervisor and other colleagues.
- Discussing your work with other researchers you meet in conferences.
- Read recent PhD theses on the same topic.
- …….

The Literature



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Best Practice

- Write, write, write, write, ……don't be a careless writer, old habits die hard!!
- Target the best 3-4 journals and conferences in your area.
- Good reviews can be very useful to improve your work (free advice after all).
- You need to market your work. A lot of talks and visits to conferences and other research groups are needed.
- To convince others of the value of your work they have to be able to reproduce it (to appreciate it and then cite it).
- Don't get into the habit of publishing the same piece of work 100+ times (even with minor incremental changes).

Writing Good Papers

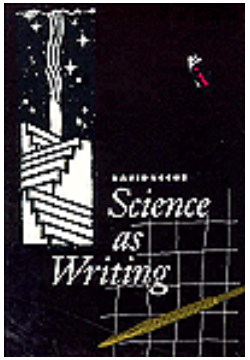
- Focus on an appropriate and interesting subject (your research topic).
- Narrows the subject to a topic that suits the purpose and audience.
- Contains a clear thesis.
- Supports the thesis with authoritative evidence.
- Presents the evidence as direct quotations, paraphrases and summaries.
- Give credit for all evidence in the correct format.
- Follows a clear method of organization.
- Shows evidence of original thinking.
- Is typed and formatted according to the conventions of the research paper.
- Includes a references page.

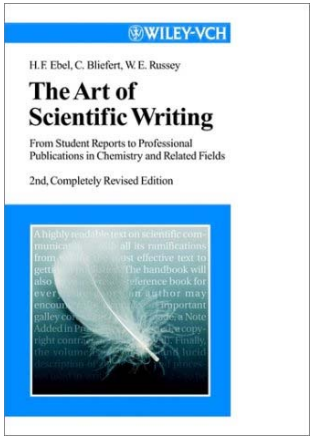
Writing Good Papers (contd.)

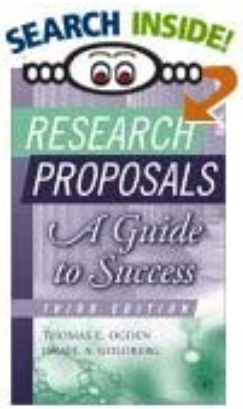
- Reference material:
  - Books, Handbooks, Encyclopaedias, etc
  - Journals, technical magazines, white papers, government documents, surveys, historical records….
  - Web sites, Google, Bing, public and proprietary data bases, etc.
  - Always remember that all sources are NOT the same.
- Time flies when you are writing a paper! Set deadlines, Expect catastrophes.
- Revise and edit your paper.
  - Read with an Eagle Eye!
  - Consider your audience, purpose and content as you revise and edit.
  - Delete irrelevant material and adding necessary elaborations.
  - Use punctuation to make your meaning clear.
  - Revise for unity by combining related sentences, deleting off topic sentences, and adding transitions, to name a few.

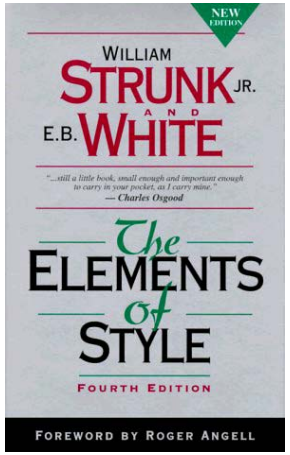
No tale is so good that it can't be spoiled in the telling.

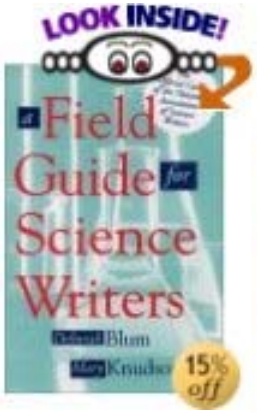
Proverb

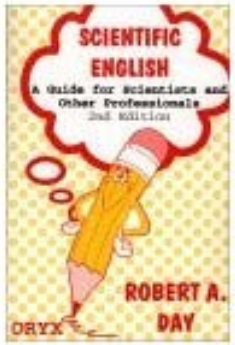


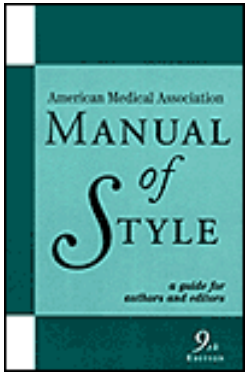


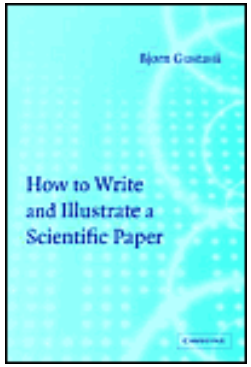


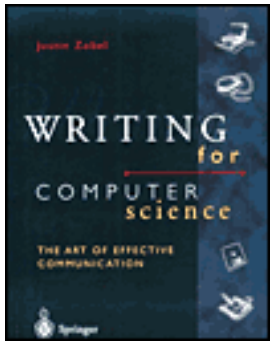


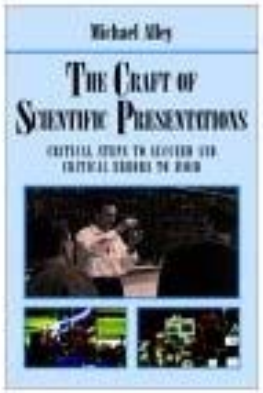










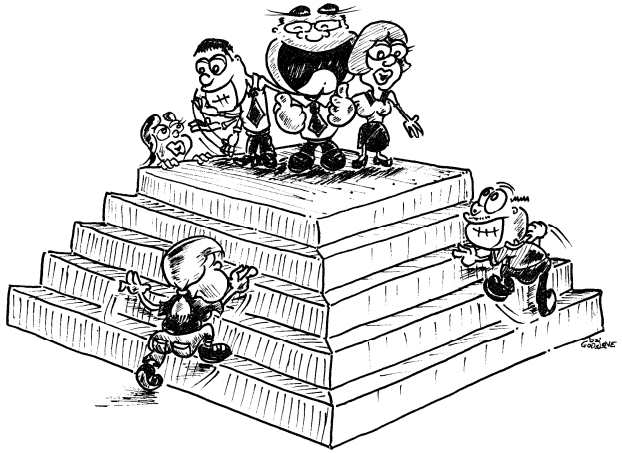


Some last advice

- **Recap:** Reading, aRithmetic, Research, and wRiting.
- **Feynman's Method:** Keep a few of your favourite problems constantly present in your mind, although by and large they will lay in a dormant state. Every time you hear or read a new trick or a new result, test it against each of your problems to see whether it helps. ("Luck favors the prepared mind." Pasteur).

- Learn to give back. When you get to the top don't try to lock the others out!

- There is plenty of room at the top.



Thank you