How to write computer science papers (I)

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Outline

What is research in computer science?

- What is computer science: Computer science is "*not science, but a synthetic, an engineering, discipline*" – Fred Brooks, Turing Award winner
- "*the scientist builds in order to study; the engineer studies in order to build.*"
- "*Computer scientist is a toolsmith - no more, but no less*".
- Our mission is to build **useful** computational tools, e.g., software and algorithms for users to solve their **real** problems!
- Please read The computer scientist as toolsmith

How to choose your reseach topics

- To be pragmatic: to choose a hot and emerging topic
  - lot of new progress,
  - adequate existing funding
  - a few good people beginning to enter the area.
  - much easier to have impact on a new emerging research area rather than a well-established research area.
- To be idealistic: to choose a topic you "have passion for, and truly love".
- You ideal topics should be both pragmatic and idealistic

I have done my research, what should I do now?

- Research done in CS $\equiv$ You have a product (tool)
- You mindset: How can I sell my product?

I have done my research, what should I do now?

- You mindset: **How can I sell my product?**
- First thing: Know your customers (readers)
- Customers by fields:
  - Some CS researchers who are doing similar research, which include your reviewers!
  - Some researchers who want to use your product
- Customers by types:
  - PIs: most of them will only read abstract, introduction and conclusion, maybe some results.
  - PhD students and postdocs: apart from above, they will read detailed methods for implementation
- The most important bits: Abstract, Introduction and Conclusion.
- Assuming they want products similar to yours, how to persuade them to buy your product?

Influence: The Psychology of Persuasion

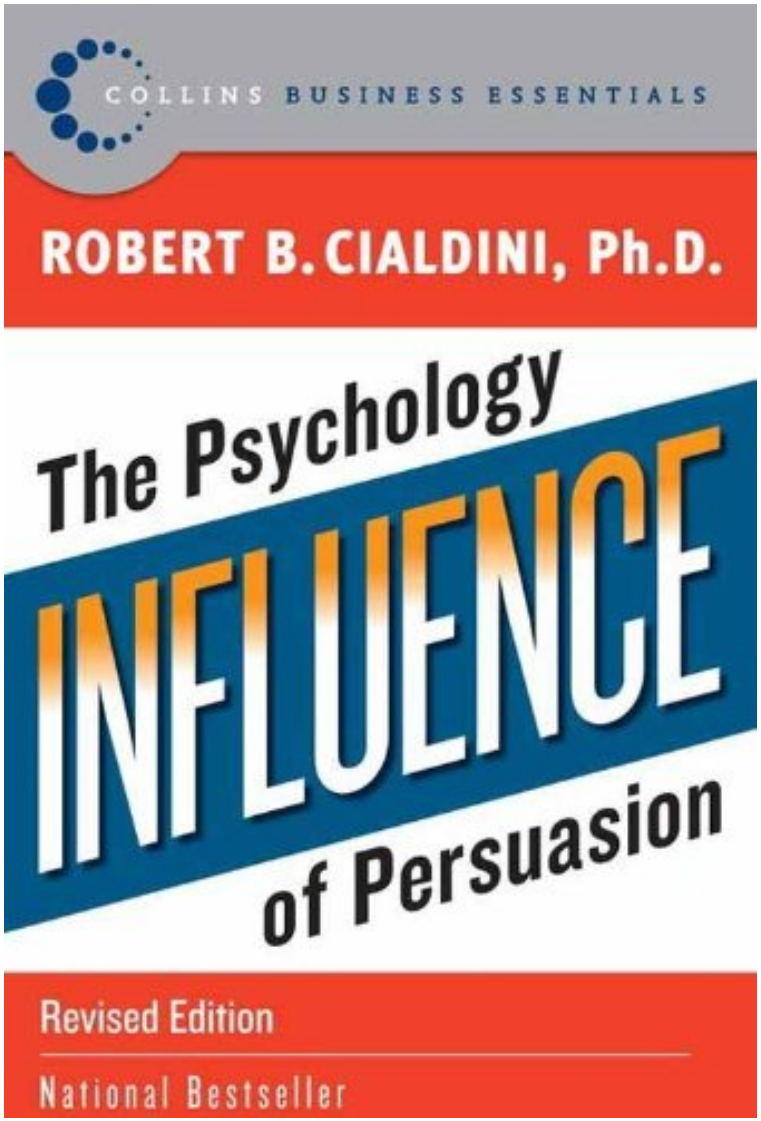

Figure : Influence: The Psychology of Persuasion.

I have done my research, what should I do now?

Six key principles of influence:

- **Scarcity**: Perceived scarcity will generate demand.
- **Authority**: People will tend to obey authority figures, even if they are asked to perform objectionable acts.
- **Reciprocity**: People tend to return a favour.
- **Social Proof**: People will do things that they see other people are doing.
- **Commitment and Consistency**: If people commit to an idea or goal, they are more likely to honor that commitment because of establishing that idea or goal as being congruent with their self-image.
- **Liking**: People are easily persuaded by other people that they like.

I have done my research, what should I do now?

How to map these six key principles to your scientific papers:

- **Scarcity**: New and novel research
- **Authority**: The theory/techniques underpin your research is sound. You or your group has done a lot of work in the area.
- **Reciprocity**: Your or our group's previous work, esp. with open source tools
- **Social Proof**: The research is a hot topic
- **Commitment and Consistency**: Your or our group's previous work
- **Liking**: They like your paper

Except for Liking, all the principles are determined before your research is done, but bad writing will not help to persuad

How to write high impact papers?

- Except for Liking, the other 5 principles are determined before your research is done
- However, we need to use these principles to guide your writing
- The four key messages in your paper:
  - **Why**: why you write this paper? This should follow the Scarcity principle.
  - **Who**: your or others' previous work, which follows the Authority, Reciprocity and Commitment and Consistency principles
  - **What**: the theories/techniques underpin your research, which follows the Authority principle
  - **How**: detailed methodology which allow others to reproduce your results precisely

How to write high impact papers?

- Why: From your perspective – why you write this paper?
- Why: From your readers' perspective – why should I read your paper (**More important!!**)
  - Big picture why: why your research (tool) is important and useful?
  - Close-up why: if your research is important and useful, there must be previous work in this area. Why you proposed this research?

Why

- Big picture why: why your research (tool) is important and useful?
- Important: **You must think this through when you start your research!!**
- Be general: e.g., active modules can reveal cellular and molecular mechanisms of disease
  - Abstract: first 1 or 2 sentences.
  - Introduction: first 1 or 2 paragraphs

Why

- Close-up why: Why you proposed this research?
- Essentially to identify the research gap:
  - What have been done? Also addresses the "**Who**" question, i.e., your or others' previous work
  - What is an ideal world? The motivation of your research
  - In order to achieve this ideal world, what need to be done?
- Do NOT forget **Liking**: Present other people's work in a objective way. **Do NOT criticise or diminish their work**!
  - Abstract: The next 2 sentences to briefly summarise existing work and point out the gap
  - Introduction: The next 2-3 paragraphs

What

- You must have some sound theories or techniques, e.g., ensemble methods, that underpin your research
- Explain briefly your theories or techniques.
- Justify their appropriateness, e.g., this theory has been used in other fields.
- Tip: You need to present your research as a new and novel way, following the Scarcity principle, e.g. ensemble methods have not been applied to active module identification.
- Do NOT give details which should be in How (Methodology)
  - Abstract: The next 2 sentences to briefly address the 'What' question
  - Introduction: The next 1 paragraph

How: Methodology section

- Only present details in the **Methodology** section
- Goal: allow others to follow your method to reproduce your results

Other parts of the paper

- **Results**: only include the key results to support your answer to the "why" question!
- **Discussion**:
  - Summarise your results: do your results support your answer to the "why" question?
  - Be honest and point out all the drawbacks
  - Future work
- **Conclusion**: final piece of sales pitch to summarise FAB (From Write to sell):
  - Features: what features your product has? Based on what and how.
  - Advantages: what gaps it filled? Explicitly address the close-up why question
  - Benefits: what benefits your product provides? Address the big-picture why question

Liking: how to make them like your paper

- Principle: Easy to read and understand
- I will discuss this in my next tutorial