

Notes for research design and paper writing

Part I: A “5C” law

Part II: Paper structure and components

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Part I: A “5C” law

- **C1: Critical**

Critical

- What is a **PhD**?
 - Publish papers? Research projects? Experiments? or
 - “Permanent Head Damage”?
- My answer: PhD is “a **critical** way of thinking”.
- **Critical**: see a thing clearly and truly in order to judge it fairly;
- **Critical thinking** involves determining the meaning and significance of what is observed or expressed, or, concerning a given inference or argument, determining whether there is adequate justification to accept the conclusion as true. (Wiki)



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3 approaches for research design

- App 1: **New** method for **old** problem
- App 2: **Old** method for **new** problem
- App 3: **New** method for **new** problem

- Clearly, research needs something “**NEW**”.
- However: “**NEW**” should not be the merely reason to do research!
- Resources are limited, so the exploration for **NEW** things should be adequately justified.



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Ask yourself before doing any research

- App 1: **New** method for old problem
 - Why the old problem needs revisiting by new method?
 - Why the new method may probably work for the old problem.

- App 2: Old method for **new** problem
 - Why the new problem is worth researching?
 - Why the old method may fit for the new problem?

- App 3: **New** method for **new** problem
 - Why the new problem is worth researching?
 - Why the new problem calls for new method?



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To be critical

- Present **background problem**
 - Why the background problem is important? Social, economic, environmental, health impacts? or to understand the universal? or to prepare for future needs?

- Define **research problem**
 - Why the research problem helps understand or solve the background problem?

- Review **existing research**
 - Review is not for “review” itself. Review is for “justifying the current research”.
 - Why the research problem calls for more research efforts? Lack of research? Existing research not enough? Why the current research is important?



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To be critical

- Set up **research hypothesis / objective**
 - Why the research hypothesis / objective is reasonable, rational, and reachable?
- Design **research strategy / methodology**
 - Design experiments, data collection and analysis method? Why the methodology is appropriate to test the research hypothesis
- Discussion and conclusion on **results**
 - How the results support or refute the research hypothesis? Justify and rationalize the results? Why can be concluded? What is the limitation of this research? And future needs?

Part I: A “5C” law

- C1: Critical
- **C2: Consistent**

Consistent

- *Newton: “If I have been able to see further, it was only because I stood on the shoulders of giants.”*
- Consistent: possessing firmness or coherence.
- To be consistent is a basic quality of a researcher!
- Consistent attitude and standpoint to specific problems in your publications.



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To be consistent

- **Consistency in research design**
 - App 1: New method for old problem, App 2: Old method for new method, both contain “OLD”. Generally, “OLD” or “Existing” is the starting point of innovation.
 - App3: New method for new problem. Very few research belongs to this category. In most cases: “New” is generated from the “Old”. No absolute “new”.
- **Consistency in theoretical derivation**
 - Theoretical evolution, coherence in model components, experiment design, variable definition, analytical framework, references, etc.



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To be consistent

- Consistency in presentation

- **Term usage:** use consistent terms in a paper or presentation. i.e. Crash vs. Accident; Accident prediction models vs. safety performance function
- **Abbreviation:** define abbreviations in the first appearing place and use it consistently afterwards.
- **References:** use consistent format for reference list and citations in text in accordance with Journal requirements.
- All other places, e.g. spacing, heading, font, etc.



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Part I: A “5C” law

- C1: Critical
- C2: Consistent
- **C3: Concise**



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Concise

- Research is an activity of creating new knowledge. Conciseness can help deliver research products and the dissemination to peers and general public.
- Publishing is costly. Save paper! Also save time of readers.
- A principle for “to be concise”: delete or ignore any materials irrelevant for evaluation of research hypothesis or accomplishment of research objective.



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To be concise

- **Intrinsic conciseness**
 - Conciseness in logic thinking, to be sharp
 - e.g. good literature review needs excellent summary and filtering for essence of existing studies only relevant to current research.
 - e.g. experimental design: to fulfill research objective, only those steps useful for testing hypothesis should be included. Do not be distracted.



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To be concise

■ Extrinsic conciseness

- Presenting only the materials supporting the conclusion. not result deliberate selection, just **do not be redundant** (including limitation or exceptional observations).
- Reference selection: the **key references only**, not as many as possible.
- Do not repeat the whole research process: **get straight** to what you found out.
- Do not be wordy in presentation. **To be sharp in writing.** Use concise and simple sentence as possible as you can.
- **Do not over-elaborate** (to explain the obvious – to explain things that every intelligent reader will know or ought to understand).
- Short paper is preferred. **The longer, the more to be criticized** (increased exposure!).

Part I: A “5C” law

- C1: Critical
- C2: Consistent
- C3: Concise
- **C4: Clear**

Clear

- Research paper is not fiction. Do not hide anything as long as you have chance to make it clearer.
- To be clear is helpful for manuscript to be more readable, acceptable, and deliverable.

To be clear

- **Go straight to the research problem.** Clearly define and present research problem and research hypothesis /objective in clear places. Do not let readers guess.
- **Present everything**, including introduction, literature review, data, results, discussion and conclusion in **clear structures and formats with clear mind.**
- Use **clear sentence** structure in paragraph: one paragraph one central sentence, central sentence appearing first or last.
- Use **clear words** in sentences: important words first.
- Use **tables, charts or numbering** to make comparable observations or parallel arguments clear.

Part I: A “5C” law

- C1: Critical
- C2: Consistent
- C3: Concise
- C4: Clear
- **C5: Complete**

Complete

- No matter how long or how short a paper is, it should be stand-alone.
- There should **not be “to be continued”**. Any paper should fully accomplish the objective within the specific scope set up before.
- Thus, there is a need to rationally set up the objective and scope. **Do not aim at an elephant, and yield an ant.**
- Given that any paper accomplishes its objective, the level of a paper can be judged by the level of objective.

Two puzzles for “To be Complete”

- Limitation and future study
 - Limitation is the limitation of “objective and scope”, not the limitation of “accomplishing the objective and scope”.
 - In other words, “limitation” should outrange the objective and scope of current study.
- Accompanying papers
 - Levine, N., et al. 1995. Spatial analysis of Honolulu motor vehicle crashes. I. Spatial patterns. *AAP* 27, 663–674.
 - Levine, N., et al. 1995. Spatial analysis of Honolulu motor vehicle crashes. II. Zonal generators. *AAP* 27, 675–685.
 - Each paper in accomplishing papers has its own objective and scope, which should be fully accomplished by itself.
 - “Accompanying” means accompanying objectives, e.g. method vs. results. Not accompanying parts to fulfill a specific objective.



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Part I: A “5C” law

- C1: Critical
 - C2: Consistent
 - C3: Concise
 - C4: Clear
 - C5: Complete
- Review your research design and manuscript by these 5 Cs prior to submission or presentation.
- Finally, two bonus “C”s regarding research spirit



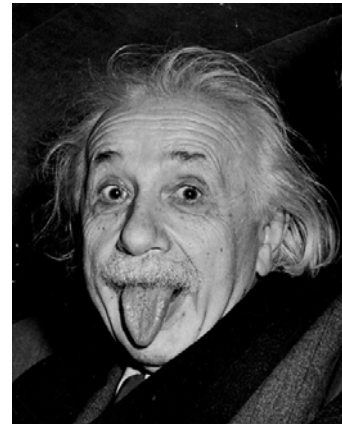
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Bonus C1: Candid

- Research is a way to create knowledge. It is sacred, so do not cheat, to be frank.
- The research circle is small. Reputation is the most treasured for a researcher.
- Do not hide the problem underlining your research.
 - Before: seriously identify it and solve it.
 - After: explain clearly the limitation.

Bonus C2 ?

Crazy!!!



Like it and then do it.

Never give up!

Part II: Paper structure and components: --- A standard approach

- Title
- Abstract
- Introduction
- Literature review
- Method
- Data
- Results
- Discussion
- Conclusion
- References

Title

- Title is very important as it tells your audience whether or not they should read the paper
- Title must convey to the reader the **overall** content of the study **concisely** and **unbiasedly**.
- **Three approaches to write a title**
 - State the specific subject of the study (***)
e.g. Multilevel data and Bayesian analysis in traffic safety
 - State the hypothesis to be tested (****)
e.g. The effect of RLC on intersection safety
 - State the results of the study (*****)
e.g. RLC significantly improves intersection safety

Abstract: a 5-sentence approach

- **Research problem:** why the research problem is worth investigation
- **Objective:** explicitly state the objective of the study presented in this paper (not the whole project)
- **Method and data**
- **Results:** principal results and major conclusion
- **Implementation:** major contribution, impact on research and practice (industry)



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Introduction (1/2)

- **Research background**
 - establish the overall field, from broad to specific
 - orient the readers and grasp their attention
 - lead into the focus of the research problem
- **Research problem**
 - outline the core or the big idea of the research
 - for the resolution of the problem, *thinking on the part of the researcher* is required
- **Summarize previous research**
 - what have been done (in summary)
 - to what extent the research problem has been solved



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Introduction (2/2)

- Indicate the research gap
 - what is missing, inadequate or essential to answer the research problem (to be critical)
- State objective and scope of the study
 - explicitly, suppose to answer which specific problem, test which hypothesis
 - scope is the **delimitation** to make the conclusion more defensible
- Outline the article
 - optional, if the paper is in a non-standard format



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Literature review (1/3)

- Build a *theoretical foundation* upon which the research is based by reviewing the relevant literature to identify research issues which are worth researching because they are controversial and have not been answered by previous researchers.
- The rule: literature review is not for “reviewing literature”, but for “**justifying the current research**”; or the literature review is not an end in itself, but is a means to the end of identifying the worthy research issues.
- Specifically, three functions
 - Justify the research problem and objective
 - Justify the method in this research (from same field? Or other fields?)
 - Summarize relevant results for comparison with the results anticipated from this study.



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Literature review (2/3)

- **Common Patterns for Ordering Citations**
 - **Chronological**
from earliest to the latest
 - **Approach**
where studies can be grouped according to methods or approaches used
 - **Distant to Close**
from studies that have fewer similar aspects to those that are most closely related

Literature review (3/3)

- **Types of gaps**
 - **Inadequacy** – important aspect(s) ignored by other authors
 - **Extension** of a topic, new question not previously considered
 - **Unresolved conflict** or disagreement

Method

- **Warning:** model or specific approach is not “method”.
- Method is the way to accomplish the objective set up in the introduction. Do not repeat the whole research steps, just highlight the important ones.
- Justification for the method adopted.
- In general, three components
 - research strategy if necessary,
e.g. “safety assessment of taxi drivers”, we have to state the research strategy first.
 - data collection approach: experiment? survey? database? etc.
 - analysis approach: variable selection? model? etc.
e.g. case study, numerical analysis, simulation, statistical models (model specification, model estimation, model evaluation, etc.)



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Data

- **Component 1:**
Description of the data collected: data sources, time, scope, limitation, descriptive statistics (mean, median, sd, min, max, etc.)
- **Component 2:**
 - Data preparation for model estimation
 - Preliminary data analysis



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Results

- **Important:** make this section a completely objective report of the results, and save all interpretation for the discussion.
- Present and summarize the major findings
- Describe each of the results, pointing the reader to observations that are most relevant.
- Do not present the same data more than once.
- Text should complement any figures or tables, not repeat the same information.

Discussion

- This is the most important part bridging results to conclusions.
- Identify important patterns observed in results
- Justify the observed patterns by
 - Comparing between results in this study
 - Comparing to previous studies
 - Discussion on the potential causes
- Justify the significance of the results to reach certain conclusions
- Also justify the importance of this research

Conclusion (1/3)

- **Warning:** Conclusion may first present a summary of the whole study, but should not repeat the specific design.
- Highlight the **contributions** of this research
 - Contribution to research
 - Contribution to practice
- Do not confuse the difference among conclusion, results, and implication.
- Conclusions are strictly based on *findings* alone, **do not over-conclude** without supportive evidence

Conclusion (2/3)

- **Implication:** The *full* picture of the research's findings within the body of knowledge
- **Theoretical implication** aims to show not only the significant contribution to knowledge in its research problem theory but also for the wider body of knowledge, including the parent theories and other related theories.
- **Practical Implication** is important to show the potential impact on relevant industry.

Conclusion (3/3)

- **Limitation**

limitation is not the limitation of “accomplishing the objective within the scope” but the specific “the objective and the scope” to fully understand the whole research problem.

- **Future study** is based on

- The limitation of this study
- The implication of the findings



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References

- Consistent within the reference list
- Consistent to the Journal requirements

Good luck in your academic experience

Contact me @ huanghelai@hotmail.com



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