

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)

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.

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?

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?

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.

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.

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.

Part I: A “5C” law

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

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.

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.

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**



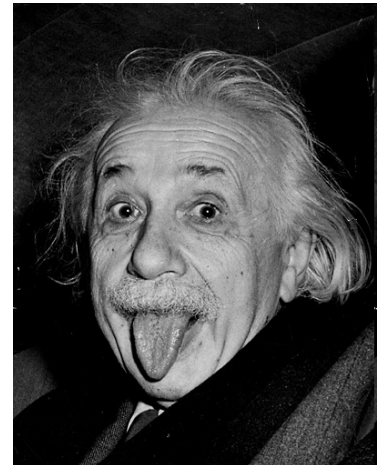
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Bonus C1: Candid

- 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!