THE UNIVERSITY of EDINBURGH
informatics

Lecture 5: Writing a Good Research Review

Informatics Research Review (IRR) 2022/2023

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IRR Purpose

- In the IRR we want you to critically evaluate research literature in a chosen area and to synthetise the knowledge contained in a number of papers to draw some conclusion.
- You are expected “to build an argument, not a library”
- This helps you develop critical thinking which is central to good education

Content

- **Justification**
- **Building a Scientific Argument**
- **Critical Questions**
- **Reviewing your Review**
- **Structure and Narration**
- **Top Tips for a Successful Literature Review**

Propositions

- A **proposition** is something that can be true or false in the world e.g. “there is an effective coronavirus vaccine” and in some sense this says something about the world (or the state of affairs or whatever).
- Propositions are true or false without anyone knowing whether they are true or false.
- Propositions can be **vague** and might in need of clarification e.g. “*There is an Covid-19 vaccine that confers immunity to the virus for at least one year in 80% of the vaccinated community*”

Propositions

- Propositions can be *consistent* (i.e. both can be true) e.g. “Joe Biden is president of the USA” and “Vladimir Putin is president of Russia”
- Some can be *contradictory* e.g. “Joe Biden is president of the USA” and “Vladimir Putin is president of the USA”
- Usually we call a proposition that is true a **fact.**
- [Aside: this all get more complicated if we think about things like time, place, etc, e.g. “It’s raining” or “X is the most powerful computer in the world”.]

Opinions/Beliefs

- An **opinion** or **belief** is a proposition that someone (the believer) thinks is true.
- So, I could have “There is extraterrestrial life” as a belief or “Vladimir Putin is president of the USA” as a belief and whether they are a fact is not important (people believe all sorts of strange things).
- If somebody wants to convince me a belief is true, they would need to justify that the proposition they believe is really true.

Morrow, D. R. (2017). *Giving Reasons: An Extremely Short Introduction to Critical Thinking*. Hackett Publishing.

Opinions/Beliefs

- A belief can be true or false

Example:

- you believe that the Earth is round, whereas Egyptians believed that it is flat.

- a belief can be justified of not (= the person may or mat not have good reasons for holding a belief)

Morrow, D. R. (2017). *Giving Reasons: An Extremely Short Introduction to Critical Thinking*. Hackett Publishing.

Opinions vs Knowledge

- An **opinion** is simply a belief: some are true, some are false
- A belief that's both true and justified is **knowledge.**

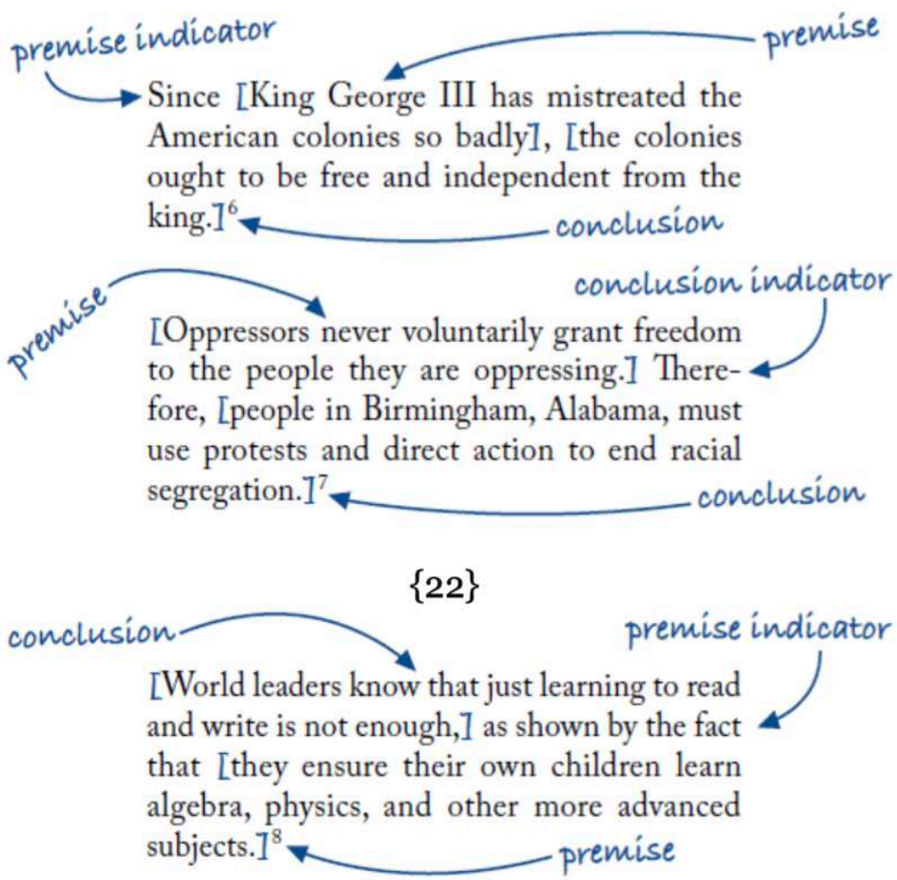
Morrow, D. R. (2017). *Giving Reasons: An Extremely Short Introduction to Critical Thinking*. Hackett Publishing.

Justification

- **Definition:** All triangles have 3 sides.
- **Perception:** It is raining because I can see it is.
- **Testimony:** Boris promised to get covid under control.
- **Authority:** The judge found Fred guilty
- **Reasoning:** The RCT for the covid vaccine indicates it is effective and safe, the medicines agency will approve a safe and effective vaccine.

Morrow, D. R. (2017). *Giving Reasons: An Extremely Short Introduction to Critical Thinking*. Hackett Publishing.

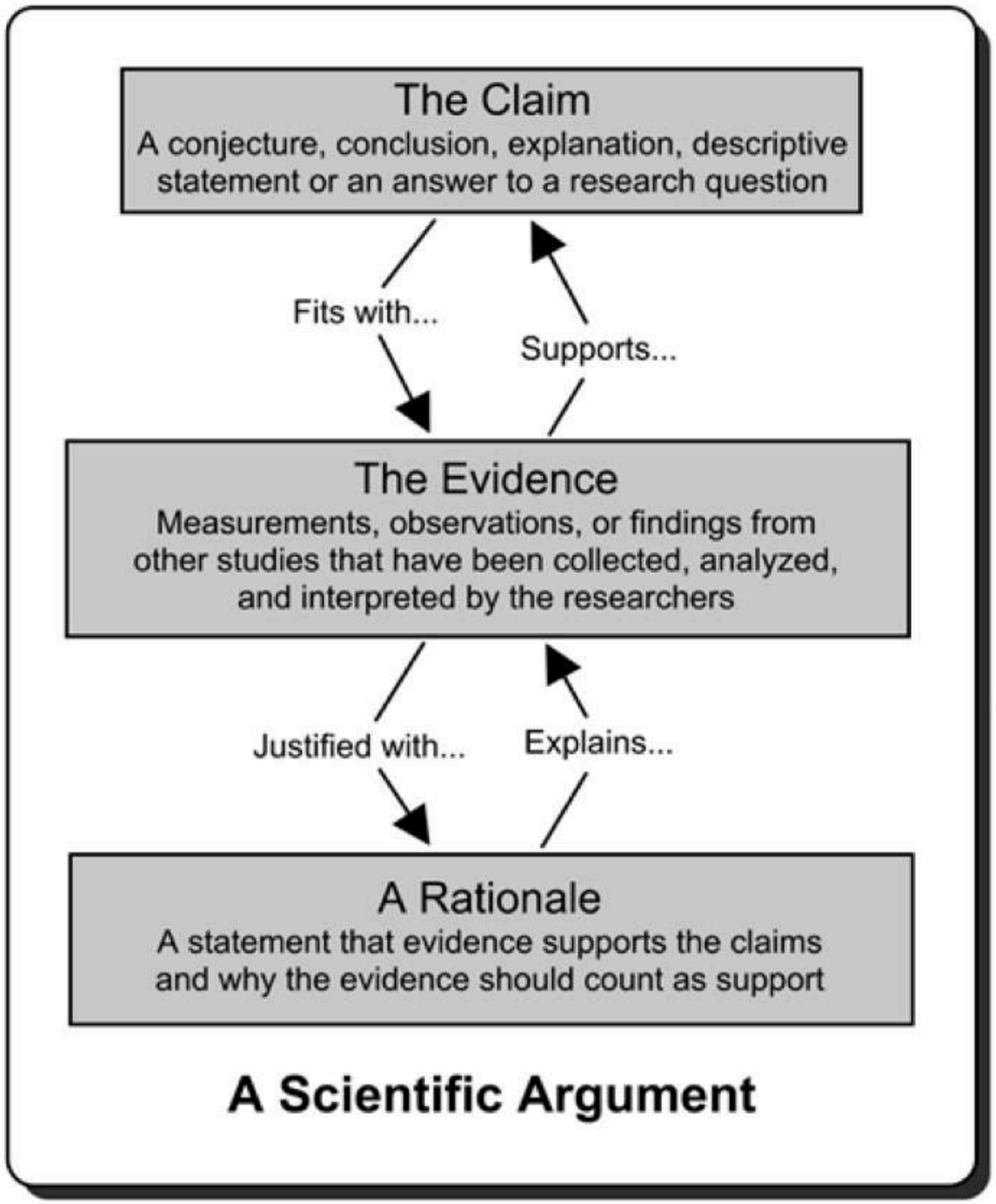
Justifying by Reasons



{23} PREMISE INDICATORS	CONCLUSION INDICATORS
because	therefore
since	so
for	thus
given that	hence
as shown by	consequently
due to the fact that	it follows that
may be inferred from	proves that
as indicated by	shows that
on the grounds that	we can conclude that
insofar as	we can infer that
assuming	which entails that
the reason is that	which means that

Morrow, David R. (2017). Giving Reasons: An Extremely Short Introduction to Critical Thinking_. Hackett Publishing Company.

Scientific Argument



Developing your Argument

- Outline your arguments in the **introduction** clearly and precisely
- Use **headings/paragraphs** to separate categories and major/minor arguments
- Revise sentences that indicate subjectivity (we know everything is subjective, but you don't want to water down argument by using "I feel," "I think," or "I believe.")
- Avoid other tendencies such as overusing pronouns and vague references. Be **concrete and specific**.
- If your claims are not original, that's fine. **Cite** the origin(s). Give others **credit** for their ideas.
- Again, **avoid plagiarism**; if the idea or statement is not yours, cite your source.
- **Paraphrasing** is more common than direct quoting in a review (not a hard and fast rule).
- **Remember that a literature review is not really just a "review"**. It is your argument, which begins with and builds from and moves beyond the stuff you read.

Critical Questions

- Does this article **fit** with other research in the area? How does it **differ**?
- Does the author **account for variation** from other researchers and findings?
- Have I identified the **major findings** of this author?
- What is the **theoretical framework**, the **rhetorical purpose**, and the **practical perspective** of this author?
- Is the author internally **consistent**?
- Does the author provide **enough evidence** to support the claims being made?
- Are the sources of **evidence appropriate**?
- Do the **conclusions follow from the evidence** or study findings presented?
- Does the **methodology** match the type of question being asked?

Reviewing your Review

- Why did you **include** some of the literature and **exclude** others?
- What is the balance between **description** and **comment**?
- Have you missed out any **important dimension** of the argument, or literature?
- Is the material presented in the most **effective order**?
- Have you been sufficiently **critical** of theories, design or methodological issues?
- Have you indicated when results/ideas were **conflicting** or **inconclusive** and **discussed possible reasons**?

Reviewing your Review

- Are there places where the reader is left with **unanswered questions**?
- Have you explained to the reader the **relevance** of each piece of evidence?
- Is there any material that is **interesting but which does not contribute** to the development of the argument?
- Have you explained adequately the **justification** for this research approach/topic/question?
- Are the references **complete** and up to date?
- How effective is my **linking** of all the elements?

Structure

- Introduction
- Body
- Conclusion
- References

Introduction

- **Define or identify the general topic**, issue, or area of concern, thus providing an appropriate context for reviewing the literature.
- **Point out overall trends** in what has been published about the topic; or conflicts in theory, methodology, evidence, and conclusions; or gaps in research and scholarship; or a single problem or new perspective of immediate interest.
- Establish the writer's reason (**point of view**) for reviewing the literature; explain the **criteria** to be used in analysing and comparing literature and the **organisation of the review** (sequence); and, when necessary, state why certain literature is or is not included (**scope**).

Body

No one-size-fits-all solution. Here are some approach examples:

- **chronologically** - although be careful not just to list items; you need to write critically, not just descriptively;
- by **theme** - this is useful if there are several strands within your topic that can logically be considered separately before being brought together;
- by **sector** - e.g. industrial practice vs academic research
- by **development of ideas** - this could be useful if there are identifiable stages of idea development that can be looked at in turn;
- by some **combination** of the above, or by another structure you create.

Conclusion

- **Summarise major contributions** of significant studies and articles to the body of knowledge under review, maintaining the focus established in the introduction.
- Evaluate the current "state of the art" for the body of knowledge reviewed, pointing out major **methodological flaws or gaps** in research, **inconsistencies** in theory and findings, and areas or issues pertinent to **future study**.
- Conclude by providing some **insight** into the **relationship** between the central topic of the literature review and a larger area of study such as a discipline, a scientific endeavour, or a profession.

Narrative Thread

Although you clearly need to write in an academic style, it can be helpful to imagine that you are **telling a story.** The thread running through the story is the explanation of why you decided to do the study that you are doing. The story needs to be logical, informative, persuasive, comprehensive and, ideally, **interesting**. It needs to reach the logical conclusion that your research is a **good idea**.

Example

Problem Description

Claims

Evidence

***Abstract*—Accurate automatic optimization heuristics are necessary for dealing with the complexity and diversity of modern hardware and software. Machine learning is a proven technique for learning such heuristics, but its success is bound by the quality of the features used. These features must be hand crafted by developers through a combination of expert domain knowledge and trial and error. This makes the quality of the final model directly dependent on the skill and available time of the system architect.**

Our work introduces a better way for building heuristics. We develop a deep neural network that learns heuristics over raw code, entirely without using code features. The neural network simultaneously constructs appropriate representations of the code and learns how best to optimize, removing the need for manual feature creation. Further, we show that our neural nets can transfer learning from one optimization problem to another, improving the accuracy of new models, without the help of human experts.

We compare the effectiveness of our automatically generated heuristics against ones with features hand-picked by experts. We examine two challenging tasks: predicting optimal mapping for heterogeneous parallelism and GPU thread coarsening factors. In 89% of the cases, the quality of our fully automatic heuristics matches or surpasses that of state-of-the-art predictive models using hand-crafted features, providing on average 14% and 12% more performance with no human effort expended on designing features.

Crisis

↓

Our Novel Solution

↓

Happiness

Cummins, C., Petoumenos, P., Wang, Z., & Leather, H. (2017, September). End-to-end deep learning of optimization heuristics. In *2017 26th International Conference on Parallel Architectures and Compilation Techniques (PACT)* (pp. 219-232). IEEE.

Top Tips

1. **Vary search terms.**
2. **Record everything.**
3. **Use bibliographies.**
4. **Create a summary document.**
5. **Build a structure.**
6. **Use your voice**
7. **Be selective**
8. **Summarise your key points**

(https://www.ed.ac.uk/institute-academic-development/study-hub/learning-resources/literature-review)