

How to write a Research Report

Scientific writing in the age of AI

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What **not** to do



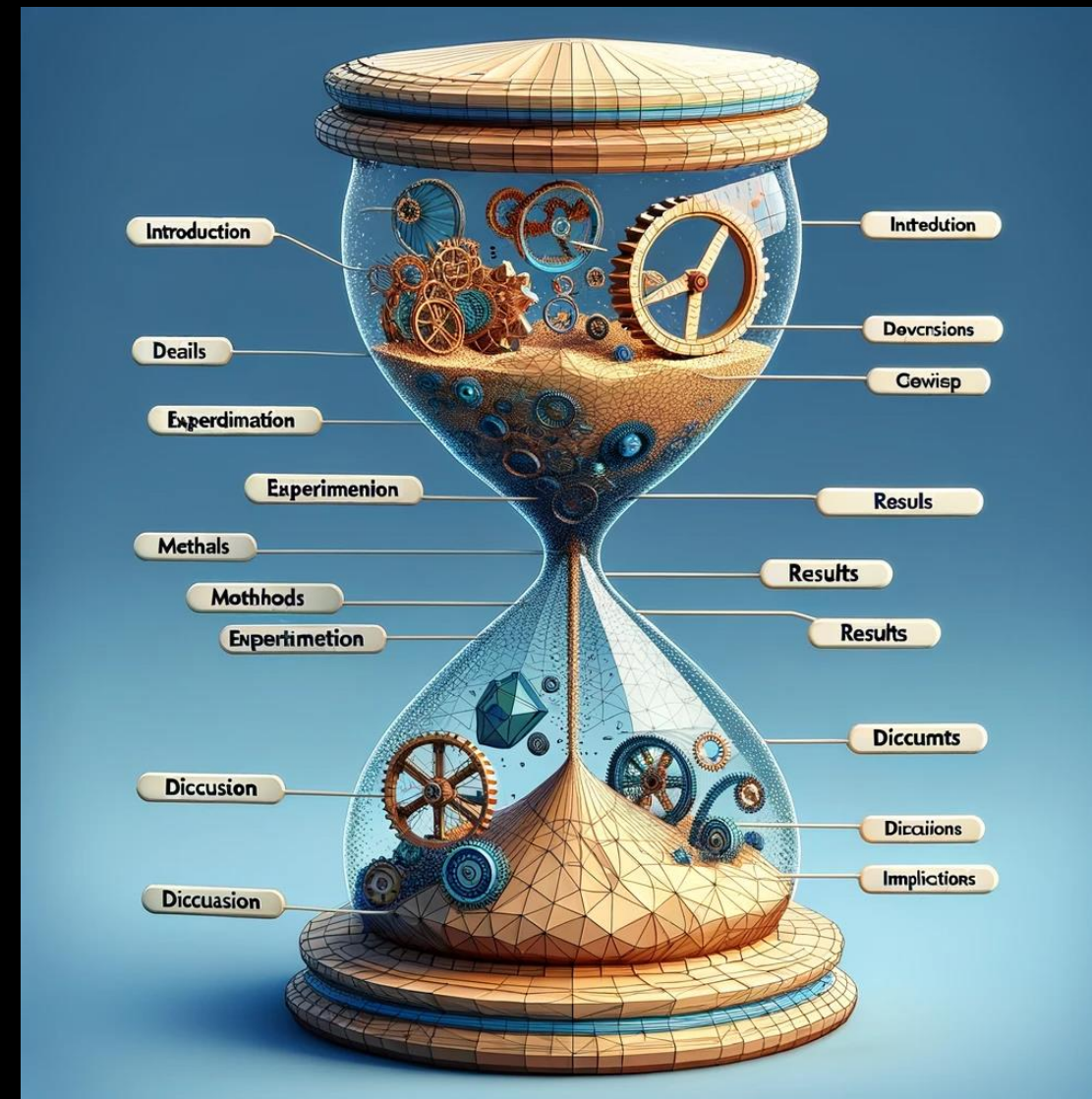
Do not write a report from top to bottom!

What to do



Write the report in a structured way

Structure of a paper



Title

Abstract

Introduction

Methods

Results

Discussion

Conclusions

Structure of a report

Depends on the report/assignment!

The ten simple rules for writing



EDITORIAL

Ten simple rules for structuring papers

Brett Mensh^{1,2}, Konrad Kording^{3,4*}

Carefully plan your logic

Write for your readers

Your scientific logic must be crystal clear to
powerfully make your claim.

The principles of paper writing

- Rule 1: Focus your paper on a central contribution, which you communicate in the title
 - Single message, main contribution
- Write for flesh-and-blood human beings who do not know your work
 - Define terms, explain relevance
- Rule 3: Stick to the context-content-conclusion (C-C-C) scheme
 - Why? > What? > So what?
 - Works on multiple scales
- Rule 4: Optimize your logical flow by avoiding zig-zag and using parallelism
 - Each subject should be covered in only one place
 - Use the same words and syntax to communicate related thoughts (e.g. thee reasons why you interpret your results in a certain way)

The components of a paper

- Rule 5: Tell a complete story in the abstract
 - Context – content – conclusions!
- Rule 6: Communicate why the paper matters in the introduction
 - progressively more specific paragraphs
 - clear exposition of what is lacking in the literature
 - State research questions and hypotheses
- Rule 7: Deliver the results as a sequence of statements, supported by figures, that connect logically to support the central contribution
 - Figures should be able to stand on their own and are vital to your readers!
- Rule 8: Discuss how the gap was filled, the limitations of the interpretation, and the relevance to the field

Interlude: The **Methods** chapter

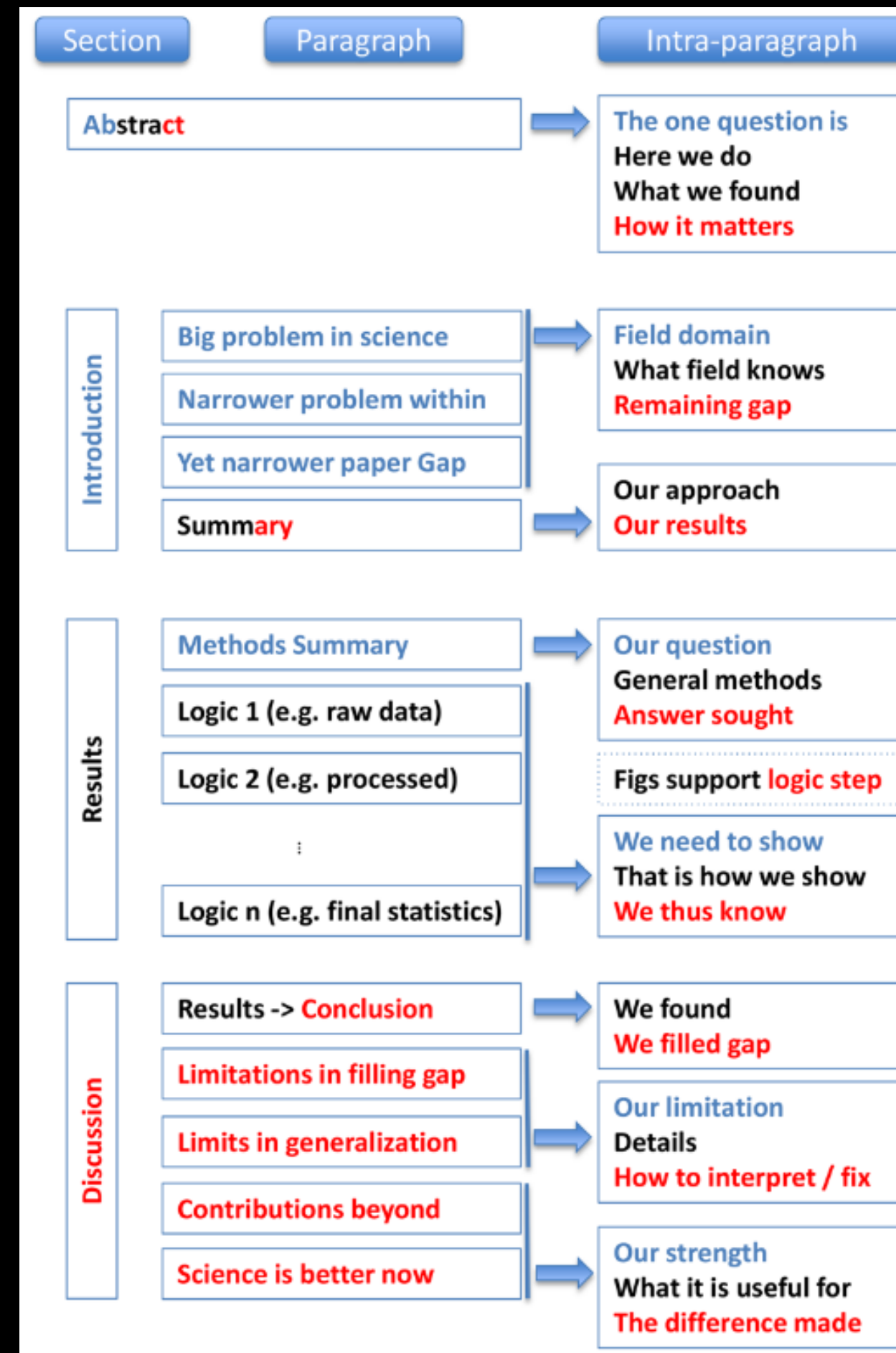
- The methods explain what you did
 - Exactly what you did
- The methods are relevant for other researchers to replicate your research
- They are also relevant to evaluate the quality of your research and whether one can trust your results and conclusions
- Least read part of a paper, but highly relevant to judge your scientific rigor!



The process of writing

- Rule 9: Allocate time where it matters: Title, abstract, figures, and outlining
 - Focus on your logical flow and quality of argumentation
 - Make an outline
 - Prepare paragraphs by single main messages
 - Flesh out each paragraph using the C-C-C scheme
- Rule 10: Get feedback to reduce, reuse, and recycle the story
 - Draft -> refine
 - Accept criticism
 - Be willing to let go of some parts

Overview



Overview

Table 1. A summary of the ten rules and how to tell if they are being violated.

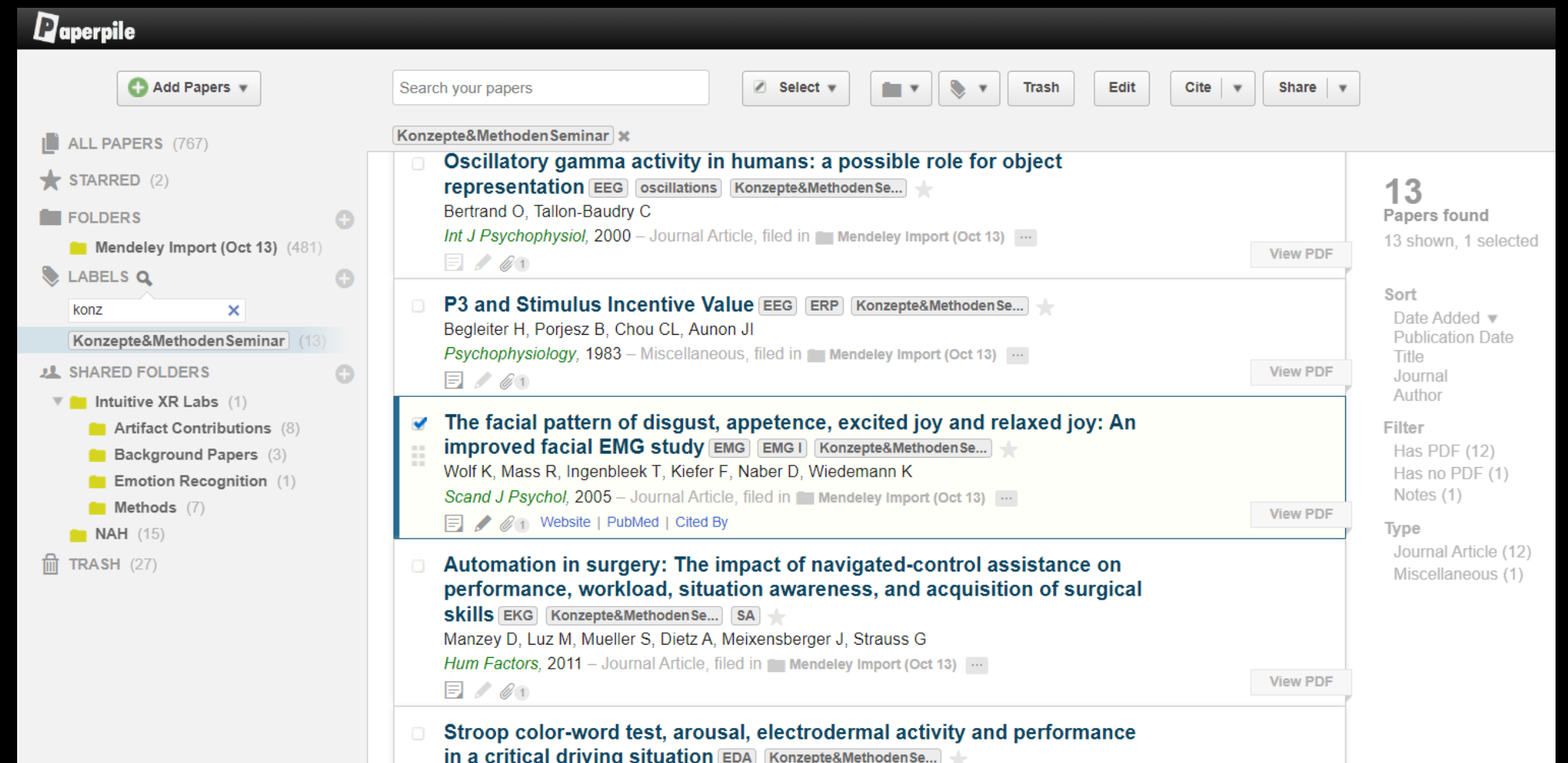
| Rule | Sign it is violated |
|--|---|
| 1: Focus on one big idea | Readers cannot give 1-sentence summary. |
| 2: Write for naive humans | Readers do not “get” the paper. |
| 3: Use context, content, conclusion structure | Readers ask why something matters or what it means. |
| 4: Optimize logical flow | Readers stumble on a small section of the text. |
| 5: Abstract: Compact summary of paper | Readers cannot give the “elevator pitch” of your work after reading it. |
| 6: Introduction: Why the paper matters | Readers show little interest in the paper. |
| 7: Results: Why the conclusion is justified | Readers do not agree with your conclusion. |
| 8: Discussion: Preempt criticism, give future impact | Readers are left with unanswered criticisms and/or questions on their mind. |
| 9: Allocate time wisely | Readers struggle to understand your central contribution despite your having worked hard. |
| 10: Iterate the story | The paper’s contribution is rejected by test readers, editors, or reviewers. |

Relevant tools



Paperpile

<https://paperpile.com/app>



Organize Papers, easy citation in Google Docs or MS Word, annotate, take notes

Not free...

Miro

<https://miro.com/>

miro | RVM Background

Types of Research Contributions

| | Empirical Research | Artifact | Methodological Work | Theoretical Work | Dataset | Survey or Meta-Analysis | Opinion |
|------------|--|--|---|--|--|--|--|
| Goal | Provide new knowledge through findings based on both quantitative and subjective qualitative observations and data | Create new evidence of effectiveness, which can be used to inform new research, or to inform existing research | Create new knowledge that informs or improves how we carry out our work | New or improved concepts, definitions, models, principles, or frameworks that are vehicles for thought | Provides a new and useful corpus for analysis of its characteristics | Review and synthesize work done on a research topic to expose trends and gaps in research, and provide a basis for future research | Opinions, essays, or arguments, used to change the minds of readers through persuasion |
| Details | Experiments, user tests, field observations, interviews, surveys, focus groups, diaries, ethnographic studies, semi-structured interviews, log files | Design artifacts, such as prototypes, wireframes, or code snippets | Improves research or practice, influence how we do science or design, improve how we discover, measure, evaluate, or build things | Inform other researchers and what we expect from them. They can be qualitative or quantitative, descriptive or prescriptive. Offer explanations, but only if they must be reliable and falsifiable | May be accompanied by secondary work to create a corpus, a stable set of data, or a set of methods | Review and synthesize work done on a research topic to expose trends and gaps in research, and provide a basis for future research | Opinions, essays, or arguments, used to change the minds of readers through persuasion |
| Evaluation | Mainly on the importance of their findings and on the soundness of their methods | Utility, reproducibility, reliability, and validity of the new method or method enhancement in a repeated validation | Novelty, soundness, explanatory power, generalizability. Validation through empirical work | Existence to which they supply the research community with useful and representative corpus upon which to base and measure other research and should be broadly accessible | Existence to which they supply the research community with useful and representative corpus upon which to base and measure other research and should be broadly accessible | Existence to which they supply the research community with useful and representative corpus upon which to base and measure other research and should be broadly accessible | Existence to which they supply the research community with useful and representative corpus upon which to base and measure other research and should be broadly accessible |

The Four Questions

1. What is the problem that this project tries to solve?
This could also be framed as a problem or challenge that scientific enquiry faces which is basically a research question that must be answered before any further progress can be made.

2. What does this project do to solve this problem?
Basically the methods, which must be reported and ideally an online repository provided for reproducibility. Explain the design process.

3. How do we know that we actually solved the problem?
For programming, what tests did we plan beforehand to ensure that the code worked as intended? For UX, validate if your requirements are met. Generalize to your answer of Q2 to solve a scientific problem.

4. Now that the problem is solved, so what?
Identify the community of academics and/or industry that would be interested that this problem is solved and describe how it could/should progress their work (even if they don't know it yet).

CHI 2016 by Contribution Type

12,116 submissions, 346 accepted (2.85%)

| Contribution Type | Percentage of Submissions (12,116 papers) | Percentage of Program (346 papers) | Acceptance Rate |
|-------------------------------|---|------------------------------------|-----------------|
| Empirical Study of System Use | 31.1% | 21.1% | 67.8% |
| Empirical Study of People | 21.1% | 11.1% | 52.6% |
| Artifact or System | 11.1% | 11.1% | 100% |
| Method | 11.1% | 11.1% | 100% |
| Theory | 11.1% | 11.1% | 100% |
| Survey | 11.1% | 11.1% | 100% |
| Meta-Analysis | 11.1% | 11.1% | 100% |
| Dataset | 11.1% | 11.1% | 100% |
| Opinion | 11.1% | 11.1% | 100% |
| Overall Acceptance Rate | 2.85% | 2.85% | 2.85% |

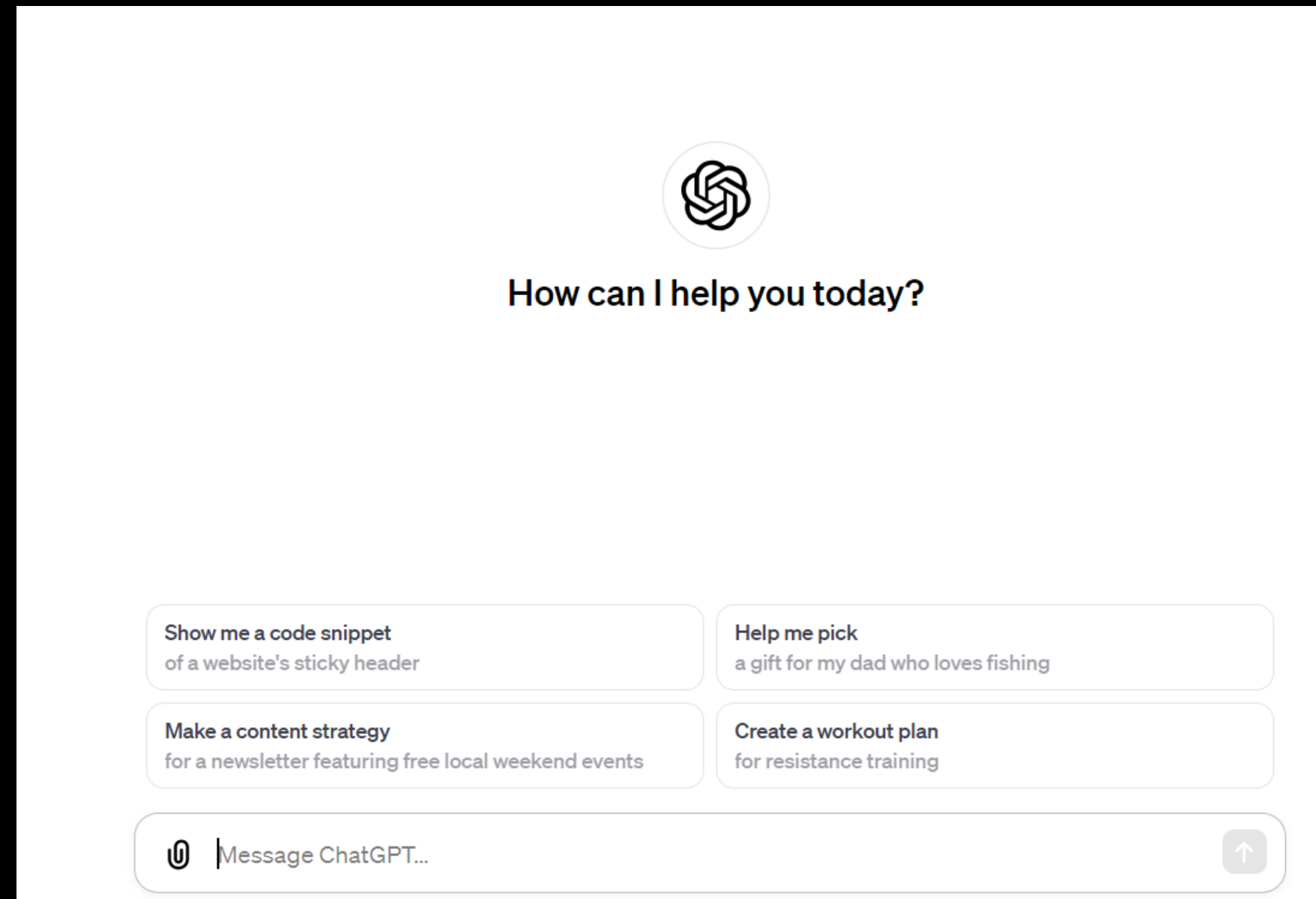
Wobbrock, J. O., & Kientz, J. A. (2016). Research contributions in human-computer interaction. *Interactions*, 23(3), 38–44.

Sticky notes for thought organization,
note taking, ideation

Free academic license

ChatGPT

<https://chat.openai.com/>

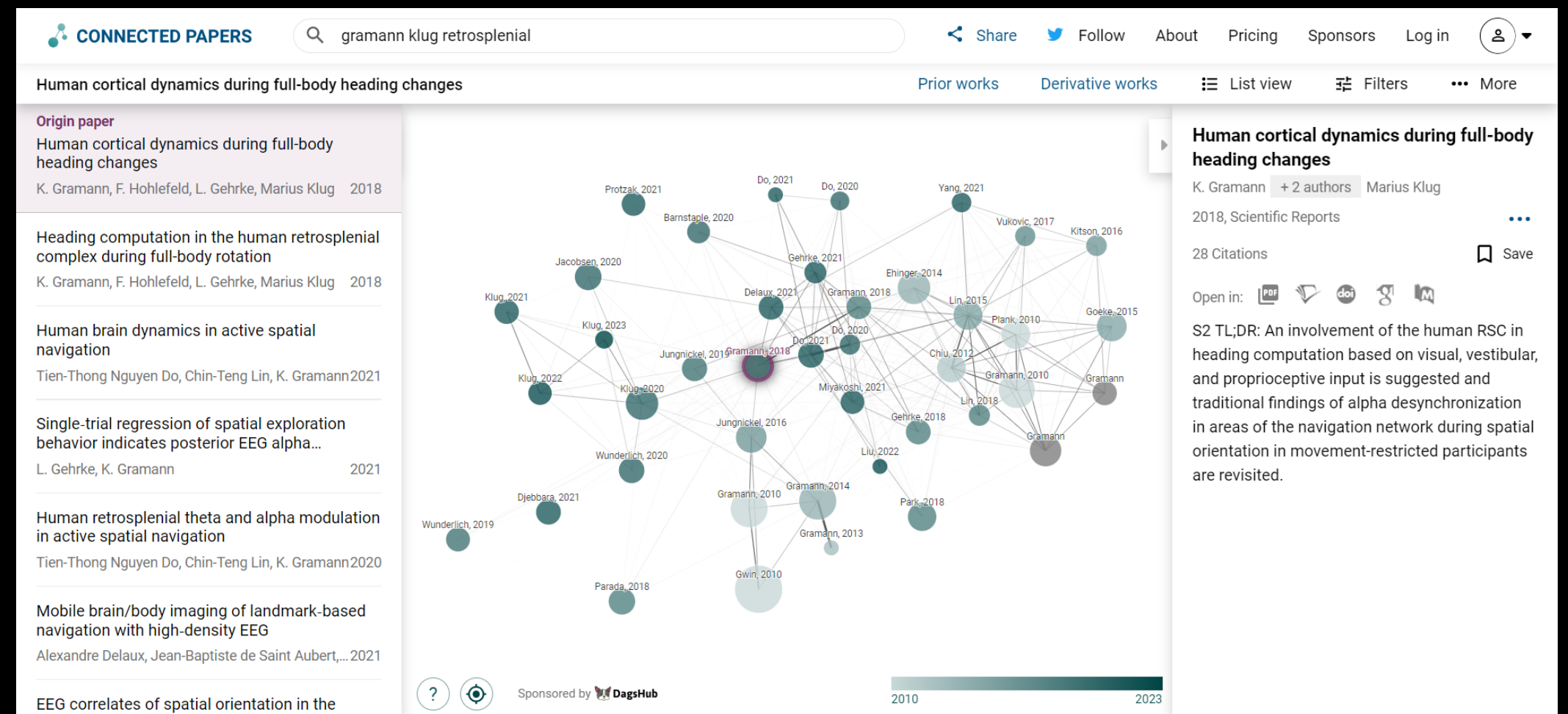


Summaries, basic questions

NOT: critical thinking

Connected Papers

<https://www.connectedpapers.com/>



Finding related research

Research Rabbit

<https://researchrabbitapp.com/>

The screenshot displays the Research Rabbit app interface, which is designed for discovering related research. The interface is divided into several sections:

- Filter:** A dropdown menu set to "Custom" with checkboxes for "Abstracts" and "Comments".
- Untitled Collection:** A list of papers with checkboxes and a green "Add Papers" button at the bottom.
- EXPLORE PAPERS:** A section with "Similar Work" (851), "Earlier Work" (23), and "Later Work" (3).
- EXPLORE PEOPLE:** A section with "These Authors" (15) and "Suggested Authors" (85).
- EXPLORE OTHER CONTENT:** A section with "Linked Content".
- EXPORT PAPERS:** A section with "BibTeX", "RIS", and "CSV" options.
- PUBLIC COLLECTION:** A toggle switch.
- SHAREABLE LINK:** A "Copy" button.
- COLLABORATORS:** An "Edit" button.
- Similar Work:** A section with a "Filter" dropdown and a list of papers with checkboxes.
- Connections between your collection and 50 papers:** A network graph showing connections between papers and authors.
- 1 selected paper:** A section showing details for a selected paper, including the title, authors, journal, and abstract.

Finding related research

Google Scholar

<https://scholar.google.com/>

The screenshot shows the Google Scholar interface with the search query "mobile EEG BCI passive". The results are sorted by relevance. The left sidebar contains filters for time (Beliebige Zeit, Seit 2023, Seit 2022, Seit 2019, Zeitraum wählen...), sorting (Nach Relevanz sortieren, Nach Datum sortieren), language (Beliebige Sprache, Seiten auf Deutsch), types (Alle Typen, Übersichtsarbeiten), and checkboxes for "Patente einschließen" (unchecked) and "Zitate einschließen" (checked). There is also an "Alert erstellen" option.

The search results list three articles:

- [HTML] Pass: a multimodal database of physical activity and stress for mobile passive body/brain-computer interface research** [HTML] frontiersin.org
M Parent, I Albuquerque, A Tiwari, R Cassani... - Frontiers in ..., 2020 - frontiersin.org [Paperpile]
... This makes the development of **mobile passive** B/BCIs ... advance **mobile passive** B/BCIs for use in everyday settings. ... and **passive** B/BCIs in realistic settings where the user is **mobile** and ...
☆ Speichern Zitieren Zitiert von: 21 Ähnliche Artikel Alle 6 Versionen Web of Science: 6 In BibTeX importieren
- [HTML] A new EEG recording system for passive dry electrodes** [HTML] sciencedirect.com
G Gargiulo, RA Calvo, P Bifulco, M Cesarelli... - Clinical ..., 2010 - Elsevier [Paperpile]
... asked to perform a **BCI** 1D cursor control task (left-right movement) and generating a mu-rhythm. Random left and right targets were presented to the subject from the **BCI** computer (...
☆ Speichern Zitieren Zitiert von: 171 Ähnliche Artikel Alle 11 Versionen Web of Science: 107 In BibTeX importieren
- A passive EEG-BCI for single-trial detection of changes in mental state** [PDF] ieee.org
A Myrden, I Chau - IEEE Transactions on neural systems and ..., 2017 - ieeexplore.ieee.org [Paperpile]
... It has recently been proposed that **passive** brain-computer ... the feasibility of a **passive brain-computer interface** that uses ... of human attention using **EEG** signals from **mobile** sensors," ...
☆ Speichern Zitieren Zitiert von: 94 Ähnliche Artikel Alle 4 Versionen Web of Science: 54 In BibTeX importieren

Finding related research

Semantic Scholar

<https://www.semanticscholar.org/>

The screenshot shows the Semantic Scholar website interface. At the top, the Semantic Scholar logo is on the left, and a search bar contains the text 'mobile passive eeg bci'. Below the search bar, it displays '622 results for "mobile passive eeg bci"'. There are several filter buttons: 'Fields of Study', 'Date Range', 'Has PDF', 'Author', and 'Journals & Conferences'. The first search result is titled 'A Comparison of Mobile VR Display Running on an Ordinary Smartphone With Standard PC Display for P300-BCI Stimulus Presentation'. The authors listed are G. Cattán, Anton Andreev, César Mendoza, and M. Congedo. The publication is in 'IEEE Transactions on Games' from February 2020. A TLDR summary is provided: 'A stable and accurate BCI paradigm relying on the recognition of a positive event-related potential occurring in the EEG about 300 ms poststimulation is implemented, which is similar to a traditional BCI running on a personal computer (PC)'. Below the summary are icons for citation count (14), PDF availability, IEEE logo, save, cite, and Paperpile. The second search result is titled 'Neurophysiological Closed-Loop Control for Competitive Multi-brain Robot Interaction'. The authors are Bryan Y. Hernández-Cuevas, Elijah Sawyers, L. Bentley, Chris S. Crawford, and Marvin Andujar. It is from 'Computer Science' and the 'International Conference on Applied Human Factors...' from July 2019. A TLDR summary states: 'The combination of vision sensors, neurophysiological sensors, and modern web technologies to expand knowledge regarding the design of social BCI applications that leverage physical systems are described'. Similar icons for citation count (1), publisher, save, cite, and Paperpile are shown.

Finding related research

- <https://web.stanford.edu/class/ee384m/Handouts/HowtoReadPaper.pdf>
- <https://www.eecs.harvard.edu/~michaelm/postscripts/ReadPaper.pdf>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3687192/>
- <https://blogs.lse.ac.uk/impactofsocialsciences/2016/05/09/how-to-read-and-understand-a-scientific-paper-a-guide-for-non-scientists/>
- <https://bitesizebio.com/11060/how-to-read-a-scientific-paper/>
- <https://www.science.org/content/article/how-seriously-read-scientific-paper>
- <https://academic.oup.com/nsr/article/7/9/1422/5859953>

Resources