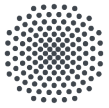

University of Stuttgart
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Conducting Research

Principles

v1.0

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We present five basic principles for conducting research that should be followed by students working on a master's thesis, bachelor's thesis, or any other research project at the Service Computing Department of the University of Stuttgart. The principles should also help you determine the best research process whose steps will depend on how much time you have and the type of project on which you work.

Conducting research

- Principle 1: Don’t Reinvent the Wheel!
- Principle 2: Keep the goal and ambitions realistic
- Principle 3: Plagiarism is cheating
- Principle 4: Claim only what you can prove and validate
- Principle 5: Be objective

Don’t Reinvent the Wheel

PRINCIPLE 1

- Research well what has been done
- Identify gaps or flows
- Use all types of sources
- Evaluate critically the literature for quality and relevance

Types of sources

- Primary sources
    - Work upon which your analysis and interpretation focus
    - Examples: journal articles, conference papers, dissertations, patents, etc.
- Secondary sources
    - Work that analyses or interprets some phenomenon
    - Examples: survey articles, scholarly books, reference books, textbooks, etc.
- Tertiary sources
    - Work that provides a broad overview of a particular topic
    - Examples: encyclopedias, dictionaries, textbooks, technical reports, etc.
    - Good place to start studying unfamiliar topics

The Web

- The Web itself is a great source
- Google Scholar has great coverage of scientific papers, patents, books and scientific reports
- Use relevant keywords
- Refine search queries as needed

Digital databases

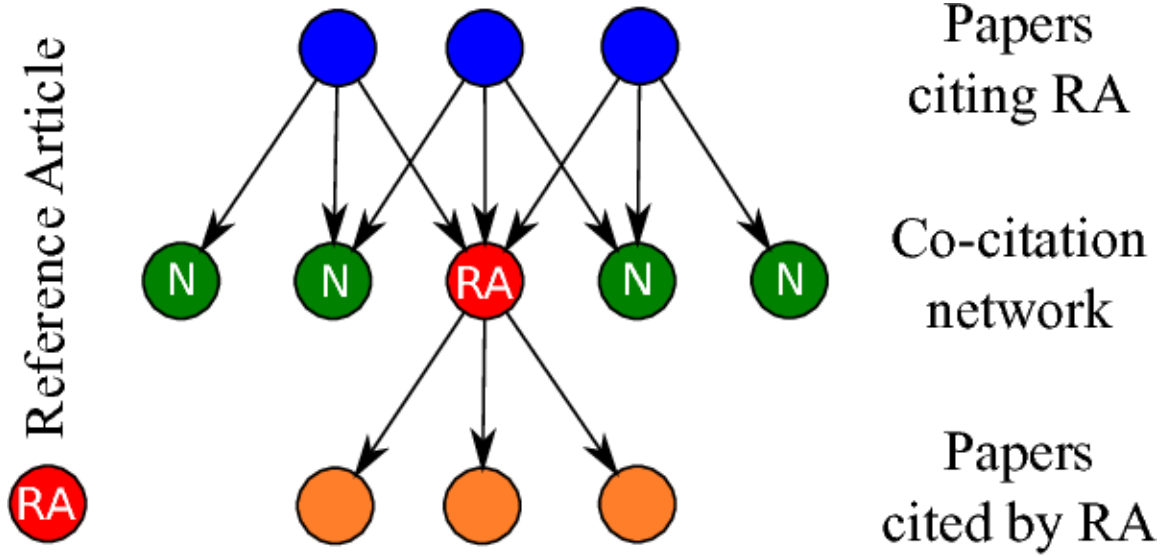
- Possible digital databases
  - ACM Digital Library (https://dl.acm.org/)
  - IEEE Xplore (https://ieeexplore.ieee.org/)
  - ScienceDirect (https://www.sciencedirect.com/)
  - SpringerLink (https://link.springer.com/)
  - AAAI Digital Library (https://www.aaai.org/Library/library.php)
- Use relevant keywords
- Refine search queries as needed

Search queries

- Combine terms with **and, or**, **not** operators
  - **and** – narrows search, retrieves records with both terms, use it for unrelated terms
  - **or** – broadens search, retrieves records with both terms, use it for related/alternative terms
  - **not** – narrows search, retrieves records with first term except those that contain the second term
- Combine words with double quotation marks
  - Multiple words next to each other in a given order
  - Compound terms
  - Exact phrases
- Truncate words
  - Use truncation symbols, such as * or ?, to retrieve records with variants of a word
  - For example, plan* retrieves plan, planning, planner
- Use filters
  - Year, language, peer-reviewed articles, publication type, etc.

Article network

- Navigate an article network by looking at citations of the article
- Find what is popular, appears trustworthy and fundamental



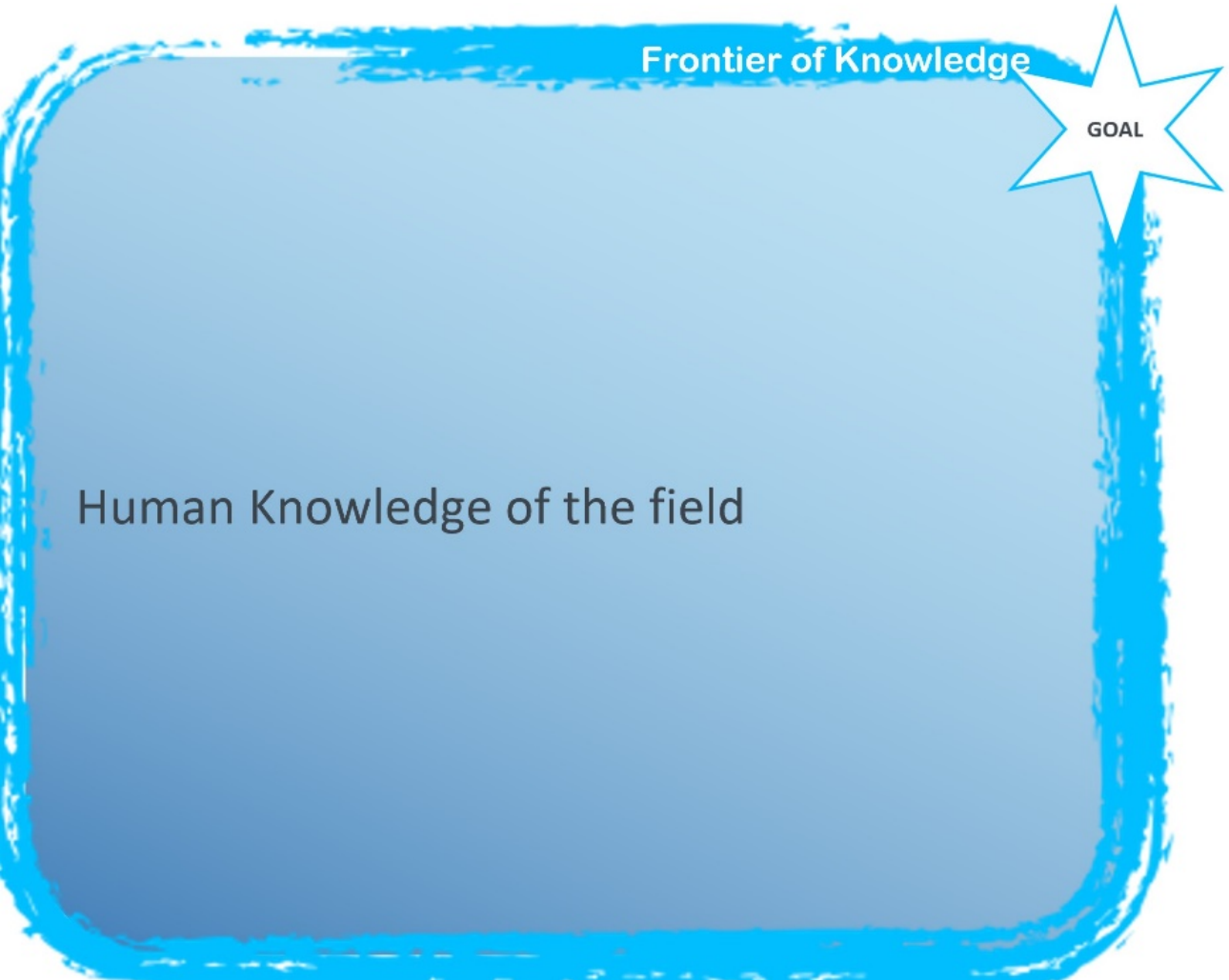
Systematic review approaches

- Systematic literature review
  - Focuses on a specific research question
  - Provides an answer to the question
  - Identifies, appraises and summarises evidence
- Systematic mapping study
  - Focuses on a broad research question
  - Provides an overview of a research area
  - Allows to discover research gaps and trends

Keep the goal and ambitions realistic

PRINCIPLE 2

Define a goal



- Have a clear goal
- Goal should not be too broad or to narrow
- Goal should not be completely within the known knowledge
- Goal should be at the frontier of knowledge
  - Things are known but not completely

Define a goal

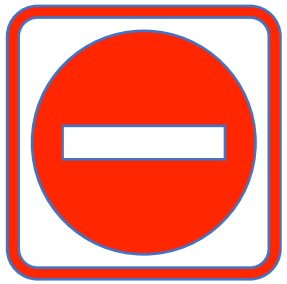
- Sometimes the goal might be a small, incremental step
- It still pushes forward the frontier of knowledge

Plagiarism is cheating

PRINCIPLE 3

- Plagiarism is not allowed
- Plagiarism is claiming someone else's work as your own
- Plagiarism can be avoided by using quotation and referencing
- If you copy a text from somewhere and paste it in your paper, you must
  - Quote it (short quotations in double quotes and longer quotations in block quotes) and
  - Provide reference for it
- If you paraphrase a text, you must provide reference for it

The World Wide Web (WWW), commonly known as the Web, is an information system where documents and other web resources are identified by Uniform Resource Locators (URLs, such as https://www.example.com/), which may be interlinked by hypertext, and are accessible over the Internet.



"The World Wide Web (WWW), commonly known as the Web, is an information system where documents and other web resources are identified by Uniform Resource Locators (URLs, such as https://www.example.com/), which may be interlinked by hypertext, and are accessible over the Internet." from Wikipedia, accessed on October 8th, 2019

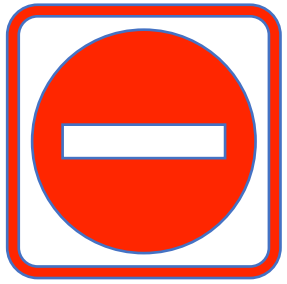
Claim only what you can prove and validate

PRINCIPLE 4

Academic claims

- Provide solid evidence
- Provide sufficient supporting arguments
- Claims can be
  - formally proven or
  - experimentally validated or
  - supported by referring to somebody else's results

The world is flat.



Since only circular and spheric objects can shade a circular shadow, and given that during an eclipse the shadow of the earth on the moon is circular, the earth cannot be flat [1].

References

[1] Graham, Daniel & Hintz, Eric. (2007). Anaxagoras and the Solar Eclipse of 478 BC. Apeiron. 40. 10.1515/APEIRON.2007.40.4.319.

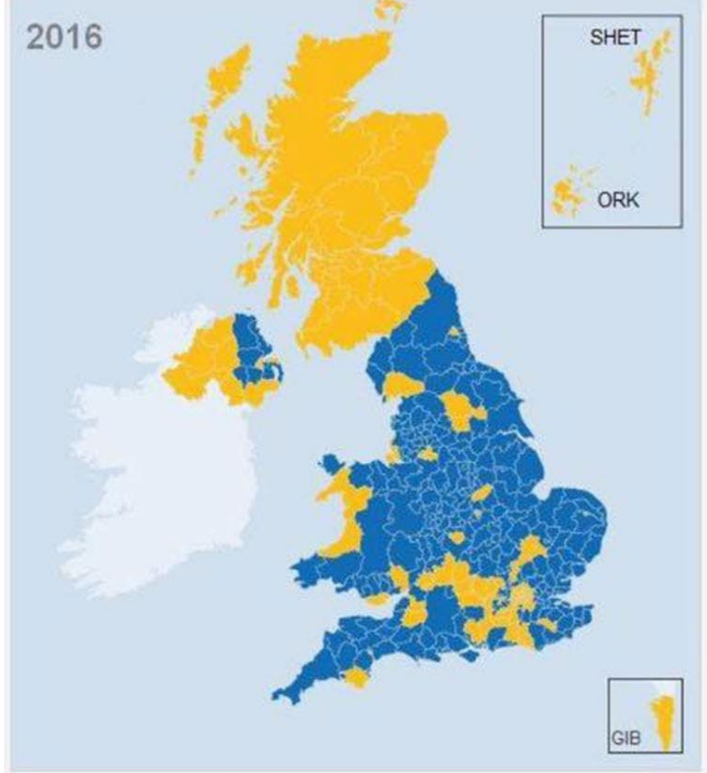
Be objective

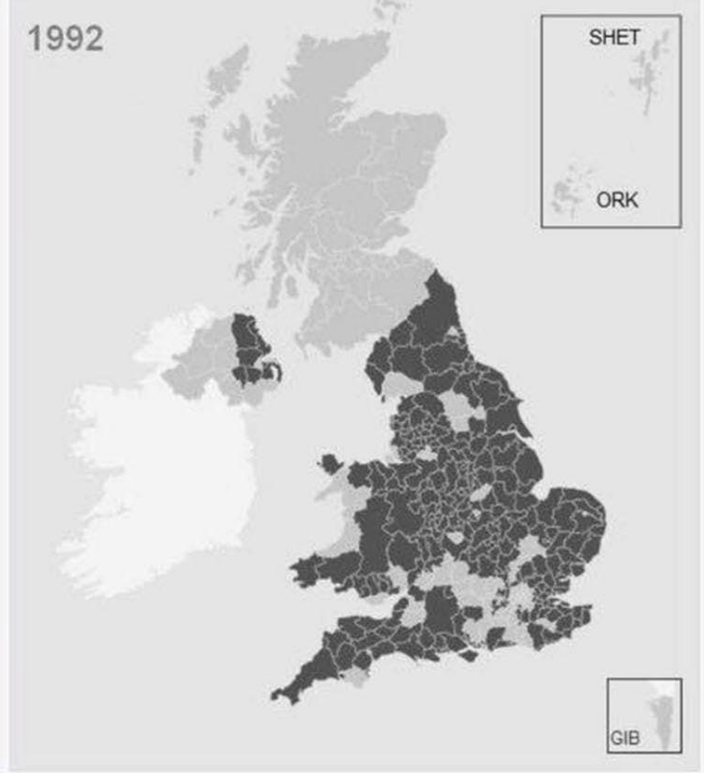
PRINCIPLE 5

"Researchers should remain distanced from what they study so findings depend on the nature of what was studied rather than on the personality, beliefs and values of the researcher." [1]

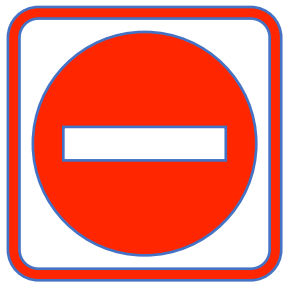
[1] Payne G. and Payne J. (2004) Key Concepts in Social Research, SAGE Publications.

- Report on the data you observed
- Say when you are interpreting the data
    - Clear distinction between the data you found, which is objective and cannot be disputed, and your interpretation





Mad cow disease caused Brexit.



There is a non-negligible correlation between the areas where there were mad cow disease outbreaks and where the majority of the population voted in favour of Brexit.

Further Reading

- University Libraries, Conducting Research, Washington University in St. Louis. URL: https://libguides.wustl.edu/research.
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- Petersen, K., Vakkalanka, S., and Kuzniarz, L. Guidelines for conducting systematic mapping studies in software engineering: An update, Information and Software Technology, 64(2015), 1-18, 2015.
- Roig, Miguel, Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing. URL: https://ori.hhs.gov/sites/default/files/plagiarism.pdf.
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