

A woman with glasses, wearing a white shirt and a brown blazer, is looking at a laptop. The background is a dark, futuristic digital interface with various charts, graphs, and data visualizations in shades of blue and red. The overall theme is technology and research.

CSCI 202 Research Methods

Research as a process

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What is *computer science*?

Take a moment to think about this and write down a concise answer to the question.

Pair up with someone in the class. Share what you wrote, learn from each other and reach a consensus in how to write up an answer that represents the understanding of both of you.

Be prepared to present what you wrote to the class for discussion.

Split personality?



Theoretical

With your partner,
build a list of
examples of areas of
research.

Experimental

With your partner,
build a list of
examples of areas of
research.

Split personality?



Theory

methods

algorithms

fundamental knowledge

Systems

gadgets

interfaces

applications

infrastructure

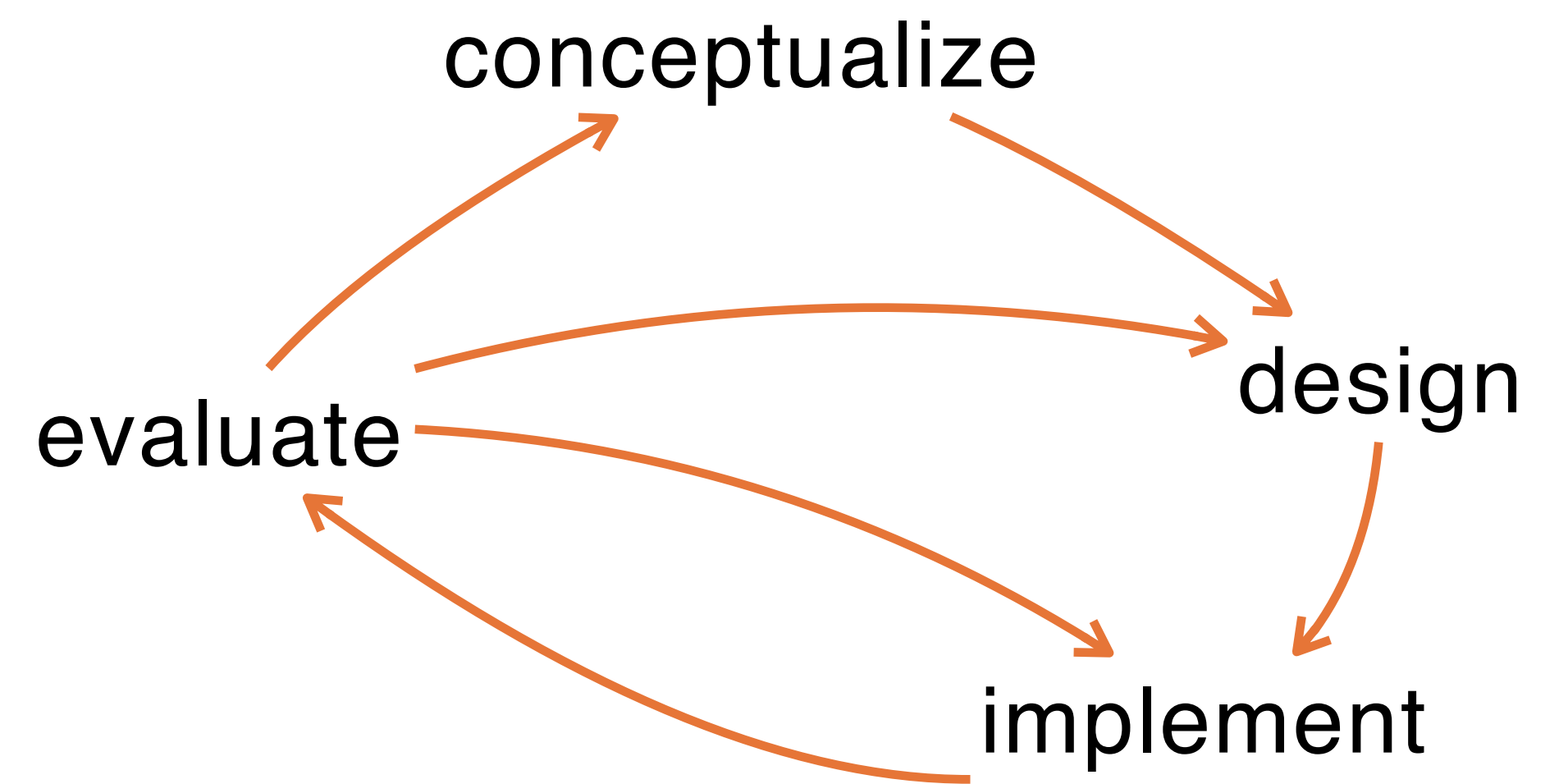
Split personality?



Theoretical

types
algorithms
complexity
optimization
cryptography
game theory
data structures
machine learning
limitations of computing

Experimental



The Scientific Method

Take a moment to think about this and write down a concise description of what you understand by “the scientific method.”

Pair up with **someone different** in the class. Share what you wrote, learn from each other and reach a consensus in how to write up an answer that represents the understanding of both of you.

Be prepared to present what you wrote to the class for discussion.



Reading about science

What gets you fired up?

Spend some time thinking of an area or problem in computer science that you find exciting. Consider not just what you know about it, but what you want to know about it.

How do you go about finding material?

Perhaps you are very adept at finding material to read about your chosen topic. Yes, Google is good and helpful, but what else can you use to identify peer-reviewed, reliable sources of information, when you want to do a literature search?

Take some time to **identify three papers** (conference or journal) that talk about your favorite area or problem in computer science. **Be prepared to share with the class how you found these sources and what they are.**

Using your resources

- Google
- Google Scholar
- ACM DL
- IEEEExplore
- EUDL
- ...
- Institutional at Bucknell

How do you know?

- Is your source legitimate and reliable?
- Has anyone validated your source?
- Did you find the most [...] source?
 - [...] = important
 - [...] = fundamental
 - [...] = up-to-date
 - [...] = relevant
 - [...] = well-known
 - etc.

Reading a scientific publication

Now that you have reliable material to read, how do you read it so that you can really learn from it?

From Science

“I first get a general idea by reading the abstract and conclusions. The conclusions help me understand if the goal summarized in the abstract has been reached, and if the described work can be of interest for my own study. I also always look at plots/figures, as they help me get a first impression of a paper. Then I usually read the entire article from beginning to end, going through the sections in the order they appear so that I can follow the flow of work that the authors want to communicate.”

Cecilia Tubiana, Max Planck Institute for Solar System Research; Göttingen, Germany

From Science

“If you want to make it a productive exercise, *you need to have a clear idea of which kind of information you need to get in the first place, and then focus on that aspect.* It could be to compare your results with the ones presented by the authors, put your own analysis into context, or extend it using the newly published data. Citation lists can help you decide why the paper may be most relevant to you by giving you a first impression of how colleagues that do similar research as you do may have used the paper.”

Cecilia Tubiana, Max Planck Institute for Solar System Research; Göttingen, Germany

From Elsevier

“Research papers follow the well-known IMRD format — an abstract followed by the Introduction, Methods, Results and Discussion. They have multiple cross references and tables as well as supplementary material, such as data sets, lab protocols and gene sequences. All those characteristics can make them dense and complex. Being able to effectively understanding them is a matter of practice.”



HOW TO READ SCIENTIFIC PAPERS

Much of a scientist's work involves reading research papers. Because scientific articles are different from other texts, like novels or newspaper stories, they should be read differently. Here are some tips to be able to read and understand them.

1 SKIM



First get the “big picture” by reading the title, key words and abstract carefully; this will tell you the major findings and why they matter.

- Quickly scan the article without taking notes; focus on headings and subheadings.
- Note the publishing date; for many areas, current research is more relevant.
- Note any terms and parts you don't understand for further reading.

RE-READ 2

Read the article again, asking yourself questions such as:

- What problem is the study trying to solve?
- Are the findings well supported by evidence?
- Are the findings unique and supported by other work in the field?
- What was the sample size? Is it representative of the larger population?
- Is the study repeatable?
- What factors might affect the results?



If you are unfamiliar with key concepts, look for them in the literature.

3 INTERPRET



- Examine graphs and tables carefully.
- Try to interpret data first before looking at captions.
- When reading the discussion and results, look for key issues and new findings.
- Make sure you have distinguished the main points. If not, go over the text again.

SUMMARIZE

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- Take notes; it improves reading comprehension and helps you remember key points.
- If you have a printed version, highlight key points and write on the article. If it's on screen, make use of markers and comments.



Assignment

Visit Moodle to find an assignment in which you will select and article to read and to summarize.

The assignment is due at the start of the next class.



Writing about science

Staying organized with a reference manager

- Mendeley
- Papers
- Zotero
- RefWorks
- ...

Good practice: keeps all the material that you read (with your personal notes) organized and generates bibliographies for your paper (in various formats).

Different types of writing

- Blog (inform the public immediately)
- Journalistic (inform the public through big media)
- Popular science magazine (inform the most interested public)
- Scientific conference (faster dissemination)
- Scientific journal (archival)
- Proposal (persuasive)

How do you approach each?

- Blog
- Journalistic
- Popular science magazine
- Scientific conference
- Scientific journal
- Proposal

We will be developing your writing skills for some of these kinds of publications throughout the semester.

Next time:

Writing a proposal, with Dr. Margaret Marr