Cognition

PSYC 2040

L1: What is Cognition?

recap

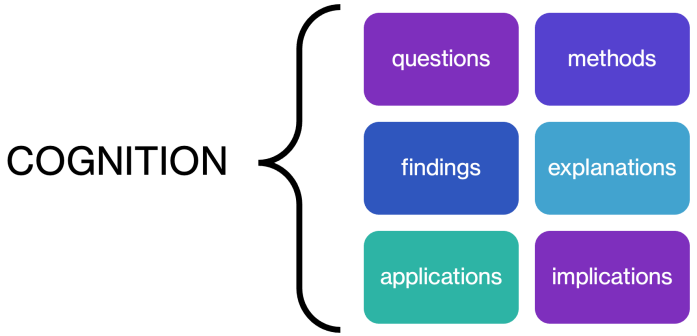
- what we covered:
  - L0: Getting Started
  - course overview
- your to-dos were:
  - *filling out*: pre-class survey
  - *reading* L1: What is Cognition chapter

today's agenda

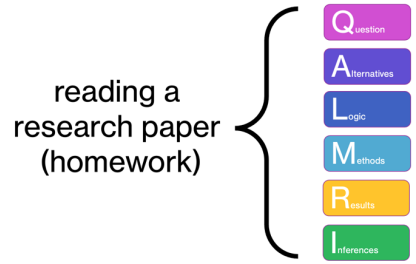
COGNITION

- questions
- methods
- findings
- explanations
- applications
- implications

today's agenda



- we will cover in class:
  - what is cognition? (1.1 to 1.7 from the reading/textbook)
- we will not cover in class (but you are expected to study)
  - 1.8-1.11 of the textbook (QALMRI)
  - quiz questions will cover the entire module



cognition is a museum

- just as a museum has many rooms, stories, and artifacts, cognition also has a broad array of ideas, concepts, and theories
- you cannot fully explore a museum in a day, and you cannot fully explore cognition in a semester!
- this course is meant to give you slivers and slices and instances of cognition (think of them as amuse-bouches)

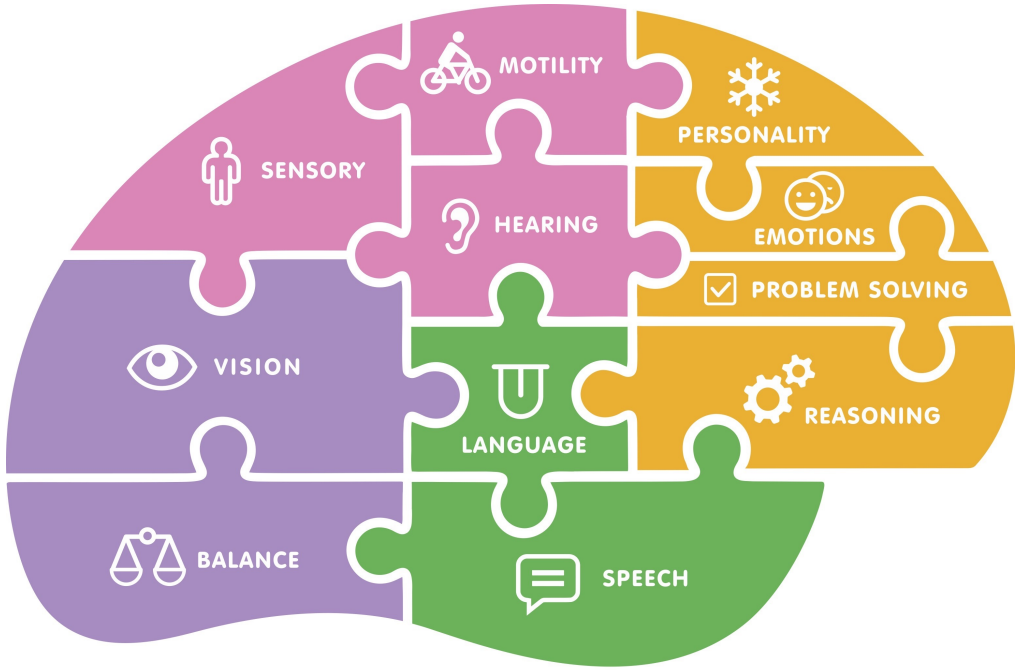
Crump, M. (2021)

defining cognition

- many researchers, many views
- Ulric Neisser: "*…all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used*"
- Oxford dictionary: "*the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses*"

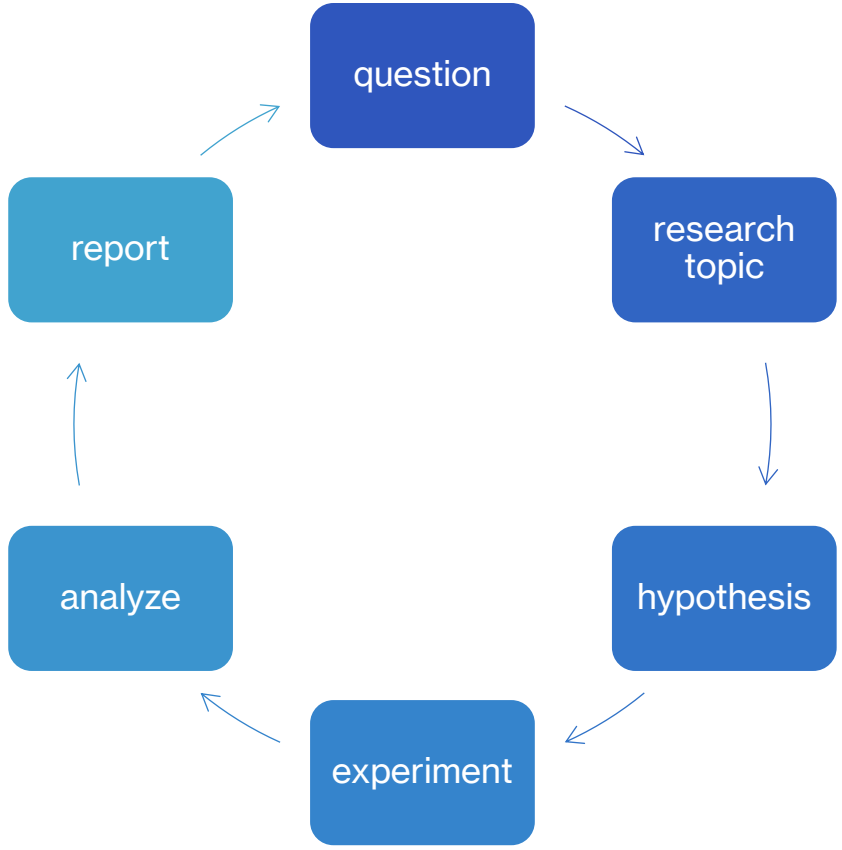
questions of cognition

- what kinds of questions are cognitive scientists asking and trying to answer?
  - typically: **how** does a cognitive ability come about and work?
- questions are often grouped into research **domains and [sub-domains]**
  - memory
  - perception [object recognition, vision]
  - language [speech, pragmatics]
  - .....

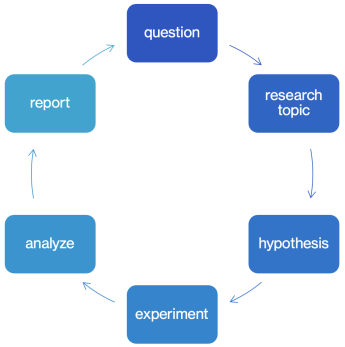


methods of cognition

- the research cycle employs *the scientific method* to answer questions about cognition
- the scientific method is a method for acquiring knowledge by making predictions, carrying out experiments to test those predictions, and making inferences based on the observed outcomes
- let's examine the research cycle with the example from the education literature

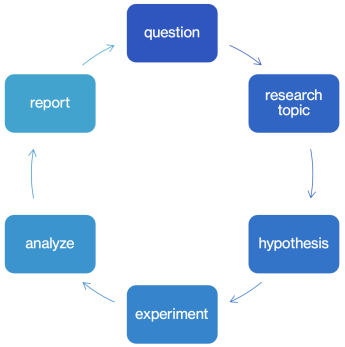


methods of cognition: question

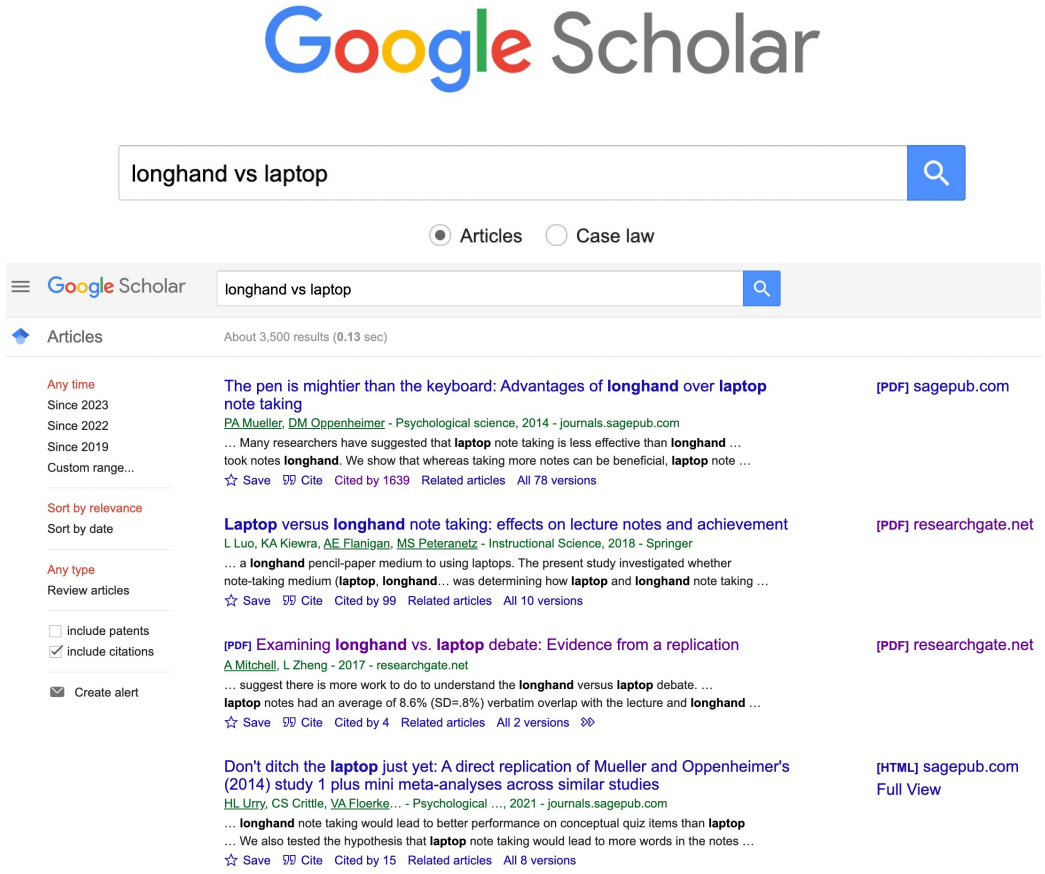


- broad question: does the manner of notetaking impact learning outcomes?
- empirical question: do longhand vs. laptop-based notes produce differences in long-term retention?

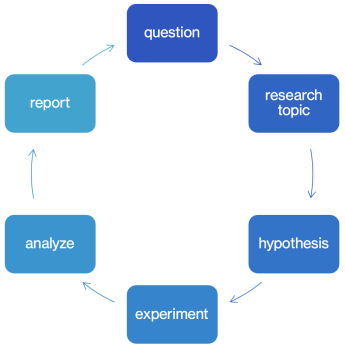
methods of cognition: topic



- once you have identified a broad question, the next step is to conduct some background research on the topic
- this typically involves:
  - searching for classic and new papers
  - consolidating and reading all papers
- quick exploration exercise:
  - log on to Google Scholar
  - search for: “longhand vs. laptop”
  - trying different keywords is part of the process!



methods of cognition: topic



- reading highly cited articles is a good first step:
  - it informs you about prior research that has generated interest (NOT always a proxy for good research)
  - it can provide ideas about testable hypotheses
- sometimes, review articles are also a good first step

The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking

Pam A. Mueller and Daniel M. Oppenheimer View all authors and affiliations

Volume 25, Issue 6 | https://doi.org/10.1177/0956797614524581 | View correction

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Abstract

Taking notes on laptops rather than in longhand is increasingly common. Many researchers have suggested that laptop note taking is less effective than longhand note taking for learning. Prior studies have primarily focused on students' capacity for multitasking and distraction when using laptops. The present research suggests that even when laptops are used solely to take notes, they may still be impairing learning because their use results in shallower processing. In three studies, we found that students who took notes on laptops performed worse on conceptual questions than students who took notes longhand. We show that whereas taking more notes can be beneficial, laptop note takers' tendency to transcribe lectures verbatim rather than processing information and reframing it in their own words is detrimental to learning.

Don't Ditch the Laptop Just Yet: A Direct Replication of Mueller and Oppenheimer's (2014) Study 1 Plus Mini Meta-Analyses Across Similar Studies

Heather L. Urry, Chelsea S. Crittle, [...], and Jonah E. Zarrow (+85) View all authors and affiliations

Volume 32, Issue 3 | https://doi.org/10.1177/0956797620965541

The effect of notetaking method on academic performance: A systematic review and meta-analysis

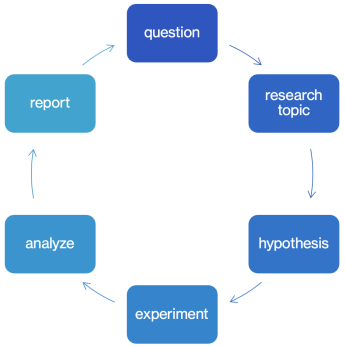
Daniel Voyer, Scott T. Ronis, Narissa Byers

Show more

activity: key takeaway from background research

- go to course website > L1: What is Cognition?
- under “view/watch/listen”, open the webpage of any **one** paper
  - **Option 1**: the pen is mightier than the sword
  - **Option 2**: don’t ditch the laptop just yet
  - **Option 3**: effect of notetaking: meta-analysis
- read the abstract, discuss, and note down your main takeaway(s)
  - 2 minutes
- come back and debrief

methods of cognition: hypothesis

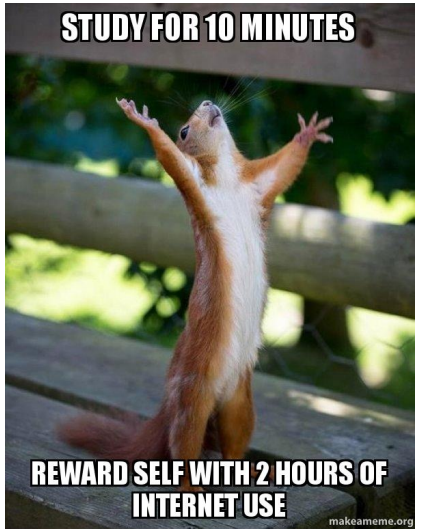


- prior research tells us that: students who take longhand notes ***may*** perform better on conceptual questions than students who take notes via laptops but findings vary and are inconclusive
- hypothesis: distraction is a moderator of this finding, i.e., students are more likely to get distracted on digital devices, which may in turn affect performance
- inference: when controlling for distraction, the effect of medium (longhand vs. notetaking) on performance should go away

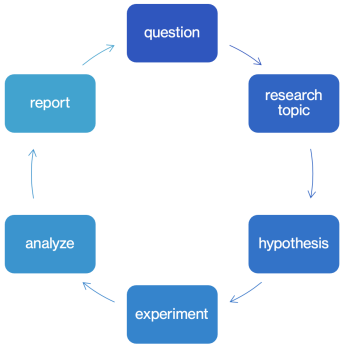
The impact of digital distraction on lecture note taking and student learning

Abraham E. Flanigan[1] · Scott Titsworth[2]

Received: 23 August 2019 / Accepted: 6 June 2020



methods of cognition: experiment



- an experiment helps researchers test the validity of the hypothesis in a controlled setting
  - many types of experiments are possible
- experiment design:
  - independent variable (IV): something that the researcher *manipulates* or varies
  - dependent variable (DV): something the the researcher *measures* for all versions of the independent variable
  - key question: did the manipulation cause a change in the measurement?
- often, the basic design can be gleaned from the abstract itself

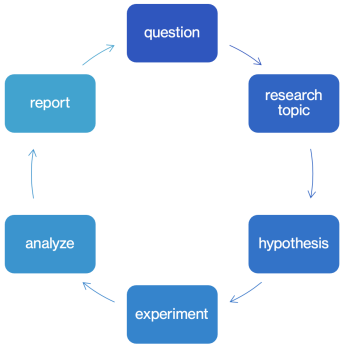
activity: reading an abstract

- individually (2 mins), find the:
  - independent variable (IV): something that the researcher *manipulates* or varies
  - dependent variable (DV): something the the researcher *measures* for all versions of the independent variable
  - answer to key question: did the manipulation cause a change in the measurement?

Abstract

Laptop computers allow students to type lecture notes instead of relying on the traditional longhand (i.e. paper–pencil) method. The present research compared laptop and longhand note-taking methods by investigating how the quality (i.e. complete versus incomplete idea units) and quantity (i.e. total words and total idea units) of typed and handwritten notes differed when students did or did not reply to text messages during a simulated lecture. Accounting for the presence of text messaging while participants took notes situated the present study within the reality facing many students in today's digital age. Findings indicated that a considerable proportion of the idea units captured in participants' notes were incomplete, regardless of note-taking method or exposure to distraction during the simulated lecture. However, only the total number of complete idea units stored in student notes meaningfully predicted lecture learning. Furthermore, the presence of digital distraction was particularly disruptive to the quality and quantity of laptop users' lecture notes relative to longhand note takers. Finally, digital distraction emerged as a more meaningful predictor of lecture learning than note-taking method. Recommendations for improving the quality of student lecture notes are discussed and avenues for future research into note-taking completeness and the interplay between digital distraction and note-taking method are proposed.

methods of cognition: experiment

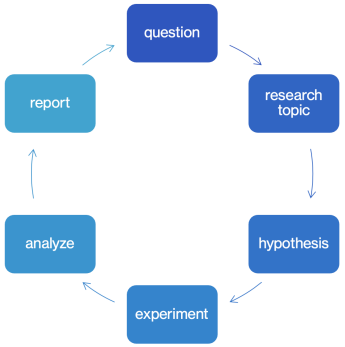


- independent variable(s):
  - note-taking medium: laptop vs. longhand
  - distraction level: texting vs. no-texting
- dependent variable
  - quality and quantity of notes
  - but how do we measure *quality & quantity*??
    - the number of words and "idea units" in notes
    - a test after note-taking (after how long, allow note review?)
  - measurements are not perfect!
- answer to key question
  - distraction was disruptive for both methods, but maybe some more disruption for laptop
  - could take away other mini-findings too

Abstract

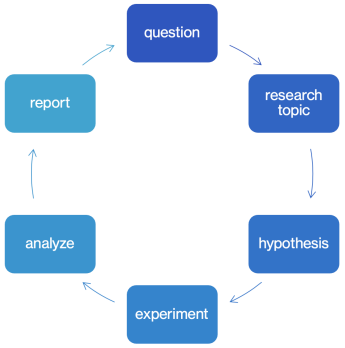
Laptop computers allow students to type lecture notes instead of relying on the traditional longhand (i.e. paper–pencil) method. The present research compared laptop and longhand note-taking methods by investigating how the quality (i.e. complete versus incomplete idea units) and quantity (i.e. total words and total idea units) of typed and handwritten notes differed when students did or did not reply to text messages during a simulated lecture. Accounting for the presence of text messaging while participants took notes situated the present study within the reality facing many students in today's digital age. Findings indicated that a considerable proportion of the idea units captured in participants' notes were incomplete, regardless of note-taking method or exposure to distraction during the simulated lecture. However, only the total number of complete idea units stored in student notes meaningfully predicted lecture learning. Furthermore, the presence of digital distraction was particularly disruptive to the quality and quantity of laptop users' lecture notes relative to longhand note takers. Finally, digital distraction emerged as a more meaningful predictor of lecture learning than note-taking method. Recommendations for improving the quality of student lecture notes are discussed and avenues for future research into note-taking completeness and the interplay between digital distraction and note-taking method are proposed.

findings in cognition



- one outcome of the research cycle is the findings it produces
- within an experiment, a finding refers to whether or not the manipulation (IV) influenced the measurement (DV)
- answering this empirical question requires analyzing data from the experiment

findings in cognition: analysis



- analysis involves inferring patterns from data using statistics
- the findings from these analyses are then summarized and reported publicly via visualizations (typically tables and figures)
- after findings have been reported, researchers generally draw inferences, ask more questions, and generate new hypotheses, thus starting over in the research cycle!

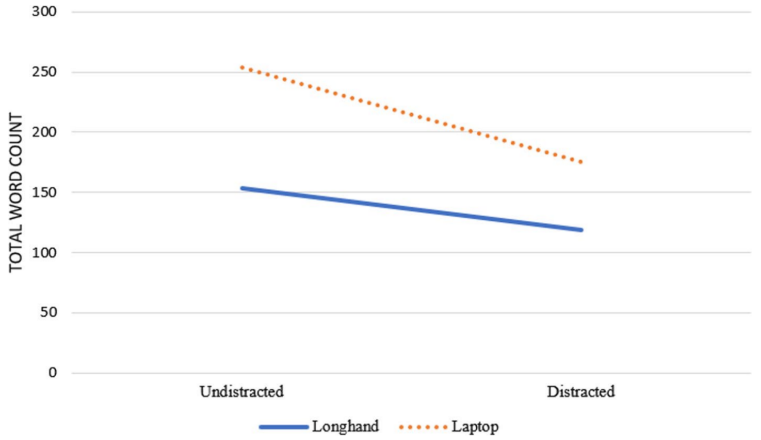


Table 5 Differences in posttest scores and note-taking outcomes across groups

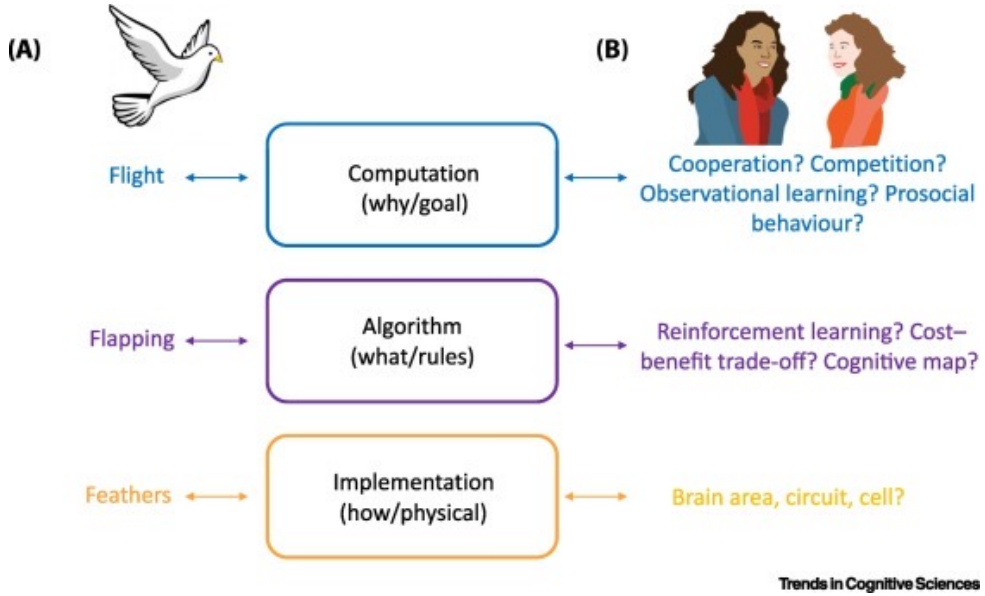
	Distracted laptop	Distracted longhand	Undistracted laptop	Undistracted longhand
Total posttest score	22.12 (5.66)	21.88 (6.02)	24.32 (5.13)	24.84 (6.71)
Total words	175.12 (58.88)	119.80 (36.69)	253.84 (73.67)	153.08 (51.91)
Total complete ideas	31.32 (7.66)	27.00	43.12	33.92

so what do we know so far?

- distractions disrupt student learning
- the medium of note-taking is less important than the quality of note-taking and the amount of distraction
- think about ***how*** you take notes:
  - are you noting down everything I'm saying verbatim or trying to interpret, paraphrase, and connect ideas?
  - are you distracted? how can you minimize distractions?
    - laptop: exit out of browsers / enable "focus" on Mac / do not switch windows
    - handwritten: listen actively, make connections, jot down takeaways

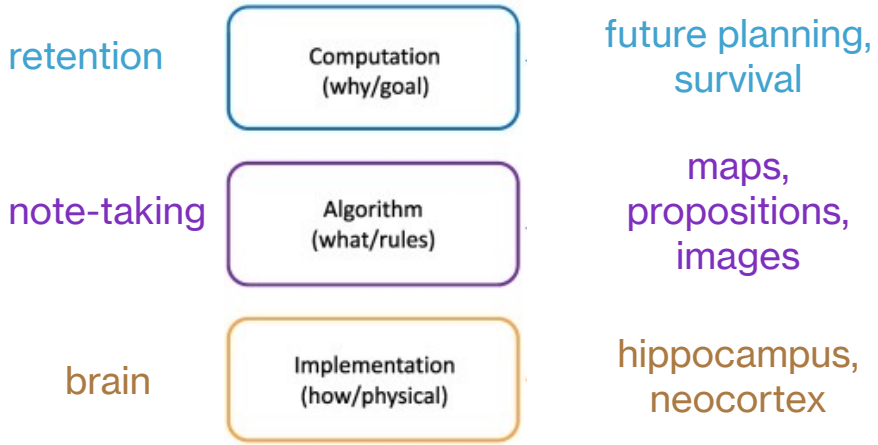
explanations in cognition

- explanations refer to an account of a cognitive phenomena
- explanations can have different forms and levels
- David Marr proposed 3 levels of explanation:
  - computational (why/goals)
  - representational/algorithmic (what/process)
  - implementation (how/hardware)



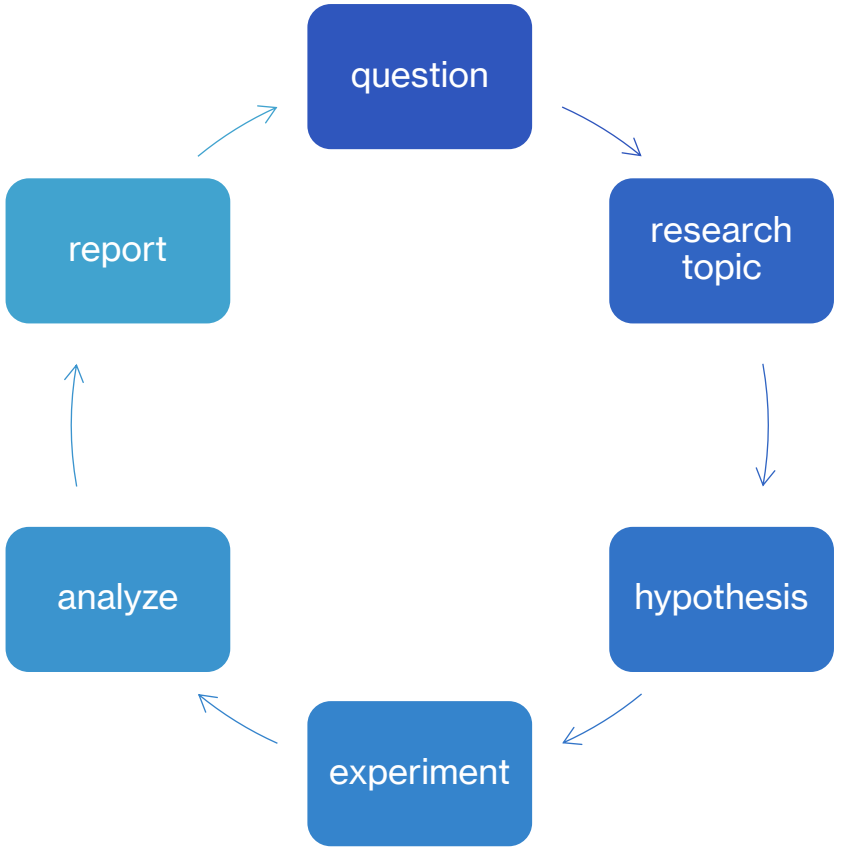
explanations in cognition

- for our example of notetaking
- computational (why/goals)
  - why do we retain information?
- representational/algorithmic (what/process)
  - cognitive maps, propositions, etc.
- implementation (how/hardware)
  - brain area, memory network?



applications of cognition

- the cycle of research produces:
  - more research and novel knowledge
  - real-world applications
- examples of novel knowledge
  - (in)effective study/notetaking strategies
  - how babies learn
- examples of real-world applications
  - eyewitness testimonies
  - AI (e.g., Siri, Alexa, chatGPT, etc.)



implications of cognition: basic

- cognition is fundamental to nearly everything we do!
- research on cognition can help us understand:
  - ourselves
  - our society and other creatures
  - (and build) machines
- applied cognition has the potential to help develop interventions for cognitive impairments, design better technologies, and improve quality of life

implications of cognition: big-picture

- there are several inequalities in the history of psychological and cognitive science research
- we will spend some time reflecting on this history
- questions to ask/ponder over during the semester:
  - what are the goals and who set them?
  - are these goals useful and have they led to benefits?
  - who are the goals benefiting vs. hurting?
  - what kinds of questions are not being asked?
  - how should society decide which research is important?

big takeaways

- jot down the key takeaways from today **without** looking at the slides/notes someplace you can revisit
- retrieval practice + elaborative encoding

note about next week

- next week, we will cover two modules
  - L2: Mental imagery
  - L3: Eugenics and Intelligence Testing
- two sets of quizzes and writing assignments will be made available
  - you can choose to do both OR just one
  - you accumulate up to 30 points (3 per module)
  - skipping some modules is ok!

next class

- **before** class:
  - *fill out:* pre-class survey
  - *complete:* L1 quiz and/or writing assignment + meme
  - *read:* L2 (mental imagery) chapter
  - *complete*: imagery experiment (link on Canvas)
- **during** class:
  - what is mental imagery?
  - how has this concept been studied over the years?

reading a research paper (homework)