Cognition: Methods and Models

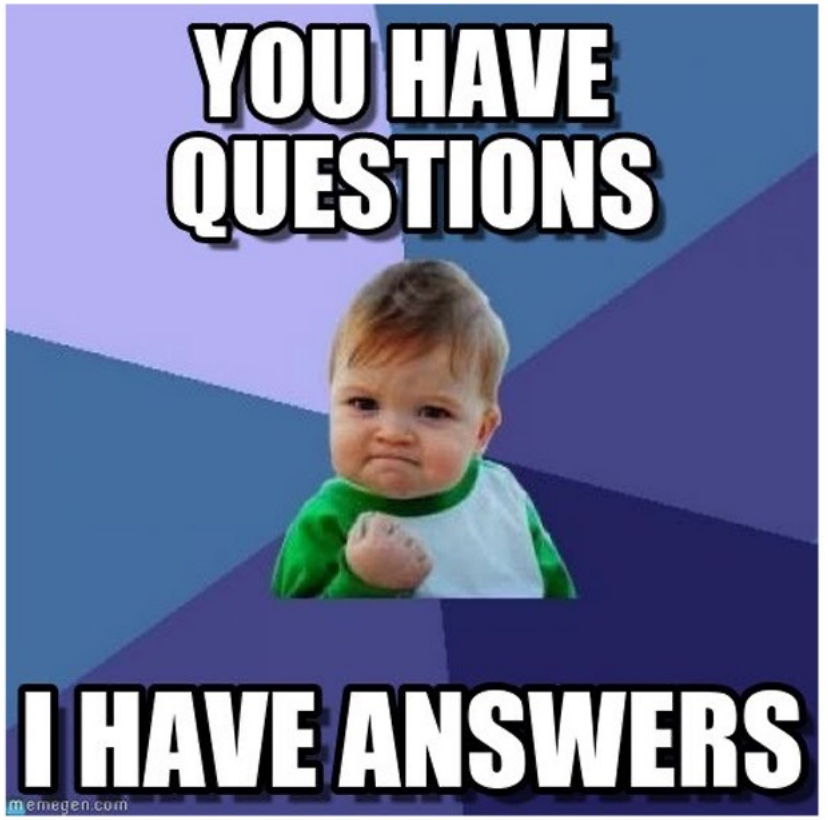
PSYC 2040

L2: Mental Imagery

Part 1

logistics: office hours

- My office hours (Kanbar 217):
  - Tuesday, 9-11 AM
  - Tuesday, 3-4 PM
  - Thursday, 9-10 AM
  - Friday, 11-1 PM
- Matt's office hours (Kanbar 200)
  - Monday, 7-8 PM
  - Wednesday, 7-8 PM



logistics: weekly assignments

- weekly assignments max out at 65 points, but we have a total of 70 possible points you can earn throughout the semester (L0-L13)
- this is intentional so that you have some wiggle room if you don't do well a particular week or miss one week
- choosing between a quiz and writing assignment:
  - you can view your quiz score immediately after your attempt
  - so, prioritize taking the quiz! (also good for retrieval/spaced practice)
  - if you don't do well, then consider the writing assignment (elaborative encoding)
  - writing assignments will not be graded until Wednesday each week

Have you been curious about using ChatGPT for assignments?

Yes

No

Maybe

ChatGPT policy

- I'm a cognitive scientist and I'm interested in language models such as ChatGPT!
- so, here's the policy for assignments in this class:
  - you can probe ChatGPT with the writing prompts if that is helpful, but you MUST mention its use in your assignment
  - you will NOT be penalized for using ChatGPT, as long as you mention it
  - there is NO need to hide this information!
  - you should reflect on the AI's response and comment on it!
  - this is an opportunity to engage with a really impressive language tool: did you agree with it? did you not?
- for what it's worth, GPTZero is a tool for educators to assess whether any text has been written by AI
  - I am fiddling with it, and you are welcome to as well
  - I'm curious about what you think!
  - let me know (in your submissions): does it mark your original work as AI's or vice versa??
- NOTE: This policy applies to this class ONLY. Other classes may have other policies and you are required to abide by those policies

example assignment response (L1)

- “I asked ChatGPT to give me a summary of the paper and it gave me the following response. I broadly agree/disagree with the summary it provided because....”

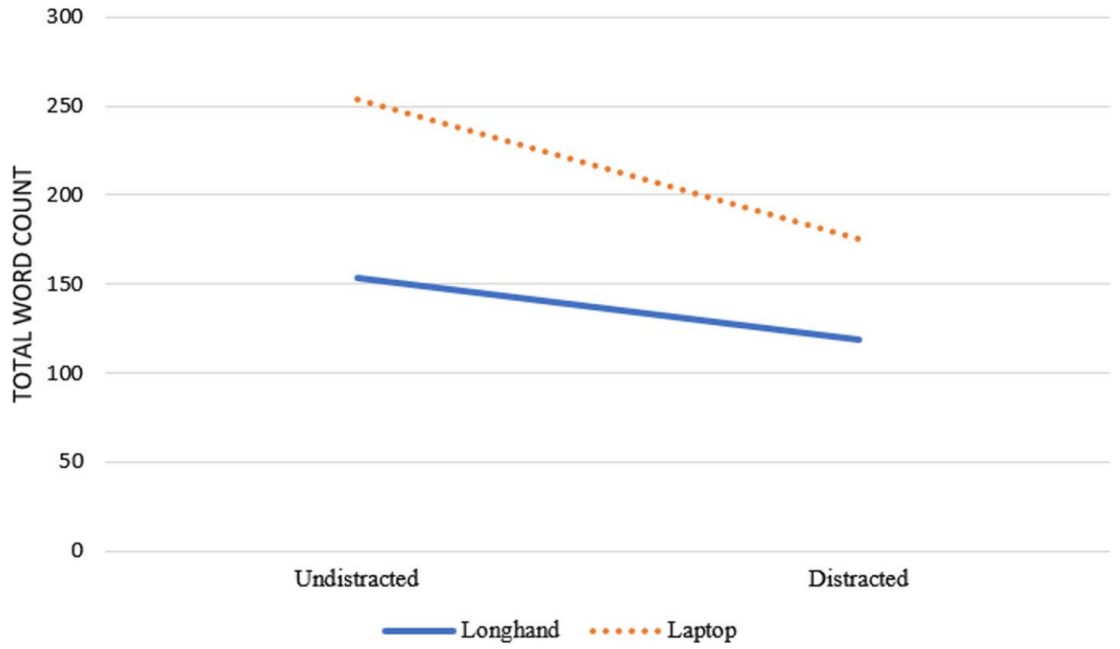
The article "Cognitive Science for Humanity: A Call to Action" raises questions about the usefulness of cognitive science to humanity and the impact of its past on its future. The authors argue that cognitive science needs to accurately represent humanity by including participants with a range of cultural, developmental and societal experiences. They suggest that cognitive science should be relevant to everyone and not just dominated by well-funded research institutions in Europe and North America. The authors also propose several steps to make cognitive science more beneficial to people, such as direct collaboration with communities and applied researchers, learning from other fields and entering into these collaborations with epistemic humility. Additionally, the authors suggest that the field should be aware of its past, which includes supporting racism, race science, colonialism and eugenics, and make efforts to avoid repeating the extractive and exploitative history between white institutions and Indigenous and Black people.

recap: Jan 26, 2023

- what we covered:
  - L0: Getting Started
  - L1: What is Cognition
- your to-dos were:
  - *fill out:* survey + poll
  - *finish*: QALMRI section in Chapter 1 (1.8 onwards)
  - *complete:* L1 quiz and/or writing assignment + meme
  - *read:* L2 (mental imagery) chapter

common quiz mistake #1

- layout:
  - x-axis: level of distraction (undistracted vs. distracted)
  - y-axis: total word count
  - colors: longhand vs laptop
- options were about a rise/drop and which method shows a steeper rise/drop
- a drop is indicated by a line going down from left to right and the drop happens for both methods
  - distraction leads to a drop in total word count
- slope: how flat the line is
  - the flatter the line, the less steep the drop
  - so the drop is steeper for laptop compared to longhand notes



common quiz mistake #2

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

	Distracted laptop	Distracted longhand	Undistracted laptop	Undis-tracted longhand
Total complete ideas	31.32 (7.66)	27.00	43.12	33.92

- reading the options carefully is as important as reading the table!
- students who were not distracted and made handwritten notes had the most complete ideas
  - feels correct but does not support the table! 33.92 is not the highest value in the table
- students who were not distracted and made laptop notes had the most complete ideas
  - feels incorrect but supports the table! 43.12 is the highest value in the table

today's agenda

- pre-class survey results!
- mental imagery
  - early explorations and introspection
  - imagery and memory

pre-class survey: dream careers

acting/theatre

biomedical researcher

corporate HR, data analysis, landscape architecture

clinical psychologist/professor

forensic scientist

still figuring it out, but tech law & policy seems really interesting to me

forest plot manager

possibly to be a clinical psychologist, possibly something else entirely!

epidemiologist

therapist/psychiatrist? not sure

not entirely sure, being an educator or working with kids

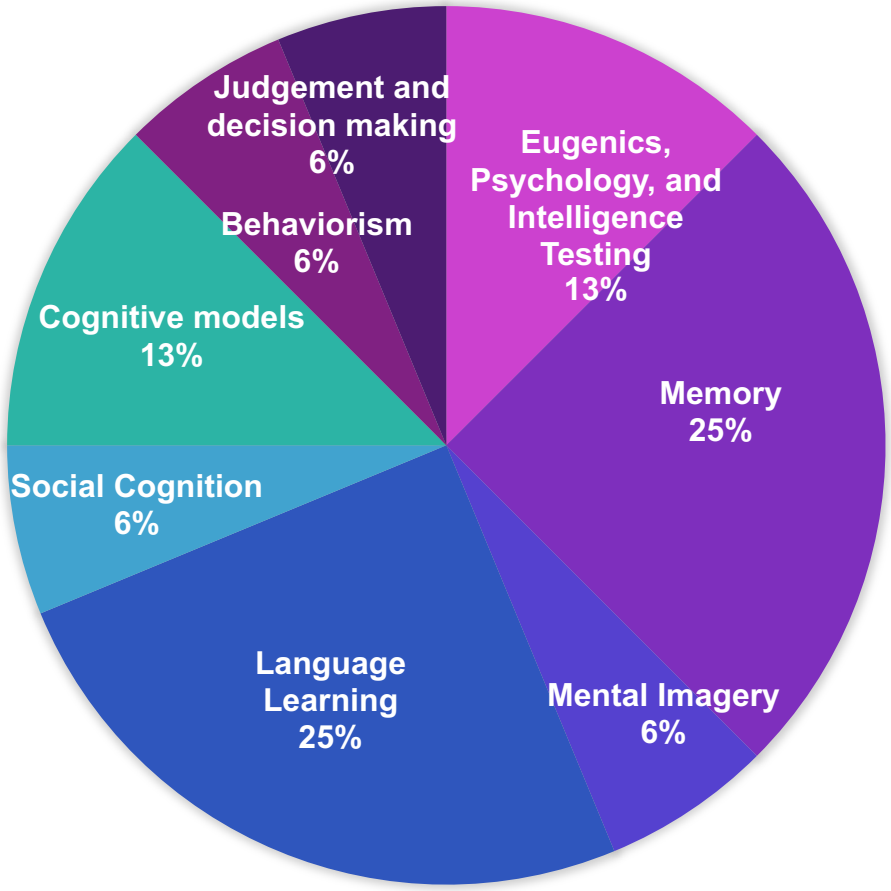
realistically a software engineer, but being a wildlife photographer would be unreal

children's therapist/psychiatrist

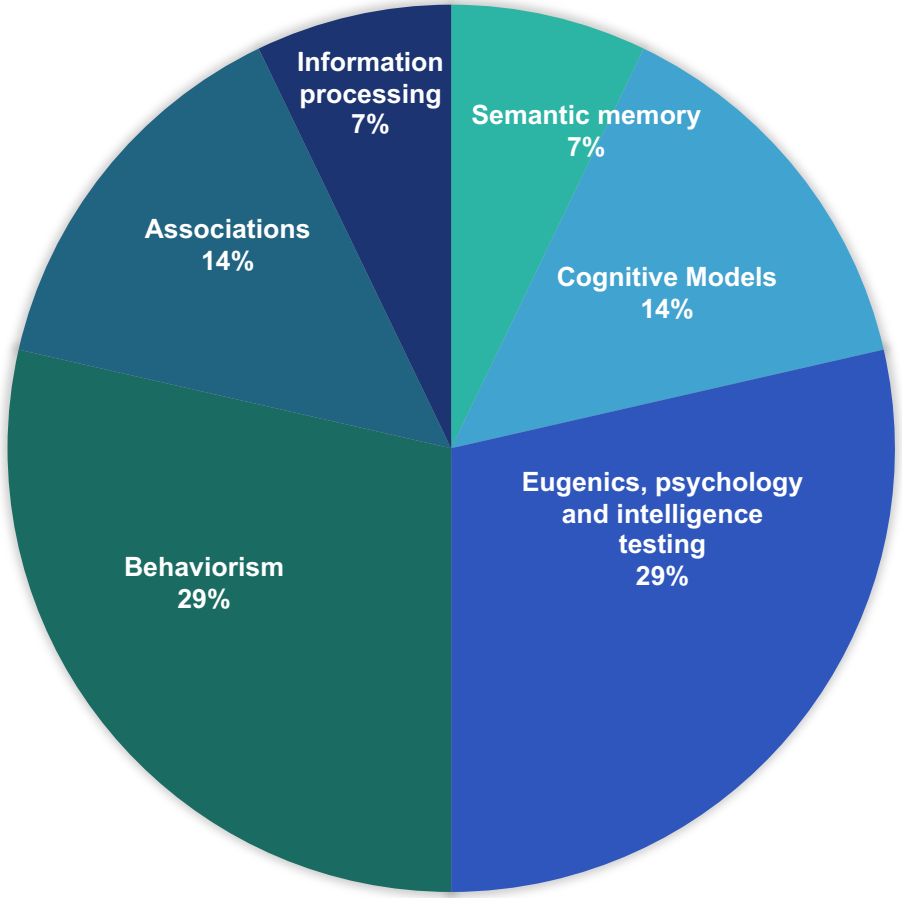
3 idiots (2009 Bollywood movie!)

pre-class survey: topics

most exciting



least exciting



pre-class survey: inclusion

being called on when I raise my hand

group work

I feel included in a class when opportunities are presented to me to work individually, in groups, and as a whole class throughout the semester. also, simply having a warm, welcoming class atmosphere goes a long way towards feeling included.

peers who share the floor

having my ideas responded to thoughtfully

mutual respect among all peers

opportunity to speak either in small or larger groups and share ideas.

opportunity to speak either in a small or larger class setting

being engaged with the content in an exciting manner

feeling like my opinion is valued with positive affirmation, feeling like I know my classmates well

when I know everyone or most people in the class, and the professor makes an effort to connect with students and connect the students to each other

small group discussions or class discussions if class isn't too big where everyone has room to speak.

pre-class survey: teaching strategies

pair-to-pair share

Debates

a blend of lecturing and discussion. I appreciate it when teachers stop to ask the class if there is any confusion at regular intervals as well, as that gives me more time to process the new information and address any comprehension issues I may have had.

letting students lead class activities

Making lesson slideshows/materials available for studying after class

Breaking into groups to discuss parts of the lecture, and breaking up a long lecture into smaller parts.

Small group discussions, for discussion-based classes

I enjoy small group discussions quite a bit for making people feel more comfortable to talk and give their ideas.

case studies provide real life example

Small group discussions are great for letting everyone get a chance to speak and feel less pressure than in a big group.

Being able to say "I don't know"

pre-class survey: Maine recs!

Gelato Fiasco

Go to the ocean whenever you can (even in the winter!)

Morse mountain

I love Taj Cuisine in South Portland!

La bodega in Portland

The Coastal Studies Center is also stunning and an amazing place to see bioluminescence in the the summer.

Eastern Promenade in Portland! And bird & co tacos (for your current taco phase!)

Bailey Island during sunset

Little Tokyo's and Bay Bowls

Raven and Crow

Flatbread Pizza in Portland is always a good spot and a good place to island hop from the ferry! Nordic skiing or snowshoeing at Pineland Farms is also a blast!

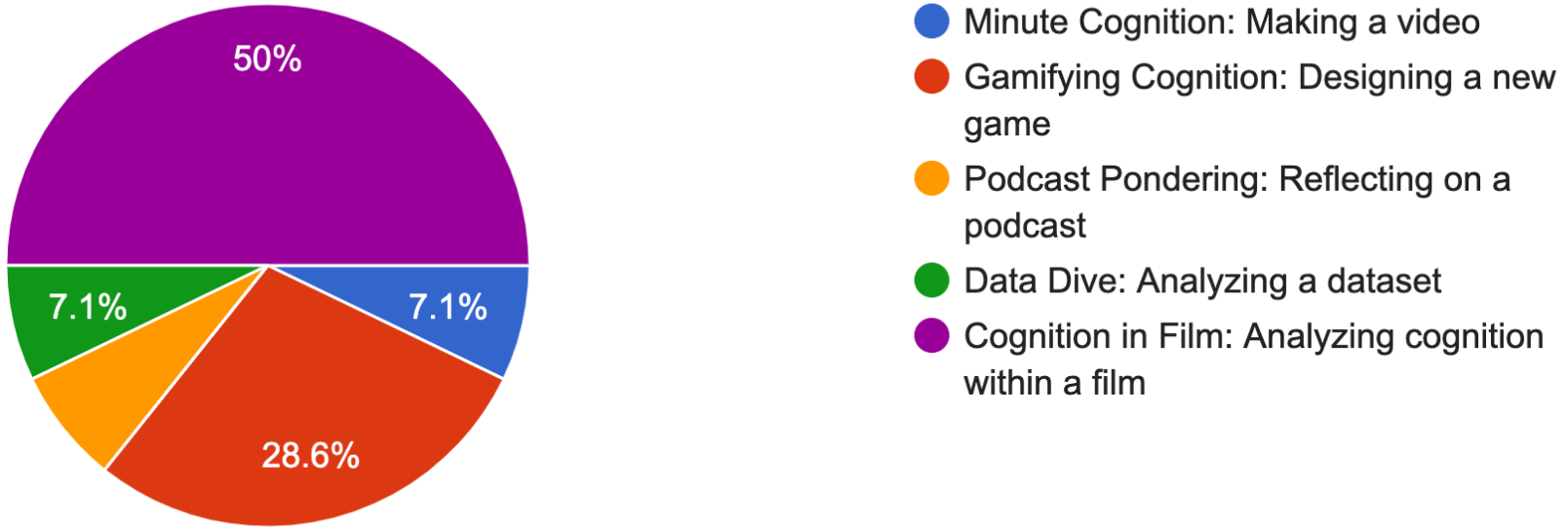
Giant's Steps and Little Tokyo

Zao Ze Cafe

pre-class survey: projects

You will also submit a final group project as part of this course. Which of the following options for the final project sounds most exciting to you as of now?

14 responses



pre-class survey: project survey

- the bottleneck: we have some students whose top preference does not match with anyone else's based on the pre-class survey
- potential solution:
  - please fill out a top-3 preferences survey by Wednesday (tomorrow) night
  - we will try to match everyone's top-2 choices
  - we are trying to match preferences, schedules, and skills!

pre-class survey: projects

today's agenda

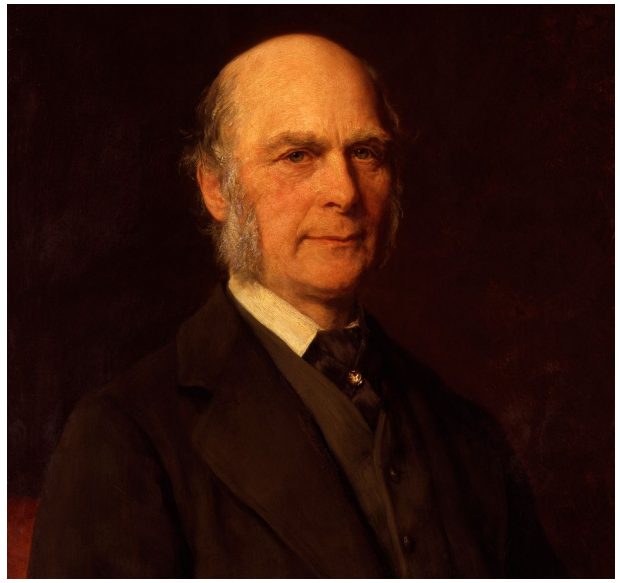
- pre-class survey results!
- mental imagery
  - early explorations and introspection
  - imagery and memory

so, what is mental imagery?

- a *subjective* experience of perception-like sensations
  - visual: “seeing” with your mind’s eyes
  - auditory: “hearing” sounds/voices/music in your head
  - olfactory/gustatory: “smelling” or “tasting” things
- why study mental imagery?
  - it’s cool and might be key to our imaginative abilities
  - it can inform how we learn and teach people with different abilities
  - it can help develop better models/AI

studying mental imagery

- studying any form of *subjective* experience is hard
- method #1: ask people to **introspect**!
- this is what Sir Galton Francis did in 1880 via the Breakfast Table Task
  - asked 100 people to rate their mental image of what they had for breakfast on three scales:
  - illumination, definition, coloring



how well can you visualize your room?

- extremely vivid, as if you are back on your bed again
  - “brilliant, distinct, never blotchy”
  - “I feel as though I was dazzled”
- vivid, pretty clear picture
  - “fairly clear as a general image; details rather misty”
- fuzzy, not super clear image but you can “see” some things
  - “dim and indistinct, yet I can give an account”
- nada, no mental pictures
  - “my powers are zero”, “I recollect...but do not see it”

how well can you visualize your room?

extremely vivid

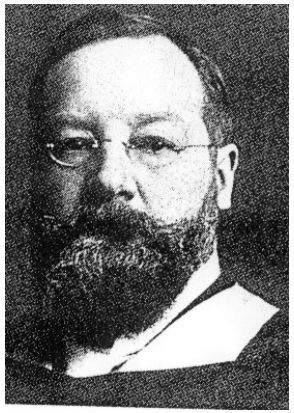
vivid

fuzzy

nada, no imagery

individual differences in imagery

- Galton found wide individual differences in reports of mental imagery
- as is the case with science, several replications and modifications ensued
  - Armstrong Jr.(1894): “The imagery of American students”
  - French (1902): “A summary of the replies given to Titchener’s questionary by 118 juniors in Vassar college”
  - Marks (1973): “Visual imagery differences in the recall of pictures”
    - your TODO involves watching a video on this paper this week

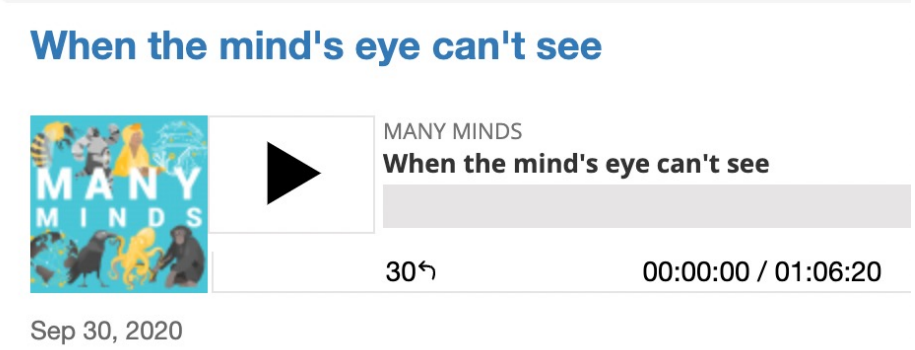


	Actual No. Yes.	Actual No. No.	Percentage. Yes.	Percentage. No.
I. Think of a bunch of white rosebuds, lying among fern-leaves in a florist's box.				
a. Are the colors—the creamy white, the green, the shining white—quite distinct and natural?	118	0	100	0
b, 1. Do you see the flowers in a good light?	106	12	90	10
2. Is the image as bright as the objects would be if they lay on the table before you?	59	52	53	47
c, 1. Are the flowers, and leaves, and box, well defined and clear cut?	115	3	97·5	2.5
2. Can you see the whole group of objects together, or is one part distinctly outlined while the others are blurred?	58	43	57	43
d, 1. Can you call up the scent of the rosebuds?	103	15	87	13
2. Of the moist ferns?	65	53	55	45
3. Of the damp pasteboard?	75	43	64	36
e, 1. Can you feel the softness of the rose petals?	114	4	96.6	3.4
2. The roughness of the ferns?	106	12	90	10
3. The stiffness of the box?	106	11	91	9
f. Can you feel the coldness of the buds as you lay them against your cheek?	108	10	92	8
g, 1. Can you feel the prick of a thorn?	85	31	73	27
2. Can you see the drop of blood welling out upon your finger?	110	4	96.5	3.5
3. Can you feel the smart and soreness of the wound?	62	52	54	46
h. Can you call up the taste of				
1. Candied rose leaves?	36	70	34	66
2. Candied violets?	87	29	75	25

from Dr. Crump:
Margaret Floy Washburn, the first woman to receive a Ph.D. in psychology (1894)

fast forward: aphantasia & hyperphantasia

- Adam Zeman and colleagues reported a patient with “blind imagination”
- coined aphantasia (little or no mental imagery) and hyperphantasia (heightened mental imagery, visions)
- Aphantasia Network
- lots of media attention
- your writing assignments this week
  - Reflections on VVIQ
  - Many Minds podcast (Rebecca Keogh)



the decline of introspectionism

- Titchener was instrumental in popularizing introspectionism as a way to study cognitive behavior
- but...why is asking people about their experience potentially problematic when studying cognitive abilities?
- some possible issues
  - people might not be able to accurately describe their experience
  - people might lie
  - your “vivid” might be different from my “vivid”
- introspectionism was criticized by behaviorists (L5) and lost some steam in the 1900s, but is still very much a part of psychological research
  - e.g., Big Five personality questionnaire, clinical questionnaires, etc.

the rise of experimental psychology

- with the decline of introspectionism, came other methods of studying psychological phenomena
- we will cover these different schools of thought (associationism, behaviorism, cognitive revolution, etc.)
- when mental imagery did come back in the 1960s, it came back as a possible explanation for other cognitive abilities such as memory

Paivio's (1963) memory task

- question: do words have imageable qualities? are some words easier to imagine and if so, are they easier to remember?
- Paivio asked if remembering word pairs would be easier if they were more concrete vs. abstract
- defining concreteness is difficult but a lot of work has been done since 1963 (e.g., Brysbaert et al. 2014)

A concrete word comes with a higher rating and refers to something that exists in reality; you can have immediate experience of it through your senses (smelling, tasting, touching, hearing, seeing) and the actions you do. The easiest way to explain a word is by pointing to it or by demonstrating it (e.g. To explain 'sweet' you could have someone eat sugar; To explain 'jump' you could simply jump up and down or show people a movie clip about someone jumping up and down; To explain 'couch', you could point to a couch or show a picture of a couch).

An abstract word comes with a lower rating and refers to something you cannot experience directly through your senses or actions. Its meaning depends on language. The easiest way to explain it is by using other words (e.g. There is no simple way to demonstrate 'justice'; but we can explain the meaning of the word by using other words that capture parts of its meaning).

Paivio's (1963) memory task

- each person learned half concrete, half abstract word pairs and then were given the adjective and had to recall the noun
- Paivio found that concrete pairs were easier to remember than abstract word pairs
- why?

Concrete pairs	Abstract Pairs
ingenious-inventor	ingenious-interpretation
technical-advertisement	technical-discourse
massive-granite	massive-rebellion
subtle-magician	subtle-prejudice
profound-philosopher	profound-analysis
colorful-maple	colorful-scenery
reliable-luggage	reliable-merchandize
expressive-actress	expressive-temperament
amazing-circus	amazing-crusade
noisy-trumpet	noisy-gossip
fashionable-overcoat	fashionable-apparel

possible explanations/inferences

- concrete pairs are more “imageable”
  - imagery!
- concrete pairs were already highly associated (e.g., noisy-trumpet vs. noisy-gossip)
  - no need for imagery!
- how would you tease these two explanations apart?
- this is a great example of how the scientific method works: you ask a question, build an experiment, obtain results that lead to further questions, and continue to refine your inferences...

Concrete pairs	Abstract Pairs
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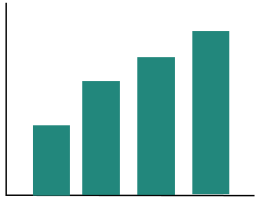
fashionable-overcoat	fashionable-apparel

follow-up experiment: Paivio (1965)

- you will learn some word pairs and then be asked to retrieve them
- go to the link below and do the experiment
- link: https://8x1hrubvvw.cognition.run
- link is also up on Canvas under Modules > L2

follow-up experiment: Paivio (1965)



- used only noun-noun pairs
  - concrete-concrete (CC) / concrete-abstract (CA) / abstract-concrete (AC) / abstract-abstract (AA)
- obtained ratings for all nouns on imagery, meaningfulness (m), and familiarity
- discuss in groups, and plot a predicted pattern of results
  - which conditions should produce the highest/lowest recall?
  - in groups, come up with a figure and reasoning
  - Matt will come around and discuss with you
- meanwhile, I will compile and report your results!

word pair	condition
string-pencil	CC
wheat-dress	CC
star-garden	CC
chair-flower	CC
magazine-virtue	CA
woman-moment	CA
river-idea	CA
coffee-effort	CA
history-potato	AC
theory-star	AC
health-house	AC
fact-tree	AC
soul-opinion	AA
freedom-series	AA
truth-duty	AA
fate-event	AA

yours vs. Paivio’s results

follow-up experiment: Paivio (1965)

- potential evidence for imagery but also other explanations...
  - are concrete words also more meaningful or easily verbalized?
  - the words could also differ on several other dimensions (e.g., frequency, valence, etc.)
- bottom line: concreteness could be related to imagery but could have alternative explanations
- thinking about or studying how aphantasics/hyperphantasics would perform these tasks can also help us constrain these theories

TABLE 1

MEAN TOTAL NUMBER OF CORRECT RESPONSES ON FOUR TRIALS AS A FUNCTION OF STIMULUS AND RESPONSE ABSTRACTNESS

	Response			
	Concrete		Abstract	
Stimulus	Mean	*SD*	Mean	*SD*
Concrete	11.41	2.83	10.01	3.21
Abstract	7.36	3.40	6.05	3.59

hot off the press!

Hidden Differences in Phenomenal Experience

Gary Lupyan,[a] Ryutaro Uchiyama,[b] Bill Thompson,[c] Daniel Casasanto[d]

[a]*Department of Psychology, University of Wisconsin-Madison*
[b]*Nanyang Technological University NTU–Cambridge Centre for Lifelong Learning and Individualised Cognition*
[c]*Department of Psychology, University of California, Berkeley*
[d]*Department of Human Development & Department of Psychology, Cornell University*

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Abstract

In addition to the many easily observable differences between people, there are also differences in people's subjective experiences that are harder to observe, and which, as a consequence, remain hidden. For example, people vary widely in how much visual imagery they experience. But those who cannot see in their mind's eye, tend to assume everyone is like them. Those who can, assume everyone else can as well. We argue that a study of such hidden phenomenal differences has much to teach cognitive science. Uncovering and describing this variation (a search for unknown unknowns) may help predict otherwise puzzling differences in human behavior. The very existence of certain differences can also act as a stress test for some cognitive theories. Finally, studying hidden phenomenal differences is the first step toward understanding what kinds of environments may mask or unmask links between phenomenal experience and observable behavior.

Keywords: Phenomenology; Individual differences; Perception; False consensus; Cryptic variation; Neurodivergence

the imagery debate

- in the 1960s and 70s, there were several studies that suggested the need for mental imagery to perform a variety of cognitive tasks
- this led to a fundamental debate in the field about what exactly happens when people are engaged in mental imagery
- broadly, the imagery debate was about representation
  - representation refers to the format of a concept
  - e.g., images are represented via pixels in a computer, what about humans?
  - propositional vs. pictorial format (next time)
- but...a related idea is that of process which is often overlooked
- we will touch on representation-process tensions throughout the semester

big takeaways

- the study of mental imagery began through the method of introspection and scientists found wide individual differences in imagery abilities
  - aphantasia and hyperphantasia represent two ends of this spectrum
- introspection was criticized as a method for probing mental processes
- imagery was then studied by experimentalists as a possible underlying ability for memory-related tasks, although with possible alternative explanations
  - evidence from recent work on aphantasics shows relatively similar performance on tasks that "should" require imagery (Keogh, Wicken, & Pearson, 2021), suggesting possible differences in strategies/processes

next class

- **before** class:
  - *fill out:* project preference survey
    - due Wednesday night
    - link also on Canvas
  - *complete:* L2
    - including Marks (1973) tutorial
  - *post:* L2 conceptual question
    - due Thursday morning
  - *look at:* L2 writing assignments
- **during** class:
  - the imagery debate