



Cognition

PSYC 2040

Week 7: Midterm review



logistics: project

- SPARK assignments have been graded
- common issues
 - article not being a peer-reviewed article
 - writing the summary in first person
 - collaboration/accountability issues
- final presentation (3) + team skills (2)
- next milestone: argument

7	T: March 4, 2025	W7: Loose Ends / Midterm review
7	W: March 5, 2025	Jennifer: Midterm Review (4.30-6.30 pm, Kanbar 200)
7	Th: March 6, 2025	Midterm Exam
8	T: March 11, 2025	Spring Break!
8	Th: March 13, 2025	Spring Break!
9	T: March 18, 2025	Spring Break!
9	Th: March 20, 2025	Spring Break!
10	T: March 25, 2025	W10: Problem Solving
10	Th: March 27, 2025	W10 continued...
10	Su: March 30, 2025	Week 10 Quiz due
11	T: April 1, 2025	W11: Decision making
11	Th: April 3, 2025	W11 continued...
11	Su: April 6, 2025	Week 11 Quiz due
11	Su: April 6, 2025	Jennifer's Office Hours (7-9 pm, Kanbar 200)
12	M: April 7, 2025	Project: Argument due

mid-semester check-in

- [calendly link](#)
- groups
 - schedule a 15-minute meeting post spring break
 - argument articles must be preliminarily “approved”
- individually
 - fill out **anonymous** mid semester survey [opens on Friday]
 - can also set up an individual time to chat separately from group

logistics: midterm 1

- 24 multiple-choice and 4 short answer
- closed-book
- you may bring ONE help sheet (handwritten, two-sided)
- calculator will not be required but is allowed

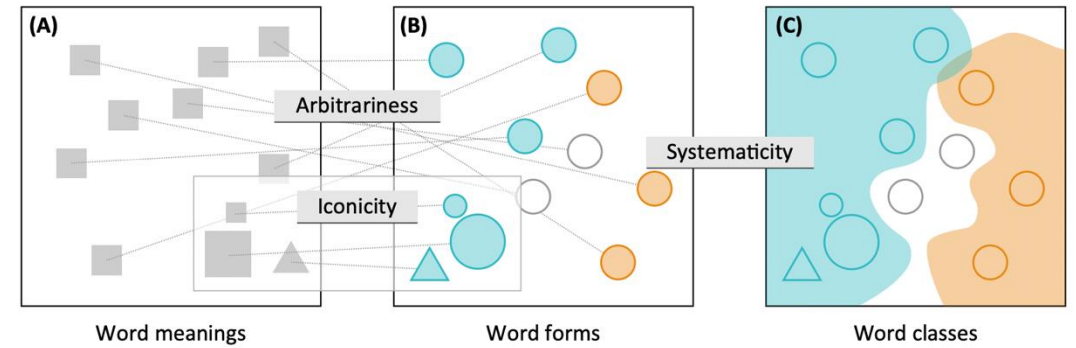
today's agenda

- language wrap
- midterm review
- course vision

language: review of findings/inferences

- we track **statistical regularities**
- we learn from **prediction error**
- we are **inherently curious** and want to reduce uncertainty
- it is possible to teach language “from scratch”

form and meaning

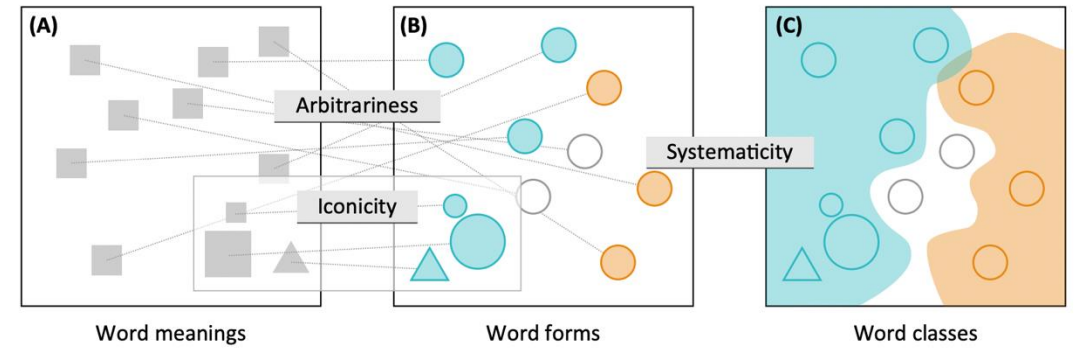


- **arbitrariness**: there is no connection between the form of a specific word and its meaning
- **non-arbitrariness**: aspects of a word's meaning or grammatical function can be predicted from aspects of its form
 - **iconicity**: perceptuomotor analogies
 - onomatopoeia
 - ideophones
 - **systematicity**: a statistical relationship between the patterns of sound for a group of words and their usage

Table 1. Some Iconic Associations Found in Ideophones across Languages [20,22]

Form	Meaning	Examples
Reduplication	Repetition, distribution	<i>goro</i> : <i>gorogoro</i> , 'one : multiple heavy objects rolling' (Japanese) <i>wùrùfù</i> : <i>wùrùfù-wùrùfù</i> , 'fluffy : fluffy here and there' (Siwu) <i>curuk-nu</i> : <i>curukcuruk-nu</i> , 'a sharp prick : many sharp pricks' (Tamil) <i>kpata</i> : <i>kpata kpata</i> , 'drop : scattered drops' (Ewe)
Vowel quality	Size, intensity	<i>katakata</i> : <i>kotokoto</i> , 'clattering : clattering (less noisy)' (Japanese) <i>pimbilii</i> : <i>pumbuluu</i> , 'small belly : enormous round belly' (Siwu) <i>giṇigiri</i> : <i>giṇugiri</i> , 'tinkling : bell ringing' (Tamil) <i>lɛgɛɛ</i> : <i>logoo</i> , 'slim : fat' (Ewe)
Vowel lengthening	Length, duration	<i>haQ</i> : <i>haaQ</i> , 'short : long breath' (Japanese) <i>piQ</i> : <i>piiQ</i> , 'tear short : long strip of cloth' (Japanese) <i>dzoro</i> : <i>dzoroo</i> , 'long : very long' (Siwu)
Consonant voicing	Mass, weight	<i>koro</i> : <i>goro</i> , 'a light : heavy object rolling' (Japanese) <i>tsratsra</i> : <i>dzradzra</i> , 'a light : heavy person walking fast' (Siwu) <i>kputukpluu</i> : <i>gbudugbluu</i> , 'chunky : obese' (Ewe)

form and meaning

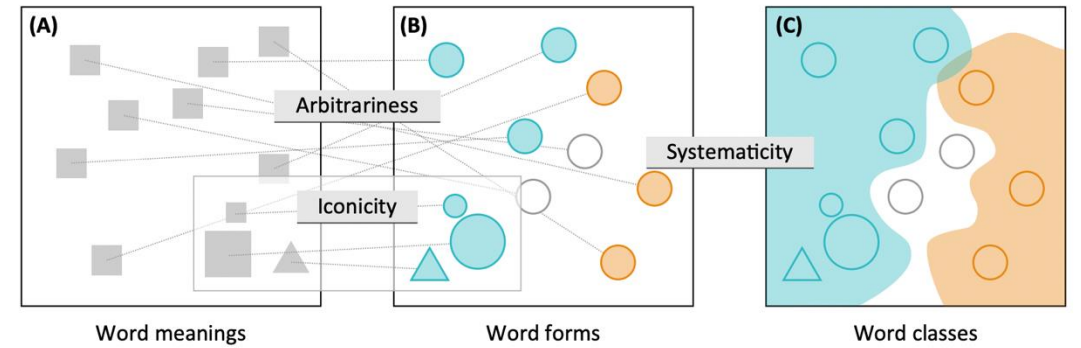


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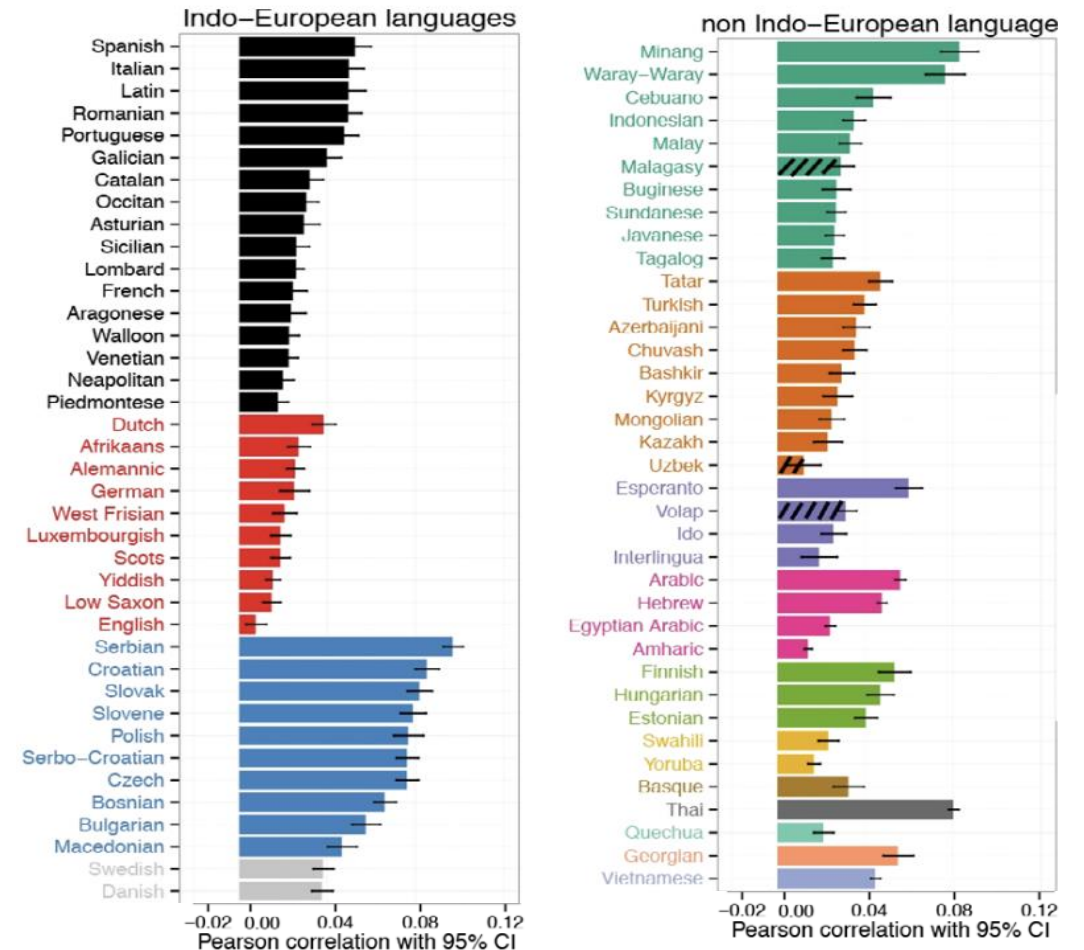
Table 2. Phonological Cues Predictive of Major Word Classes in Different Languages [33]

Category	Phonological cues
English nouns	Length of syllables, proportion of sounds in the word that are vowels
English verbs	Approximants (e.g., l, r, w) in the first syllable
Japanese nouns	Fricatives (e.g., s, z), rounded vowels (e.g., o)
Japanese verbs	Coronals (e.g., t, d, n)
French nouns	Bilabials (e.g., p, b) in the first syllable
French verbs	Proportion of sounds in the word that are vowels

form and meaning

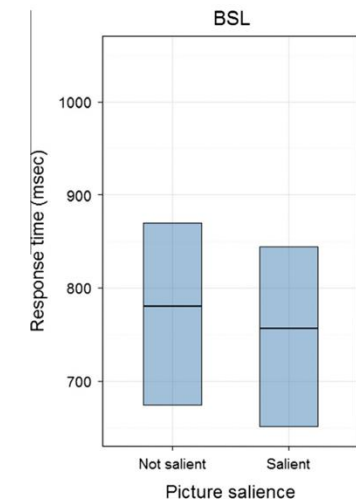
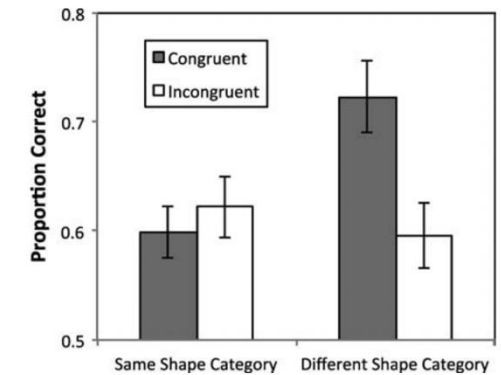
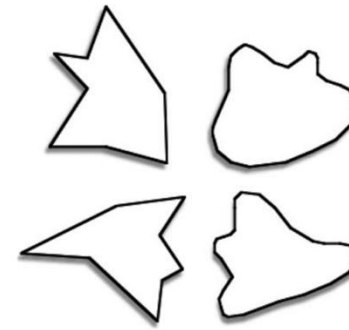


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why have both?

- non arbitrariness
 - systematicity helps with category learning and categorization
 - iconicity helps with word learning and communication
- arbitrariness
 - efficiency and discriminability
 - communicate about concepts for which perceptual grounding is lacking

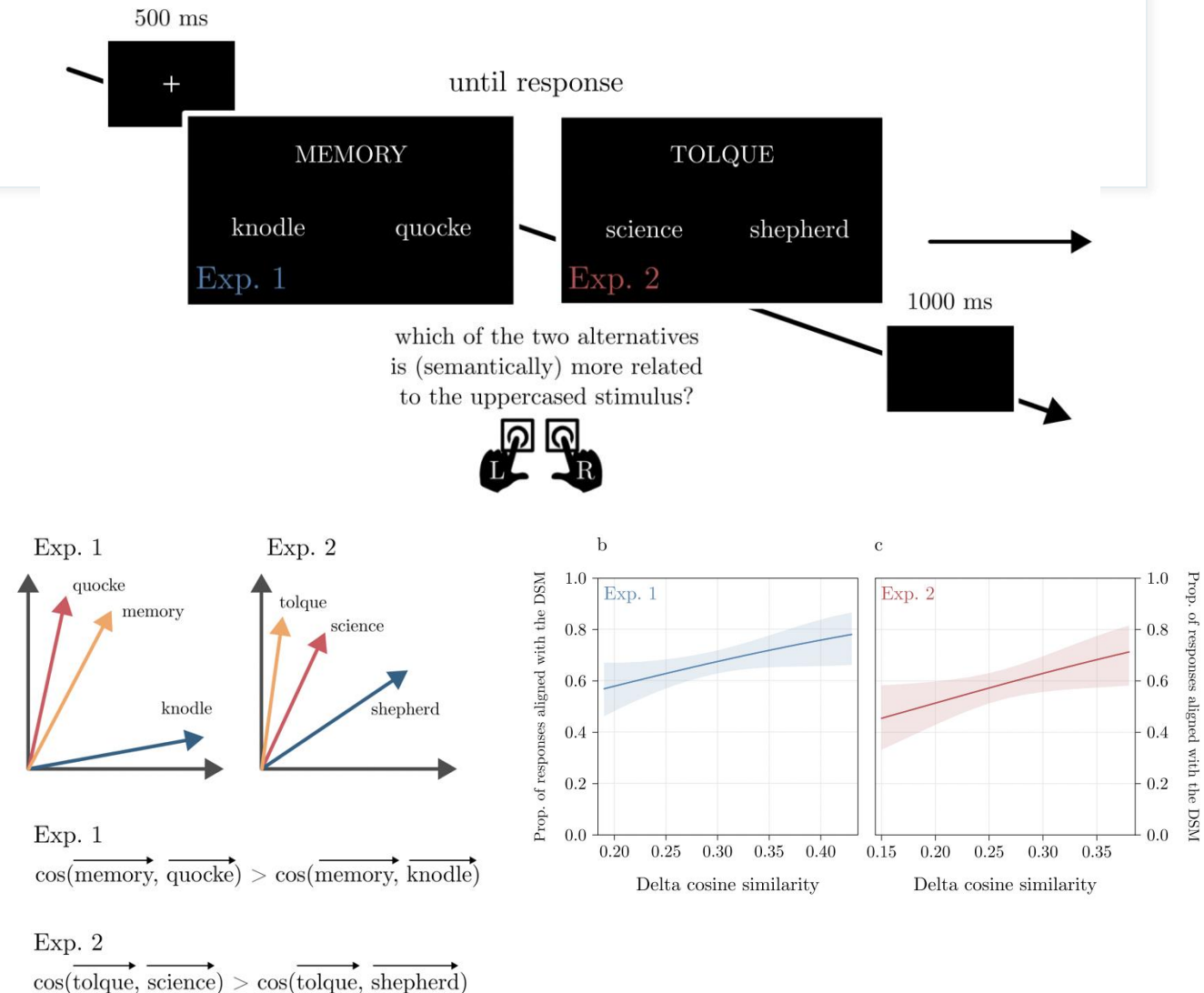


review of findings/inferences

- we track **statistical regularities**
- we learn from **prediction error**
- we are **inherently curious** and want to reduce uncertainty
- it is possible to teach language “from scratch”
- human language leverages **form-meaning mappings**

form and meaning

- participants were shown either a word/pseudoword and asked to pick related pseudoword/word
- language models can use subword information to understand novel words
- representations for words AND pseudowords were derived from a language model
- higher the cosine similarity between the model-produced related pseudoword and the target word, the higher the proportions of judgements aligned with the prediction of the model



lingering question

- Could you please discuss/explain the findings of the studies about Tip of the Tongue states? Thanks!

lingering question

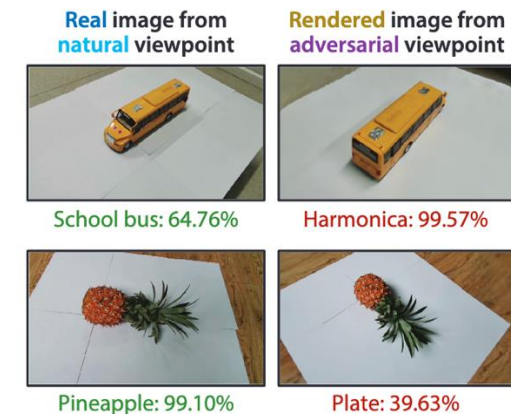
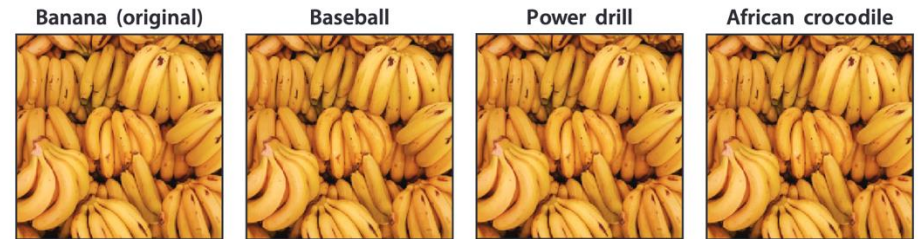
- So I thought language models don't explicitly learn the meaning of words they just measure how they are connected to other words- but I got that question wrong on the quiz. Do they learn the meaning of words? Or was this more of a "choose the best answer" situation and there was a better answer than that even if it is also true?

activity: humans vs. language models

- list similarities and differences

activity: humans vs. language models

- list similarities and differences
- similarities
 - statistical regularities
 - prediction
 - form-based cues for meaning
- differences
 - “learning”/training data
 - social & cultural learning
 - embodied/grounded learning



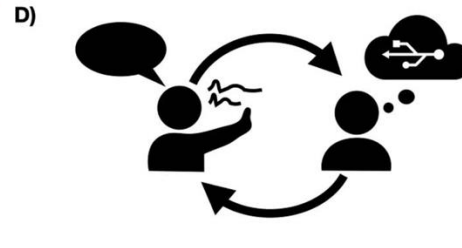
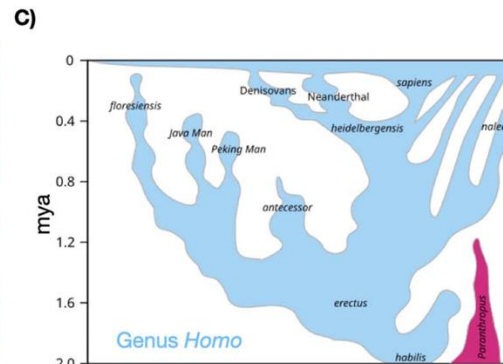
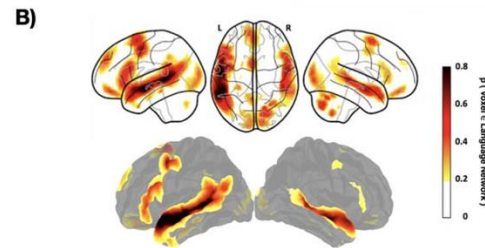
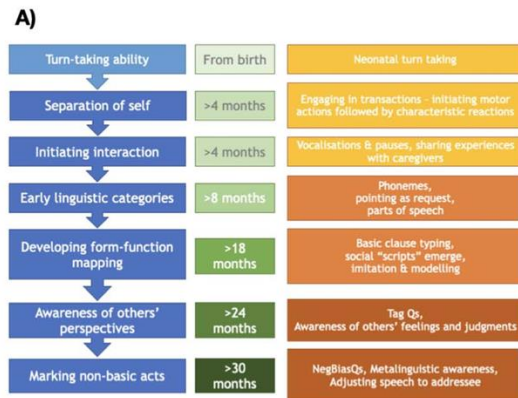
four questions



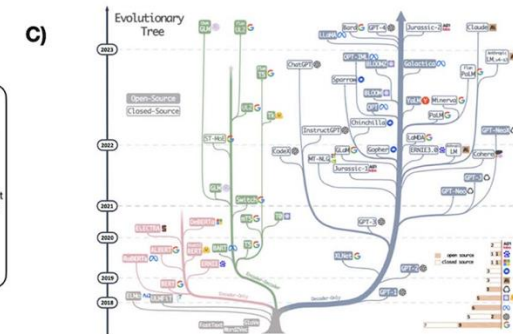
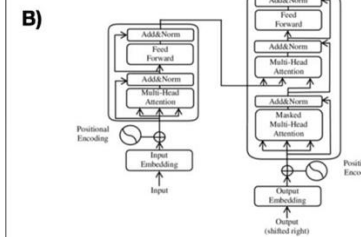
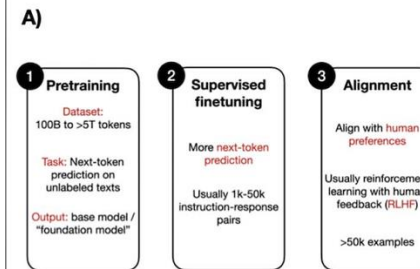
BabyLM Challenge

Sample-efficient pretraining on a developmentally plausible corpus

The Four Questions: Human Language



The Four Questions: Large Language Models



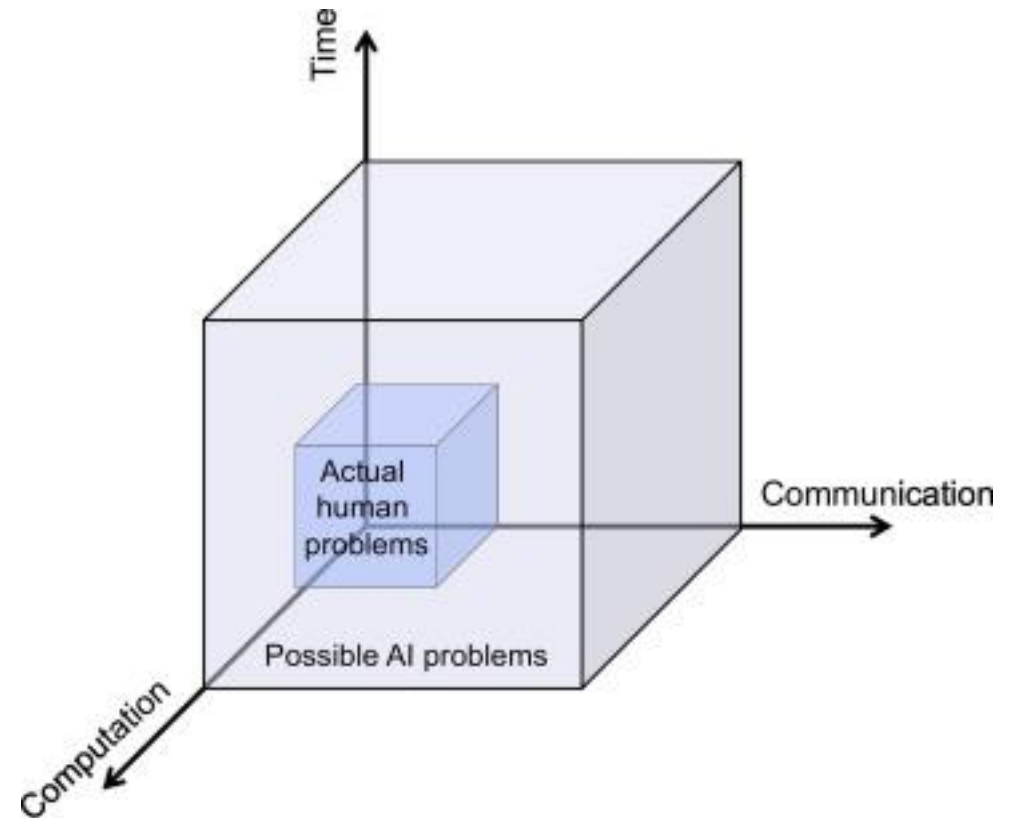
You
Can you explain how large language models differ from humans in terms of the four questions outlined by Tinbergen (1963)?

ChatGPT
Sure! Nikolaas Tinbergen, a renowned Dutch biologist, proposed four questions that help in understanding behavior in animals. These questions can also be applied to comparing the behavior of large language models (LLMs) like me to humans:

- 1. Causation:** This question focuses on the immediate mechanisms that cause behavior. For LLMs, behavior is primarily determined by algorithms and programming designed by humans. The causation of behavior in LLMs is deeply rooted in mathematical and computational processes, such as neural networks and algorithms, whereas human behavior is influenced by a complex interplay of biological, psychological, and environmental factors.
- 2. Development:** This question pertains to how behavior changes over an organism's lifetime. In

three broad human limitations (strengths?)

- limited computation
- limited time / data we can accumulate
- limited communication



lingering question

- I am a little confused. For the Saffran, Aslin, and Neeport study children spent a longer time listening to novel items and in pelucchi/hay/saffran infants spent a longer time looking towards familiar items. Do infants listen longer to novel stimuli but look towards familiar stimuli?

review: short-answer Qs

Human speech is inherently noisy, and yet infants are able to learn “words” from a stream of sounds. How do they do this? What evidence can you use to support your argument?

Alan Turing contended that if a machine can behave exactly as a human being, then we have to agree that it can “think”. One argument against this was proposed by Searle (1999), now famously called the Chinese room argument. (also suggested in a different form by Harnad, 1990). It goes something like this:

Imagine a native English speaker who knows no Chinese locked in a room full of boxes of Chinese symbols (a database) together with a book of instructions for manipulating the symbols (the program). Imagine that people outside the room send in other Chinese symbols which, unknown to the person in the room, are questions in Chinese (the input). And imagine that by following the instructions in the program the man in the room is able to pass out Chinese symbols which are correct answers to the questions (the output). The program enables the person in the room to pass the Turing Test for understanding Chinese but he does not understand a word of Chinese.

Do you think ChatGPT is like the English speaker in the above example? Why or why not? Use specific ideas we’ve discussed in class about how models like ChatGPT learn to justify your argument.



review: short-answer Qs

Two philosophers Aedis and Dorius are arguing about how concepts like “lion” and “tiger” are mentally represented. Aedis says that all concepts we know are connected to each other in a web-like manner, with concepts that are related to each other being close in this web and concepts that are less related being far from each other. Aedis further contends that there are hierarchies in this web, such that concepts that are part of a taxonomy are all stored in a multi-level manner, such that navigating to a higher level concept is harder than navigating a lower-level concept. Dorius disagrees and instead contends that all concepts are defined by a large set of features and whether or not they possess a given feature or not. They are unable to come up with an adequate test that would help them decide whose hypothesis is right.

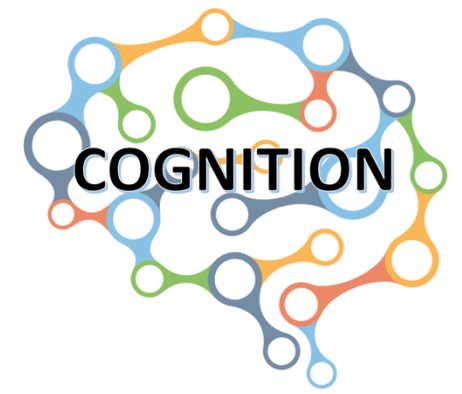
Can you come up with an empirical test for these two hypotheses? Specify the predictions each hypothesis would make and based on your knowledge on this topic, which account you think is likely to be correct.

We learned about two memory principles in class: the transfer appropriate processing principle (TAP) and the levels of processing principle (LOP). TAP suggests that if the context in which encoding and retrieval occur matches, then recall is higher. LOP suggests that the nature of processing (shallow vs. deep) determines recall. But which principle is more powerful? What evidence can you use to support your argument?

review each week

- what are the big ideas/theories?
- which empirical studies provide evidence for/against these ideas?
- what is the design of the studies (design/finding/inference)?

what is this course about?



- introducing you to the **scientific study of human cognition**
 - how people acquire, represent, and use knowledge to guide their everyday functioning
- **learning goals**
 - **understand** the fundamental questions & prominent methodologies in the study of cognition
 - **connect** theoretical ideas about cognition to specific evidence across different sub-domains and real-world applications
 - **reflect** on the sociocultural issues surrounding the study of cognition

cognition = learning, thinking, acting

learning & thinking



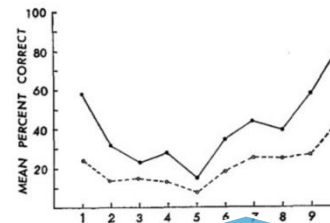
What is Cognition



Building Blocks



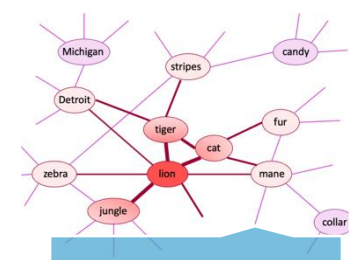
Cognitive Limitations



Learning and association



Categorization



Language



Problem Solving



Decision Making



Social Cognition



Culture



Intelligence

thinking and acting