















Cognition: Methods and Models

PSYC 2040

L3: Associations

Part 1

logistics: upcoming deadlines

Thu Feb 16, 2023	 L4: Conceptual Questions	due by 10am
	 L4: Quiz	due by 11:59pm
	 L4: Meme Submission	due by 11:59pm
Sun Feb 19, 2023	 L4: Writing Assignment	due by 11:59pm
Sun Feb 19, 2023	 Milestone 2: Instance of Cognition (+ film/podcast)	due by 11:59pm
Thu Feb 23, 2023	 L5: Conceptual Questions	due by 11:59pm
	 L5: Meme Submission	due by 11:59pm
Sat Feb 25, 2023	 L5: Quiz	due by 11:59pm
Sun Mar 5, 2023	 Milestone 3: QALMRI of Research Articles	due by 11:59pm
Sun Apr 2, 2023	 Milestone 4: Project Plan/Outline	due by 11:59pm
Sun Apr 30, 2023	 Milestone 5: First Draft	due by 11:59pm
Sun May 14, 2023	 Milestone 6: Final submission	due by 11:59pm

logistics: project meeting

- each group should schedule a 30-minute meeting with me in the next couple weeks to chat about the general direction of their project
- I will provide suggestions on articles you could choose, things to think about, software to use, etc.
- come prepared to the meeting with ideas about milestones #2 and # 3 (due Feb 19 and Mar 5)
 - the earlier you meet with me, the more feedback I can provide!
- use this link to schedule a meeting
 - <https://calendly.com/abhilasha-a-kumar/30min>
 - Mon/Wed meetings may be virtual (which is ok)

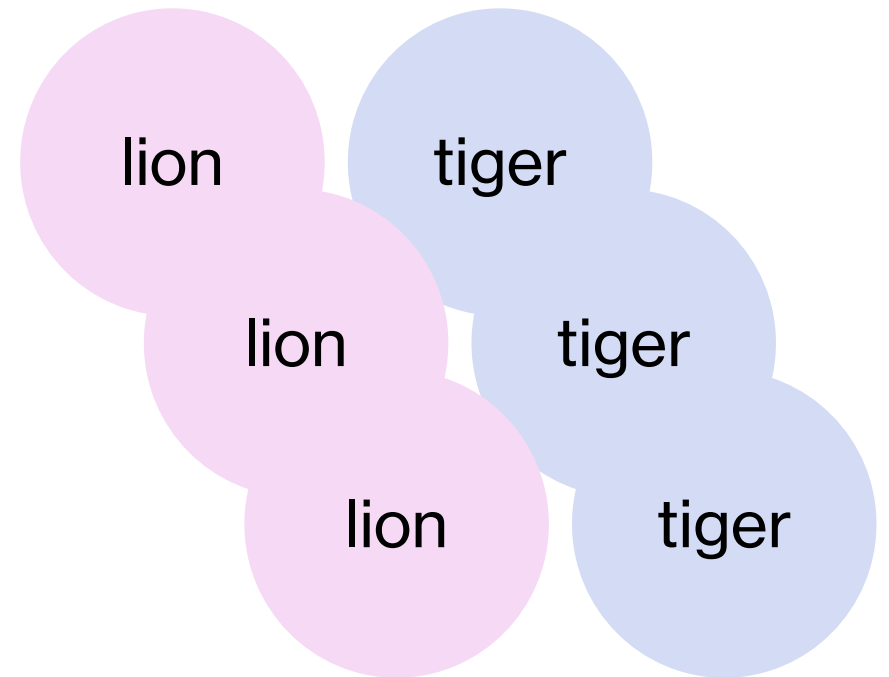
recap: Feb 9, 2023



- what we covered:
 - L3: the eugenics movement
 - L3: intelligence testing
- your to-dos were:
 - *finish*: L3 quiz + writing assignments + meme
 - *submit*: project milestone #1 (due Feb 12, midnight)
 - *read*: L4 (Associations) chapter

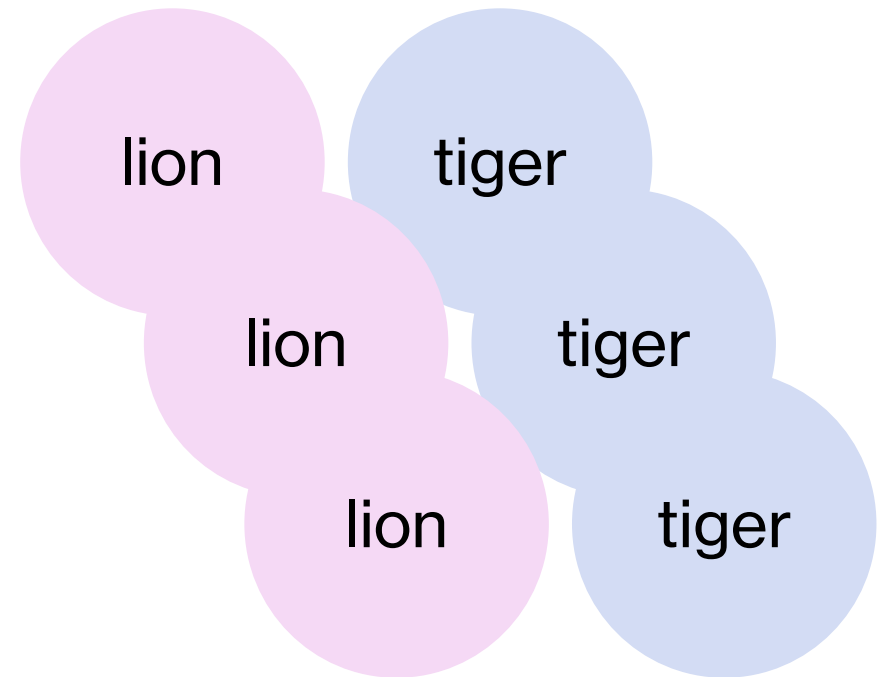
today's agenda

- first part:
 - origins of **associationism**
 - Cattell's **reaction time** studies
 - Thorndike's **puzzle boxes**
- second part:
 - project milestone #2 discussion
 - led by Beth Hoppe



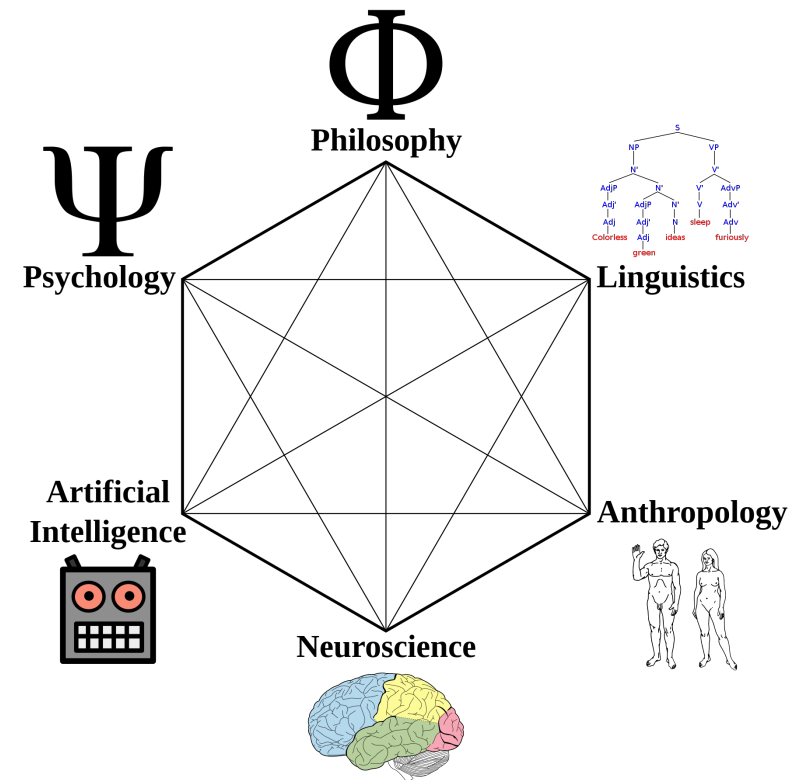
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origins: what came **before** psychology?

- psychology was born out of other attempts to understand **human and animal nature** in different fields, such as philosophy, natural science, and evolutionary biology
- even today, “cognitive science” is considered a largely **interdisciplinary effort** to understand the mind



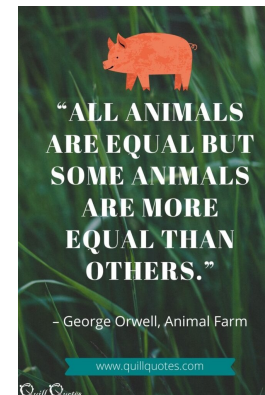
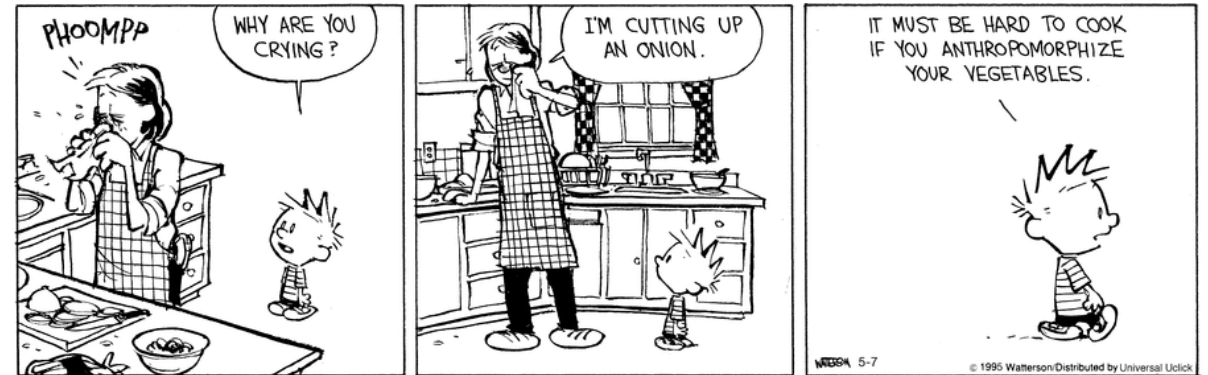
origins: animism/anthropocentrism

- anthropocentrism

- Ancient Greek origins
- humans are the most important entity in the universe
- wide implications for how we live: environment, religion, human/animal rights, science

- animism

- spiritual essences to things
- can animals be understood as humans?

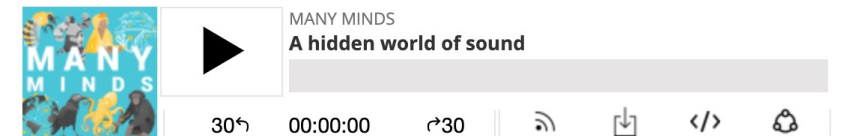


On anthropomorphism in science

(Delivered at The Philosophers' Lunch, 25 September 1985)

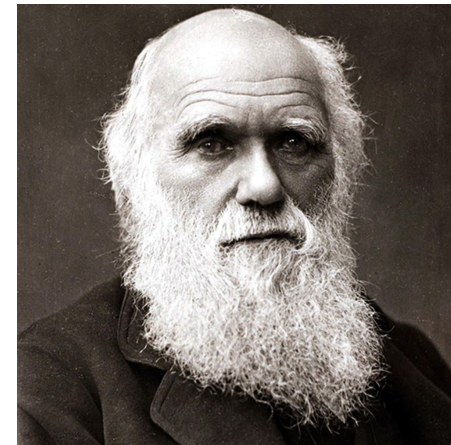
Dijkstra, 1985

A hidden world of sound



origins: natural science/evolution

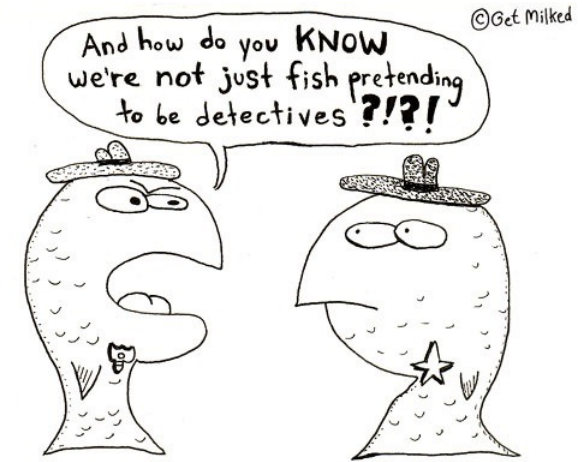
- Robert Hooke
 - came up with the word “cell”
 - proposed a model of **human memory** that worked as a **physical system** with some influence of immaterial forces
- evolution
 - Charles Darwin’s theory of evolution
 - proposed the “crazy” idea that **humans = animals**



origins: philosophy

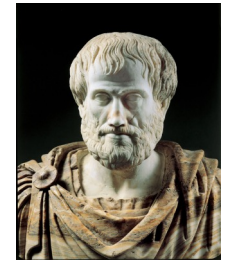
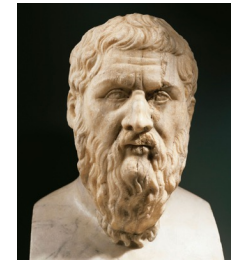


- **epistemology**: how do we **know** things?
- **rationalism**: knowledge is based on **logic & reasoning**
 - Descartes ("I think therefore I am")
- **empiricism**: knowledge is gained from **observation**
 - people collect evidence to form knowledge structures
 - how do we process incoming information?



origins: associationist ideas

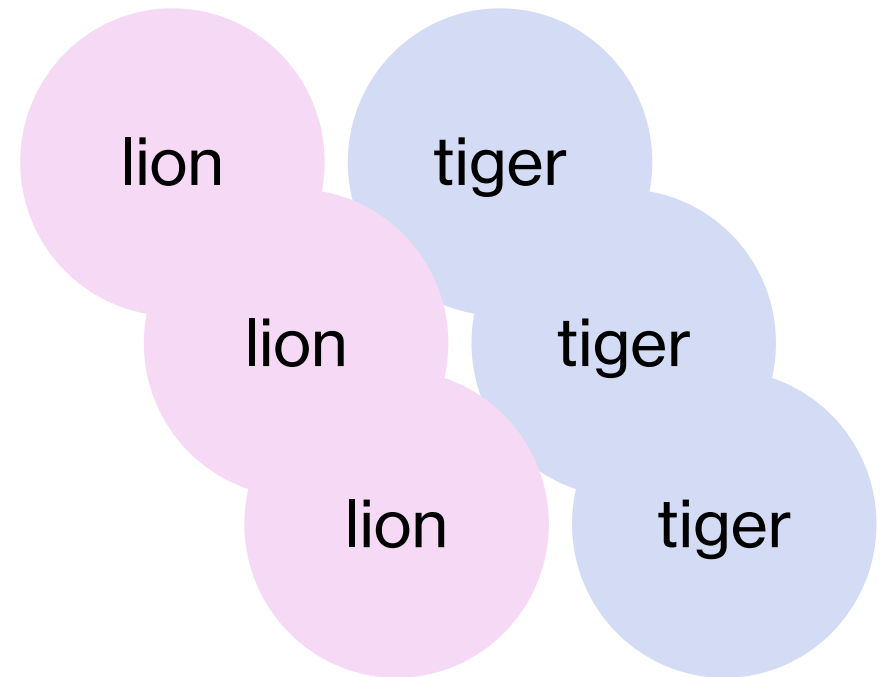
- prominent thinkers:
 - **Plato**: briefly discusses this in *Phaedo* about how ideas are recalled in connection to others
 - **Aristotle**: talks about the “act of reminiscence” in *On Memory*
 - Thomas **Hobbes**: what is already on our mind influences what comes next
 - John **Locke**: “association of ideas”, somewhat arbitrary
 - David **Hume**: “treatise on human nature”: alluded to certain principles that govern what comes to mind
- **Associationist School**: a collection of thinkers who contemplated on the nature of mental processes and associations



what is association?

what is association?

- association is simply the **relationship between any two entities**
- these entities could be events, things, concepts, ideas, people, etc.
- philosophers came up with several **laws/principles** that provided intuitions for why some things tend to be associated or bring other things to mind



principles/laws of association

- **contiguity**: if events occur in proximity to each other in space/time, then the reoccurrence of one event will bring to mind the other event
- **similarity**: the more characteristics events share, the more likely they are to develop stronger associations
- **frequency**: the more frequently events co-occur, the stronger the association
- **recency**: the more recent an event is, the stronger is its association

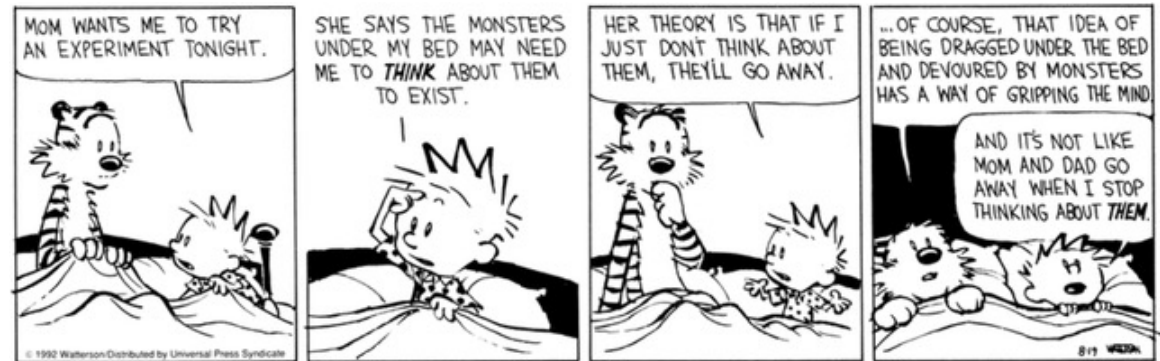


activity: brainstorm some examples

- in pairs, think about 1-2 examples for each type of law/principle
 - **contiguity**: if events occur in proximity to each other in space/time, then the reoccurrence of one event will bring to mind the other event
 - **similarity**: the more characteristics events share, the more likely they are to develop stronger associations
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- come back and debrief

testing ideas about associations

- the laws/principles were hypothesized by early philosophers but not actually put to the test
- but you could evaluate these claims
 - people have associations
 - you can learn associations
 - some associations are stronger than others
- how do the laws/principles map onto these claims?

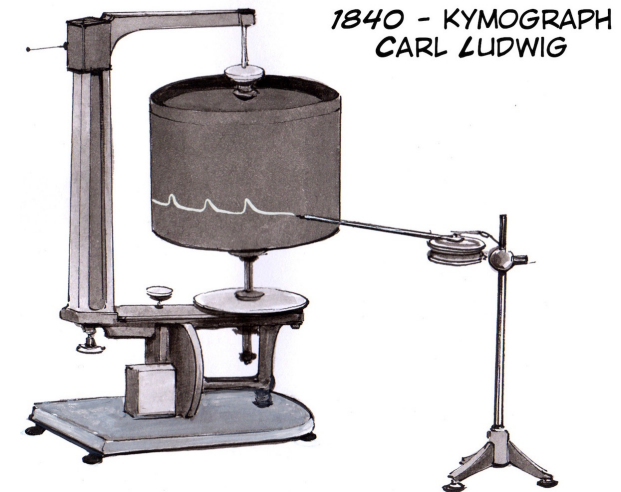


measuring associations via reaction times

- James Cattell (from intelligence tests)
 - was broadly interested in the use of experiments to test theories
 - **mental chronometry**: how long it takes to complete a mental operation or task
 - Cattell, J. M. (1886). The time it takes to **see and name objects**. *Mind*, 11(41), 63–65.
<https://doi.org/b6fr5r>
 - Cattell, J. M. (1887). Experiments on the **association of ideas**. *Mind*, 12(45), 68–74.
<https://doi.org/d9bv2m>
- how does this connect to association?
 - identifying and naming an object involved an **association** between the **perception of that object** (what it looks like) and **the action** required to name it (moving the vocal tract)

seeing and naming objects (Cattell, 1886)

- study 1:
 - modified a kymograph to present words/letters through a slit in a screen and measured naming time
 - 1 cm slit: 200 to 333 ms
 - wider slit: shorter times based on how many letters are in view
- inferences about associations:
 - previous letters can “trigger” associations and lead to faster recognition



This shows that while one idea is in the centre, two, three or four additional ideas may be in the background of consciousness. The second letter in view shortens the time about $\frac{1}{40}$, the third $\frac{1}{60}$, the fourth $\frac{1}{100}$, the fifth $\frac{1}{200}$ sec.

seeing and naming objects (Cattell, 1886)

- study 2:
 - had participants read sentences with words that have “connexion” vs. not and read letters that have “connexion” vs letters that do not make words
 - “no connexion” takes twice as long (250 ms vs. 125 ms)
- inferences about associations:
 - learning associations between letters and vocal outputs: “word superiority effect” (Reicher, 1969)
 - learning associations between surrounding context and words

to apple Marta gave Betty the

Betty gave the apple to Marta

make words. When the words make sentences and the letters words, not only do the processes of seeing and naming overlap, but by one mental effort the subject can recognise a whole group of words or letters, and by one will-act choose the motions to be made in naming them, so that the rate at which the words and letters are read is really only limited by the maximum rapidity at which the speech-organs can be moved. As the result of a

association of ideas (Cattell, 1987)

- did a series of experiments where **naming times** were measured
- some key findings:
 - reading a foreign language takes longer due to weaker associations
 - cue-based recall (city – country vs. month-following/preceding month) showed patterns consistent with what might be expected due to **stable vs. weak associations**
- key **takeaway** so far: **experiments** can provide **valuable information** about **existing associations** and the factors that influence them

<i>City-Country (52).</i>									
B	348	53	333	35	C	462	120	413	65
<i>Month-Season (26).</i>									
	415	55	410	31		310	63	306	16
<i>Month-Following Month (26).</i>									
	345	45	327	25		389	172	384	61
<i>Month-Preceding Month (26).</i>									
	763	245	619	129		832	233	815	160
<i>Author-Language (78).</i>									
	417	80	402	53		350	57	337	32
<i>Country-City (26).</i>									
B	400	72	357	45	C	346	75	340	48
<i>Season-Month (26).</i>									
	561	92	548	36		435	99	399	54
<i>Language-Author (78).</i>									
	663	200	702	110		519	137	523	83
<i>Author-Work (26).</i>									
	1076	397	1095	287		763	308	596	127

Thorndike's work with animals

- Edward Thorndike, student of Cattell
- applied experimental techniques to study animal cognition
 - view #1: animals = humans
 - view #2: animals = 'simple reflex machines'
- leader in eugenics movement



Thorndike's puzzle boxes

- Thorndike, E. L. (1898). Animal intelligence: An experimental study of the **associative processes** in animals. *The Psychological Review: Monograph Supplements*, 2(4), i–109. <https://doi.org/10/bk48z2>
- **mini escape rooms** where animals (cats, dogs, chicks) were placed in a box and had to figure out a way to get out of the box
- two **key findings**:
 - animals were able to figure a way out
 - animals improved with practice

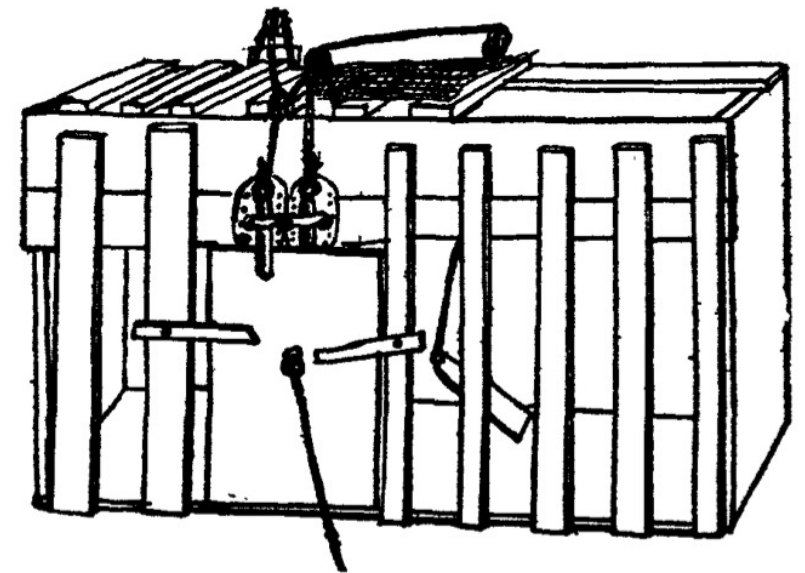


FIG. 1.

how are animals doing it?

- **claim**: there must be some kind of **association** being formed between different **features (internal and external)** of the environment
- later experiments modified some critical aspects of the puzzle box

Before describing the experiments which justify these statements, it will be worth while to recall the somewhat obvious facts about the composition of one of these associations. There might be in an association, such as is formed after experience with one of our boxes, the following elements :

1. Sense-impression of the interior of the box, etc.
2. (*a*) Discomfort and (*b*) desire to get out.
3. Representation of oneself pulling the loop.
4. Fiat comparable to the human "I'll do it."
5. The impulse which actually does it.
6. Sense-impression of oneself pulling the loop, seeing one's paw in a certain place, feeling one's body in a certain way, etc.
7. Sense impression of going outside.
8. Sense-impression of eating, and the included pleasure.

Also between 1 and 4 we may have 9, representations of one's experience in going out, 10, of the taste of the food, etc.

testing hypotheses for learning

- imitation learning
 - can you learn by watching someone else escape?
 - cats, dogs, and chicks did not benefit from imitation learning
- general(ized) concept learning
 - can you generalize learning to newer contexts?
 - animals escaped faster when newer boxes were similar to older boxes
 - learning abstract concepts vs. specific details?
- mental representations
 - do animals have mental representations?
 - A (clap hands) – 10 seconds – B (walk up & give fish) – C (climb and get fish)
 - cats did show tendency to perform C when only A was presented



reviewing associationist claims

- people/animals **have** associations
 - what is the evidence?
- you can **learn** associations
 - what is the evidence?
- some associations are **stronger** than others
 - what is the evidence?

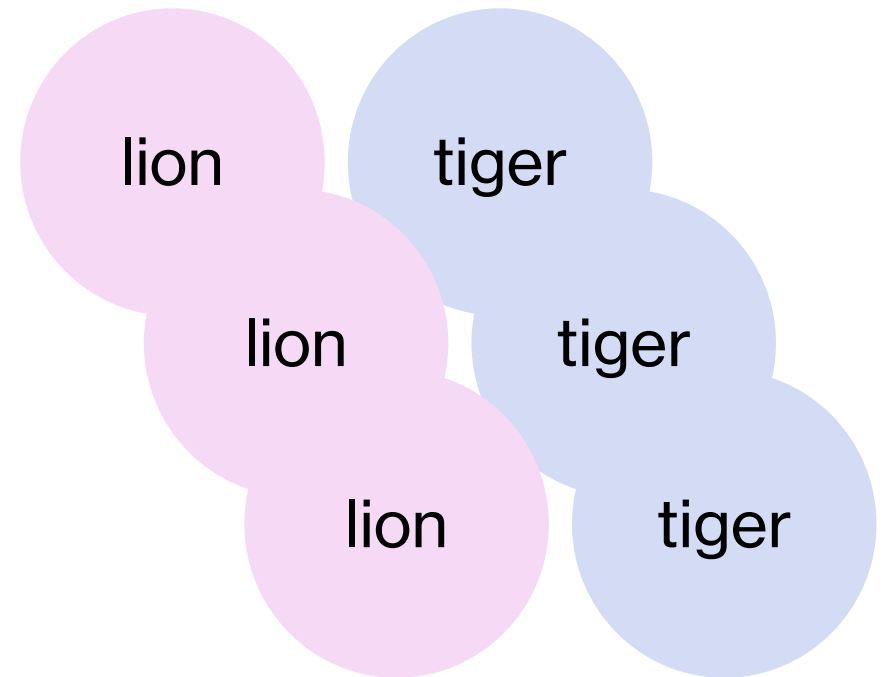
associative learning today

- the learning of **language and speech**
 - free association / what comes to mind
 - speech signals in babies
 - modern language AI
- associations in **memory**
 - false memories / eyewitness testimonies
 - computational models of memory
- **social** learning in animals
 - crows, apes, etc.



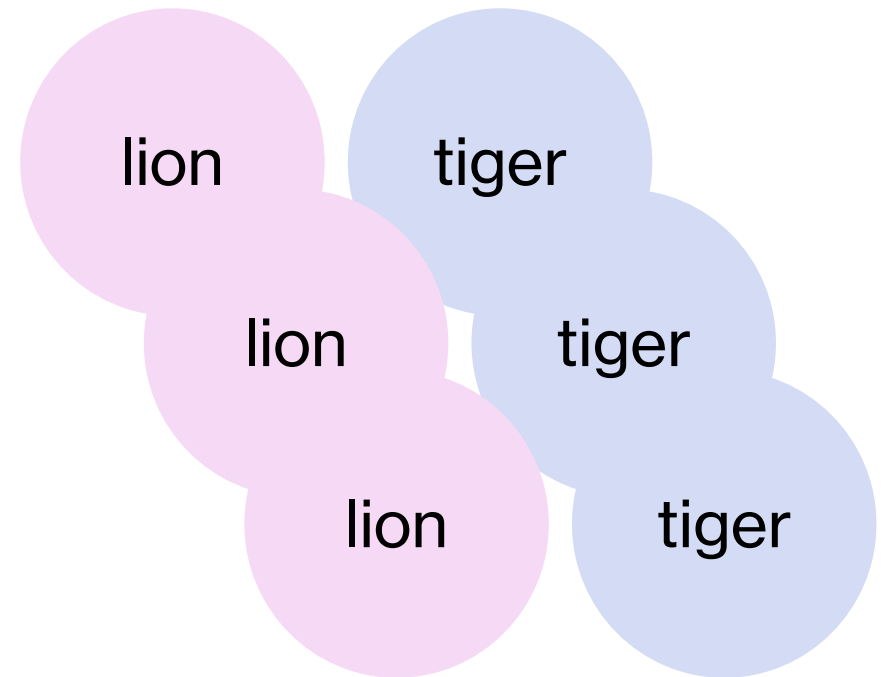
big takeaways

- association is a key idea in the study of cognition with roots that go back to before cognition was an established field
- many classic ideas of association continue to be actively studied even today via experiments, computational models, and field research
- animal cognition has provided invaluable insights into the nature of associations



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final project milestone #2

- due Feb 19, 2023 (midnight)
- thoroughly read the [google document](#) for your project
- [come up with a plan](#), assign tasks and sub-tasks, and regroup
- jointly [select an instance](#) of cognition
 - Minute Cognition & Gamifying Cognition : instance only
 - Data Dive: instance only (but limited to 4 potential datasets, details in google doc)
 - Cognition in Film + Podcast Pondering: instance + film/podcast
- find and read [one review article](#) on that instance of cognition ([250-word reflection](#))
- fill out [self/peer assessment](#): major discrepancies in these can affect your grade
- [submit individually](#) on Canvas

next class



- **before class:**
 - *finish:* L4 (Associations) chapter
 - *schedule:* group project meeting with Abhilasha
 - <https://calendly.com/abhilasha-a-kumar/30min>
 - *work on:* project milestone #2
 - *look at:* L4 writing assignments
- **during class:**
 - associations and classical conditioning