COGS 105

Research Methods for Cognitive Scientists

Week 1, Class 2:
More Background

odolog

st

- Psychology

gy

ce

ificial

hands on

Today...

- Representations
- Computations
- "CRUM"
- Introspectionism
- Turing Test
- Reaction time
- Abstract theories of the mind…

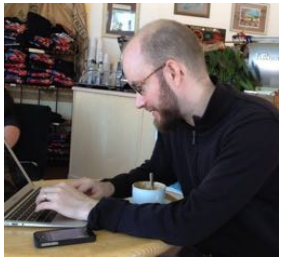
In Required Readings

Today...

CLASSICS

Behavior...

COFFEE BANDITS

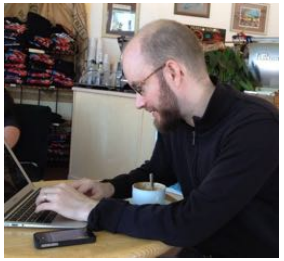


Representation

- Broad technical term that has a diversity of meanings
  - E.g., belief or memory
  - E.g., accessed word that is active in mind
  - E.g., an “interpretation” of an event, or visual stimulus
- “Internal” state that “stands for” things
- “Informational state” used by the mind.

Behavior...

COFFEE BANDITS



Computation

- You can “compute over representations.” You do things with them.
  - *Accessing* a memory
  - *Storing* a new word you just learned
  - *Decompose* word into letters...
- Therefore you go from one representation to another through computation
  - decompose(car) -> c, a, r

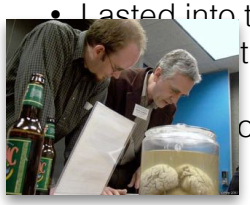
“computer metaphor of the mind”

“CRUM”

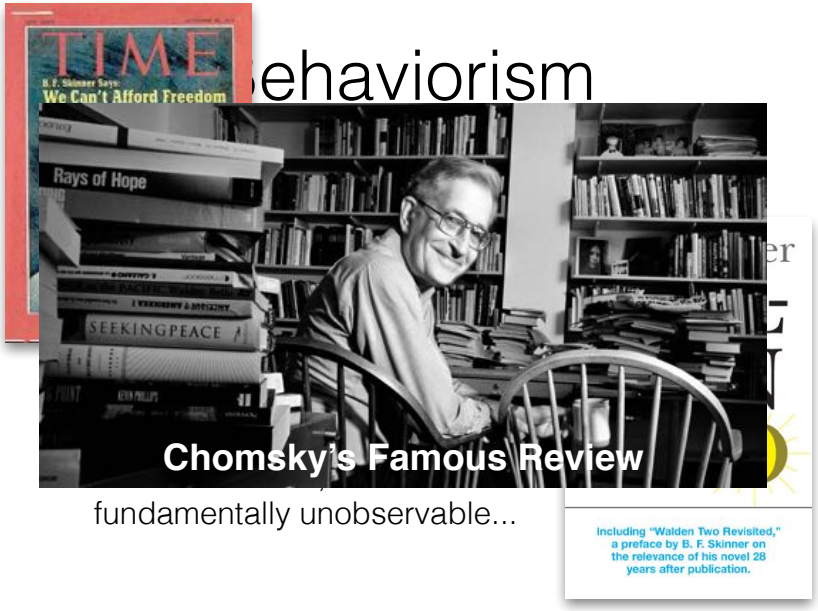
- Computational-representational understanding of mind
- You have symbols, representations, etc. in your mind that stand for things
- You think by manipulating these symbols according to particular rules, operations, etc.
- In other words: ***You are a computer, and your thought processes are just computer programs***

Introspe

- Argues that we have ri
  analyzed by getting pe
  “Reflection” will reveal
- In US: Edward Titchene
  1800s/early 1900s.
- Lasted into the 1920s:
  trol, etc.
- o behavioris

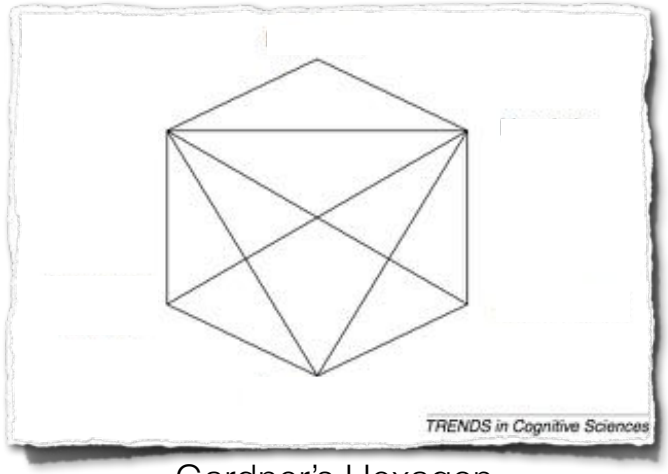


Behaviorism



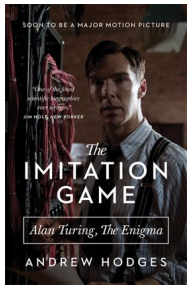
fundamentally unobservable...

Revolution?



Gardner's Hexagon

Turing T

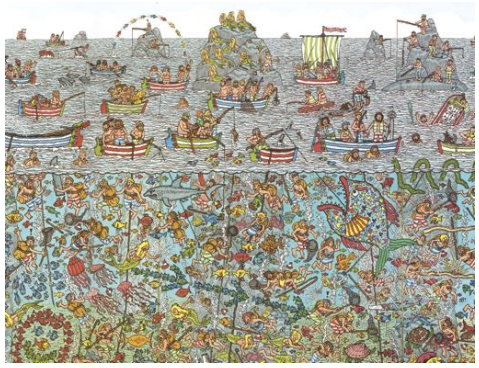


- Is a machine "intelligent"?
- Is a program "intelligent"?
- Predicted and very closely related to the sophistication of "chat bots" used for fun and in growing ways by companies.
- http://rebot.me/harrystyles

Obviously…

- You can't find out everything about mental processes by just "talking" to human participants in experiments.
- We should also develop methods that let us "peer into the mind."
- E.g.: **Reaction time** is nearly the behavioral bread and butter of cognitive psychology.

Measure Mental Timing!



RT < RT

"Mental Chronometry"; since the late 1800s!

Reaction time (RT)

- Time required to go from seeing a stimulus (e.g., a picture prompt) to making a response... often measured in milliseconds,1000 ms = 1 s.

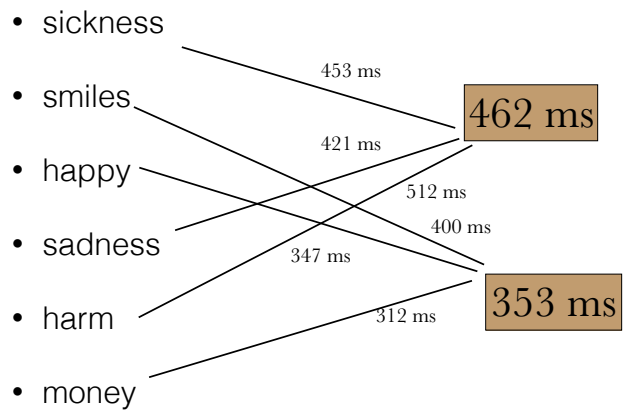
How to use RT

- In an experiment, RT is often measured in *two or more ways*. Then you *compare average RTs.*
- E.g., are people faster to respond to positive vs. negative words?
- 1) Create list of words.
- 2) Have 3 words that are negative, 3 positive.
- 3) Present to subjects, record RT.
- 4) Average the RT's in each word condition.

Example: Simple response

- On the next screen you will see words pop up.
- Tap your desk with the palm of your hand when a word appears.

Word stimuli



Another example...

- It takes a *step of computation* in order to *decide to respond* than just responding to anything.
- On the last slides: Simple response (simple reaction time to a stimulus). Aka, “respond to anything as it appears.”
- Now, let’s do this differently: Respond only to *positive words*.

Word stimuli

- roses
- injury
- poverty
- playground
- love
- dreary

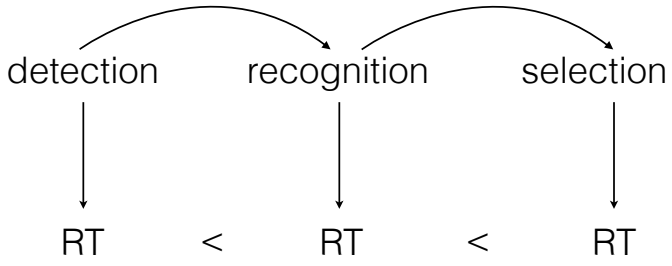
Another example...

- It takes *another step of computation* in order to *decide which response to make* than just deciding about a single response.
- On the last slides: 1 decision only. Aka, “recognize positive words.”
- Now, let’s do this differently: Respond with the right hand to positive, left to negative.

Word stimuli

- broken
- rotten
- delicious
- humor
- puppies
- heaven

Theory of simple responses

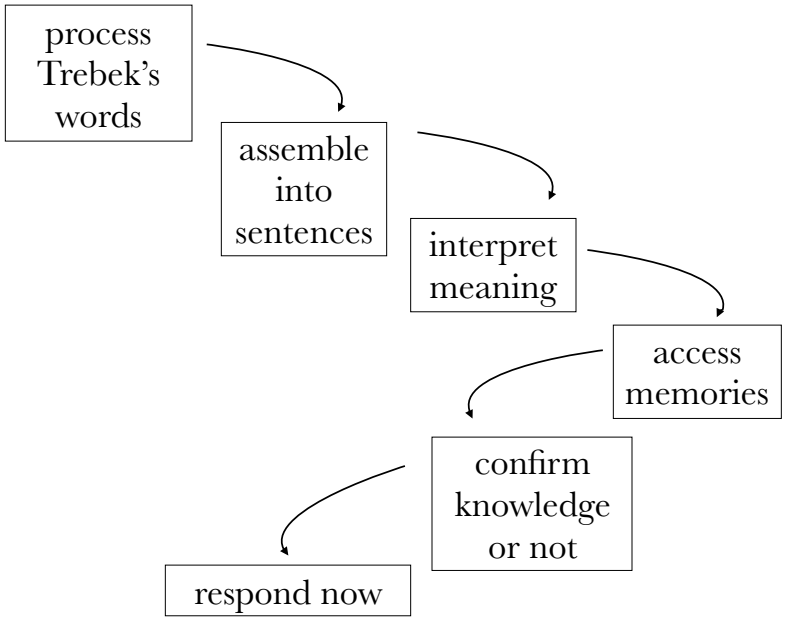


Abstract theories...

- Simplified “on paper” draw-up of how a system is working without regard to the “physical” stuff that is doing it.
- Many “classical” cognitive science/psychology theories were abstract by being “box and arrow models” of the mind.
- Examples: **logic, rules, analogies** are often used in stage-based theories (reading #2)…

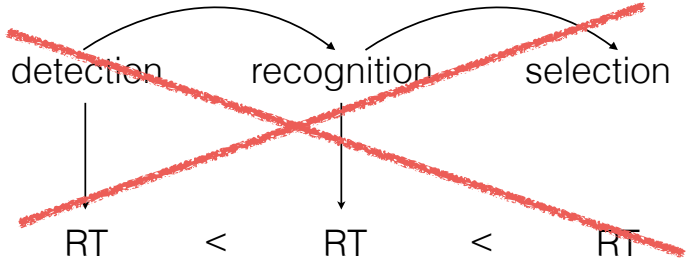
Reaction time (RT)

- Time required to go from seeing a stimulus (e.g., a picture prompt) to making a response... often measured in milliseconds (1/1000ths of a second).



However…

- We now know that stage-based theories fail for a lot of cognition! Reaction time helped us figure this out!



Respond When a "D" Is Present

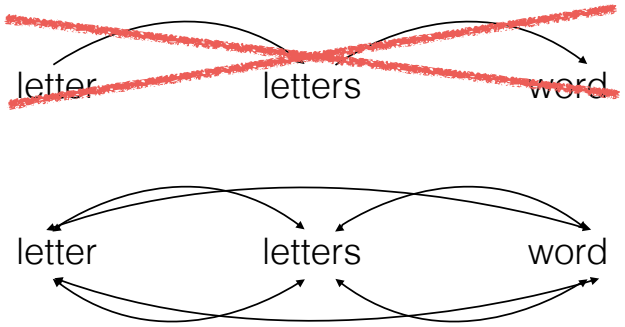
- S
- E
- D
- B
- D
- T

- SAID
- DRAW
- FRESH
- BLUE
- PARLOR
- DALE

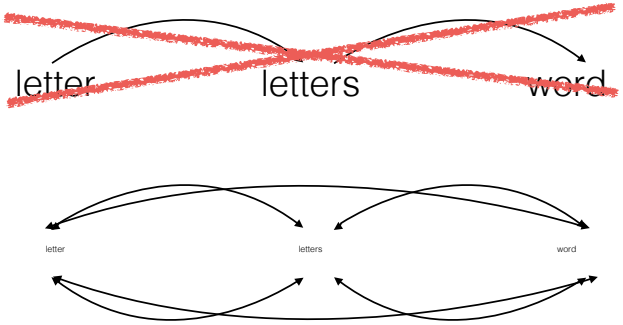
Word Superiority Effect

- Lots of evidence that you can respond to “D” faster if it is in a word (RT(“D”) > RT(“DALE”))!
- Suggests you **process words and letters together in parallel** and word processing can *help* letter recognition.
- Note: **The details are still under debate**!
- This motivated the **“connectionist” account, described in required readings**.

Non-Serial Theories



Non-Serial Theories



activation flows “in parallel”

Summary

- Representation and computation
- History of cognitive science
- Role of Turing Test and reaction time
- Theories of cognitive science: serial vs. parallel
- Word superiority effect

Next week…

- **Sections**: Section time next week! Introductions + Turing Test exercise.
- **Topic**: nature of science, cognitive science, and philosophy.