STUDYING THE MIND: A BRIEF HISTORY

COGS 101B, Lecture 1
Wednesday January 10th
WINTER 2018

ANNOUNCEMENTS

- Register clicker by Friday
  - Contact Josh (jdd001@ucsd.edu) if you are having any issues
- ZAPS Split brain lab due *Friday* night by midnight
  - Contact Carson (carsongmr@ucsd.edu) if you are having any issues with the ZAPS
- Optional sections start next week

LECTURE OUTLINE

Frist meeting of the cognitive science society (held at UCSD)

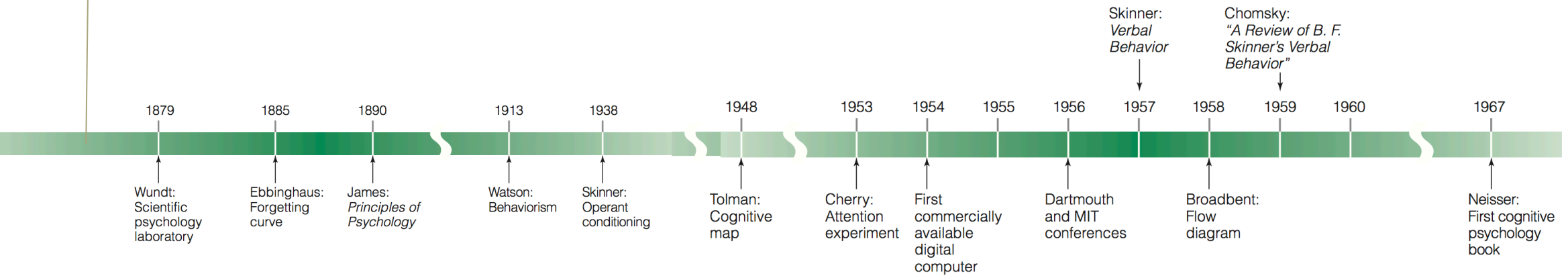
1971

Early 1800s : Mental events are hidden, we can't study them scientifically

Yes, we can! (early studies of the mind)

No, we can't! (Behaviorism)

Yes, we can! (Cognitive revolution & birth of cognitive psycholog)



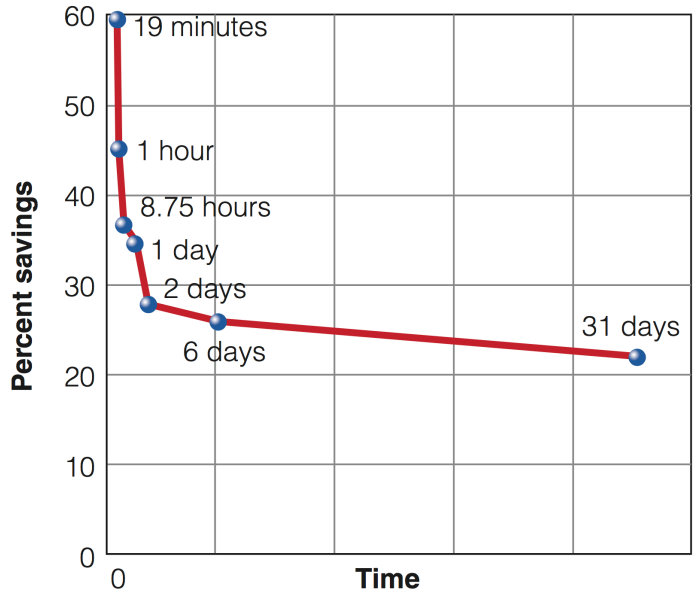
YES, WE CAN!
FIRST QUANTITATIVE MEASURE OF MEMORY

Ebbinghaus (1885)

- What is the time course of forgetting?
- Memorized nonsense syllables (e.g. DAX, QUE)

Importantly it demonstrated

- Memory can be quantified and behavior could be used to describe a property of the mind



YES, WE CAN!
INTROSPECTION – LATE 1800S

Introspection = observing your own thoughts

Focus on conscious mental events

- Analytical Introspection: Meticulous training in how to describe and record mental experiences

Contribution: attempt to study behavior in controlled conditions

- Generated fist psychology labs and students

Problems with introspection

- Some thoughts are unconscious
- No way to objectively test claims based on introspection

NO, WE CAN'T BEHAVIORISM – EARLY TO MID 1900S

- Noted problems with introspection – advocated for abandoning the study of the mind
- proposed that observable behavior (not mental processes) should be the main focus of study

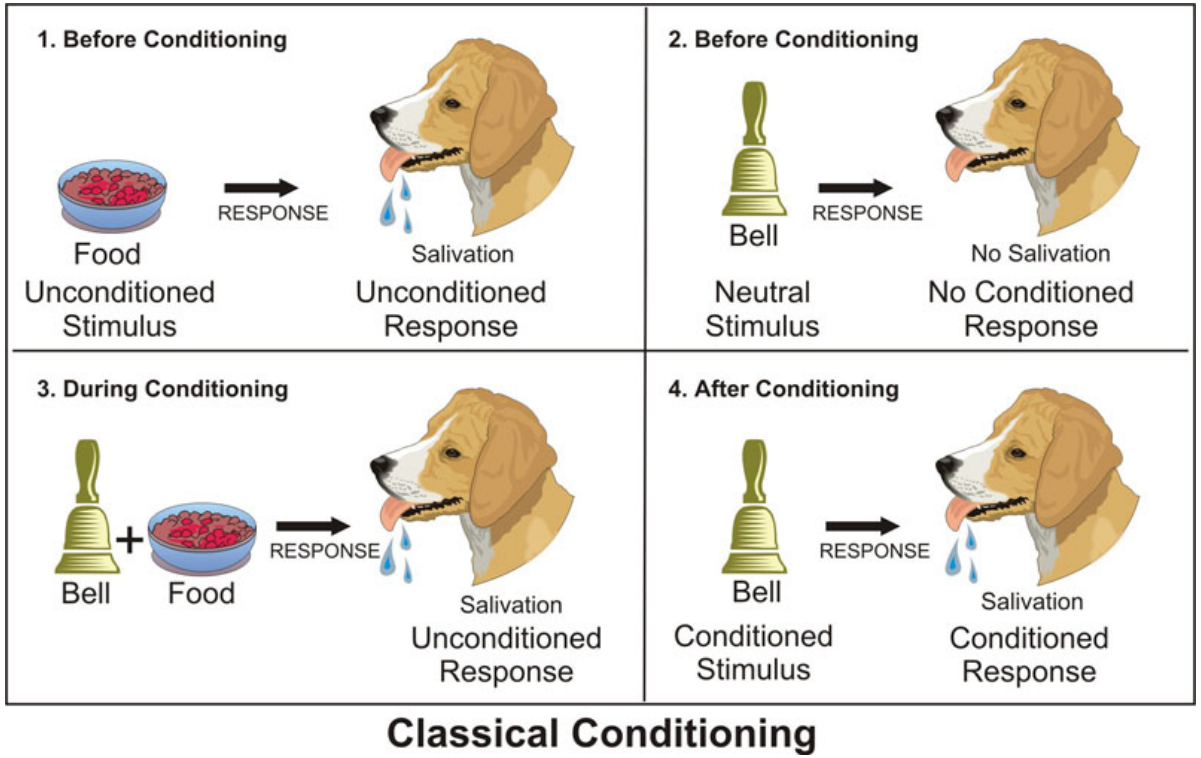
- Both stimuli and behaviors are objectively observable, but the mind is a black box.
- Replace the mind as a topic of study with directly observable behavior
  - Limit vocabulary to observables (e.g. stimulus, response).
  - No vague intermediate mental constructs (e.g. thoughts, concepts)

NO, WE CAN'T
BEHAVIORISM – EARLY TO MID 1900S

Classical Conditioning: a neutral stimulus with a stimulus that elicits a response causes the neutral stimulus to elicit a response

e.g. learning by developing associations

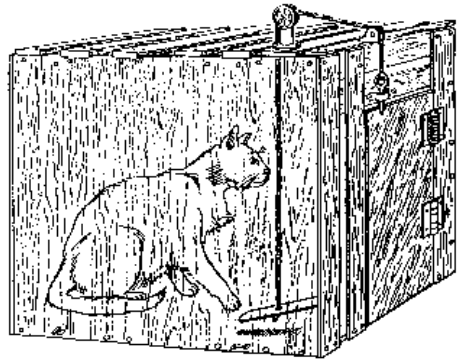
between events



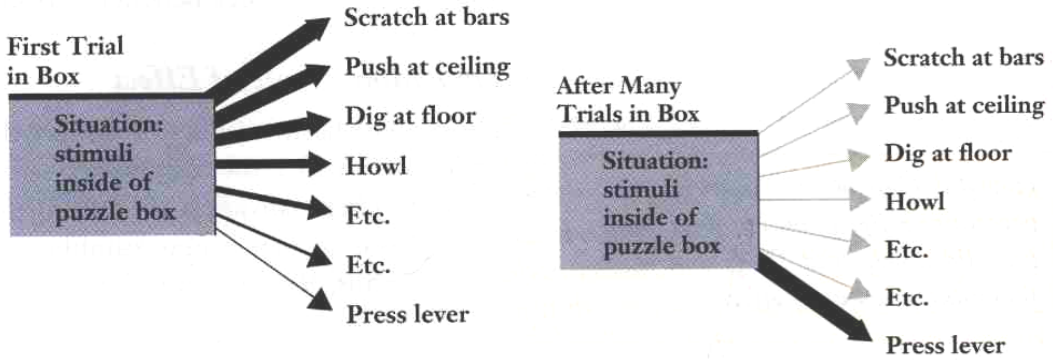
Classical Conditioning

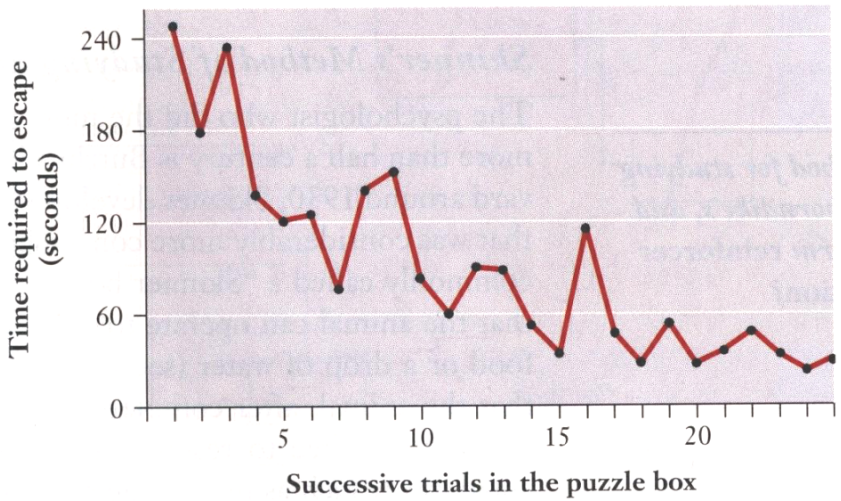
NO, WE CAN'T BEHAVIORISM – EARLY TO MID 1900S

Operant conditioning: focuses on how behavior is strengthened by presentation of positive reinforces (e.g. food), or withdrawal of negative reinforces (e.g. shock) Essentially, how behavior is shaped by reward and punishment.



Thorndike's puzzle box





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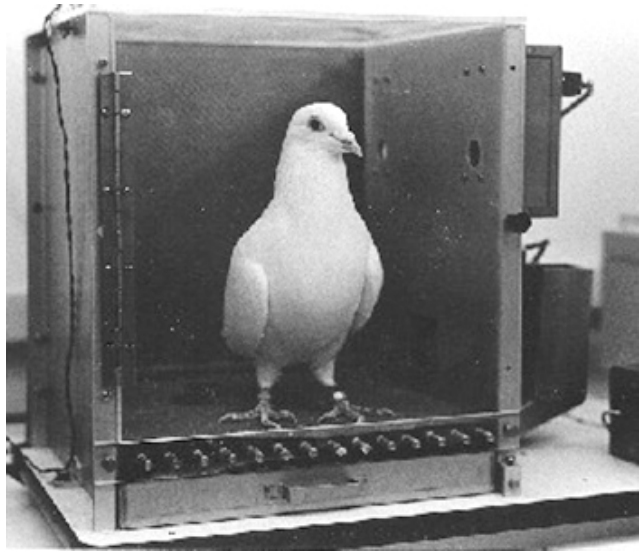
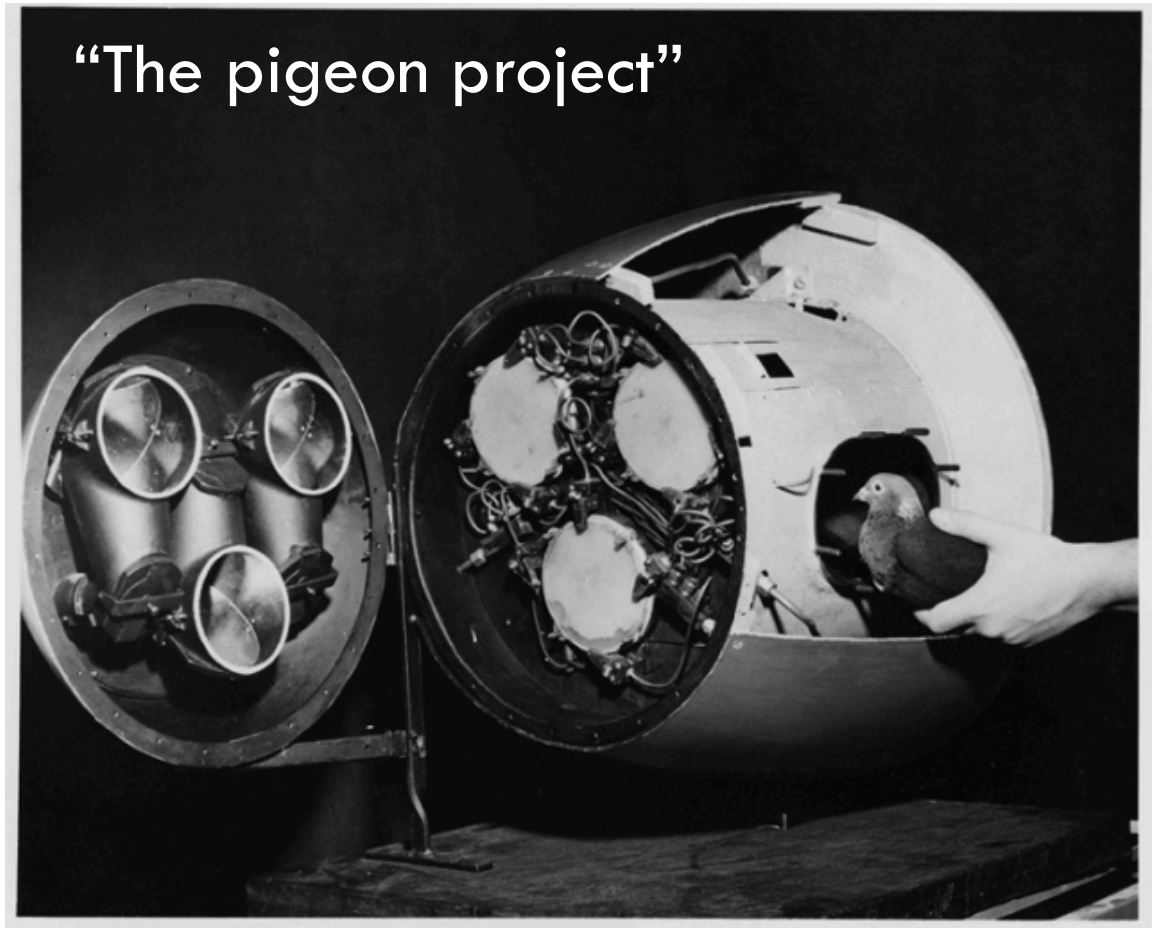
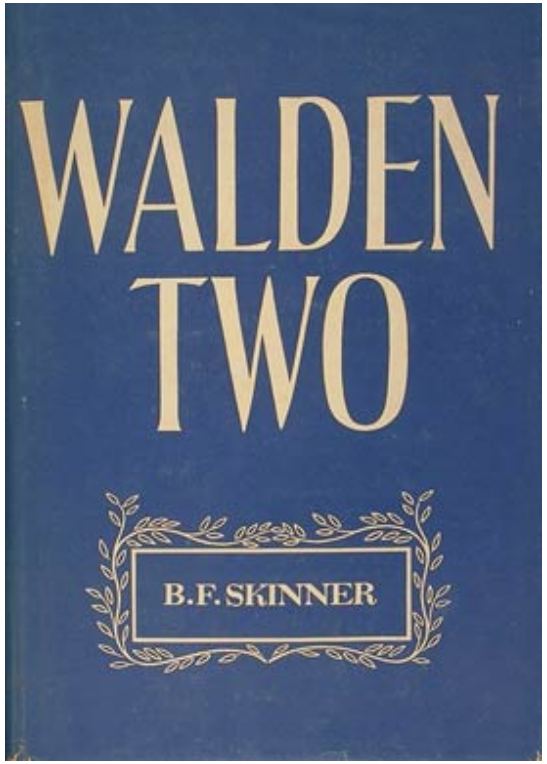
BEHAVIORISM – EARLY TO MID 1900S





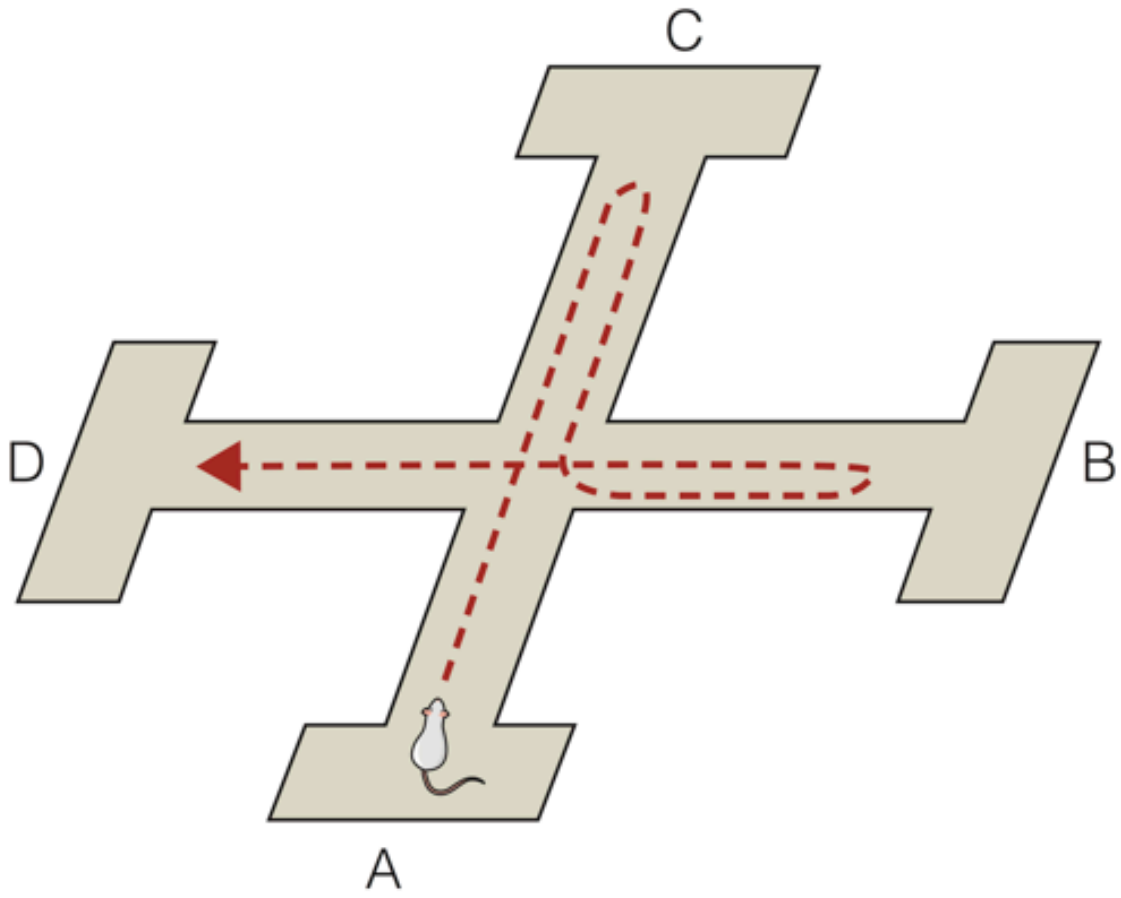


THE COGNITIVE REVOLUTION (1940S & 1950S)

Key things that spurred the cognitive revolution:

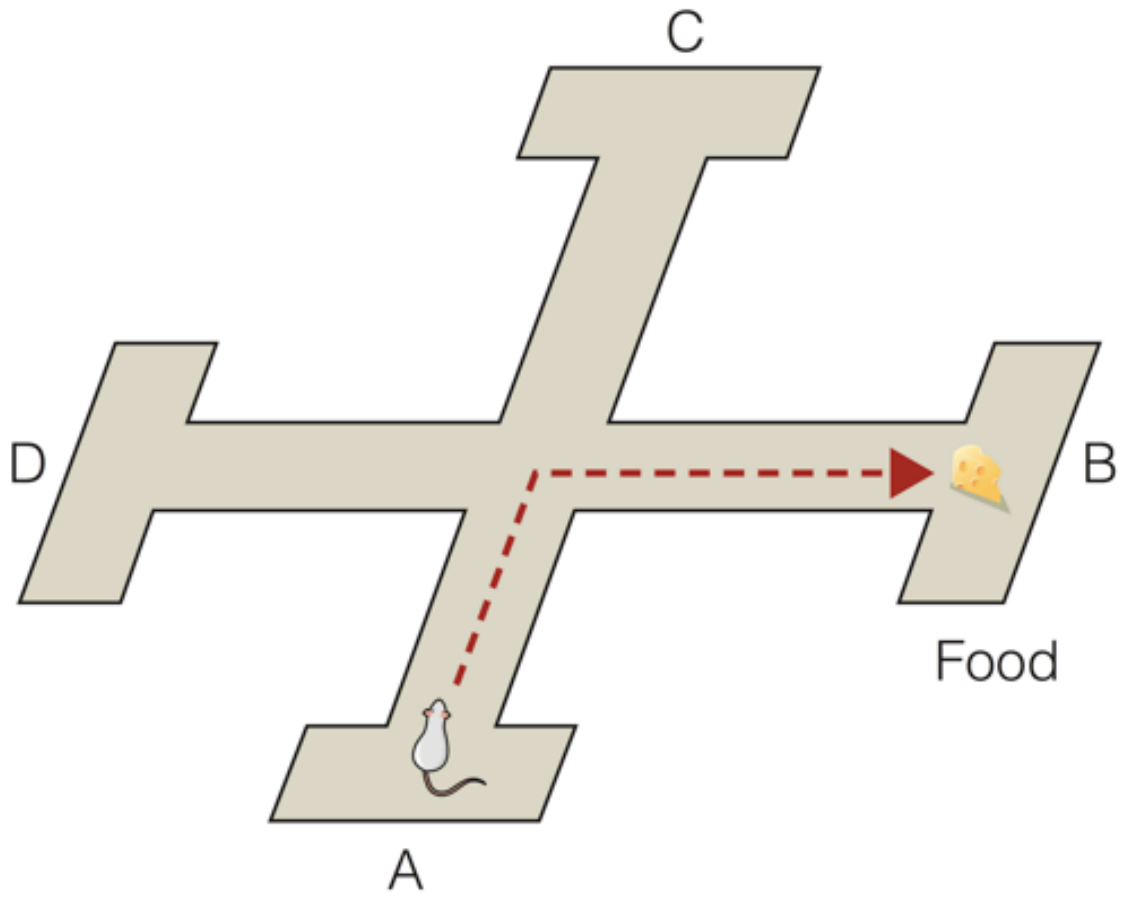
1. Behavior is often best explained by positing rich internal states
   - Tolman (1948)
   - Chomsky (1959)
2. The digital computer
3. New methods/approaches to studying the mind
   - A case study: Shepard and Meltzer (1971)
   - Cognitive Models

COGNITIVE REVOLUTION: TOLMAN'S MAZE (1948)



(a) Explore maze

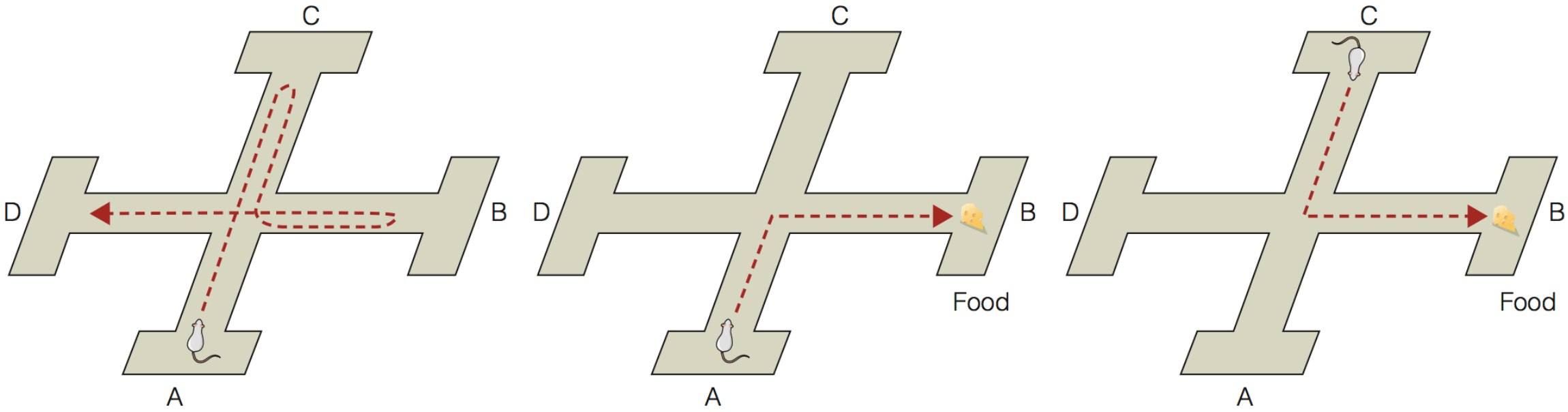
COGNITIVE REVOLUTION: TOLMAN'S MAZE (1948)



(b) Turn right for food

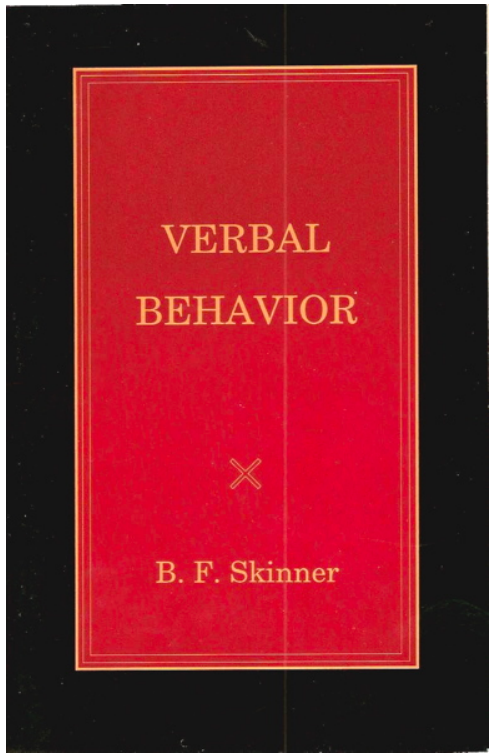
COGNITIVE REVOLUTION: TOLMAN (1948)

Tolman proposed the rat had formed a **cognitive map,** a concept of the maze's layout *inside the rats mind*.



(a) Explore maze **(b)** Turn right for food **(c)** Turn left for food

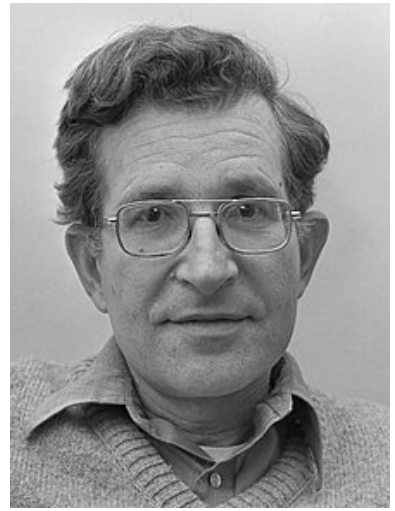
COGNITIVE REVOLUTION: CHOMSKY V. B.F. SKINNER



B.F. skinner → language is learned through operant-conditioning (reinforcement)

Noam Chomsky publishes scathing review of *Verbal Behavior*

- Kids produce all sorts of speech they never hear and are never rewarded for ("I braked it", "I hate you mommy")
- Led psychologists to reconsider the idea that language (and other complex behavior) can be explained by operant conditioning
- To understand complex abilities it is necessary to consider what this observable behavior tells us about how the mind works



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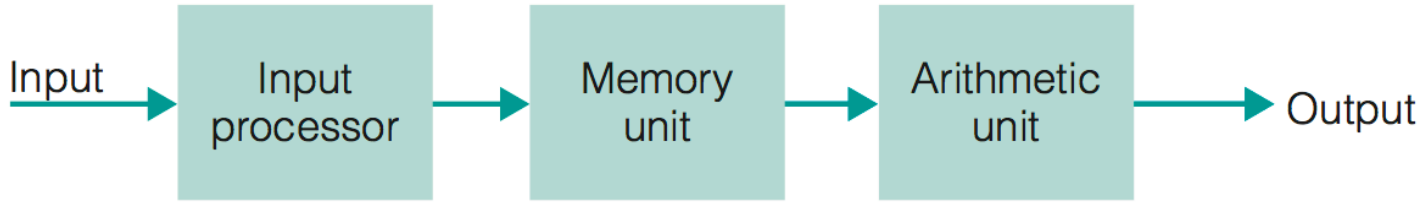
COGNITIVE REVOLUTION: THE DIGITAL COMPUTER

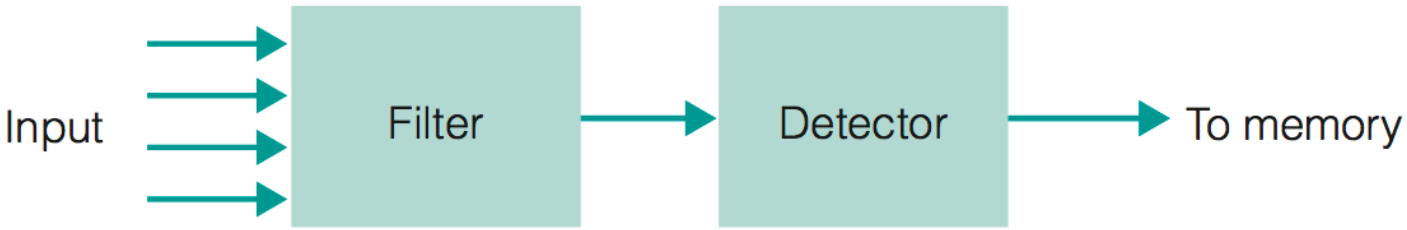
- Suggested new way of thinking about the mind

- The **Information-processing approach** traces sequences of mental operations involved in cognition

flow diagrams for computers



*Donald Broadbent (1958) proposed the first **flow diagrams for the mind** to represent attention*



COGNITIVE REVOLUTION: THE DIGITAL COMPTUER

- *1956: the "birthday of cognitive science"*
  - *Summer research project on artificial intelligence (1956)*
  - *Massachusetts Institute of Technology Symposium on Information Processing (1956)*

- *Could we program a computer to mimic the operations of the human mind?*
- *Logic theorist (Newell & Simon, 1956)*

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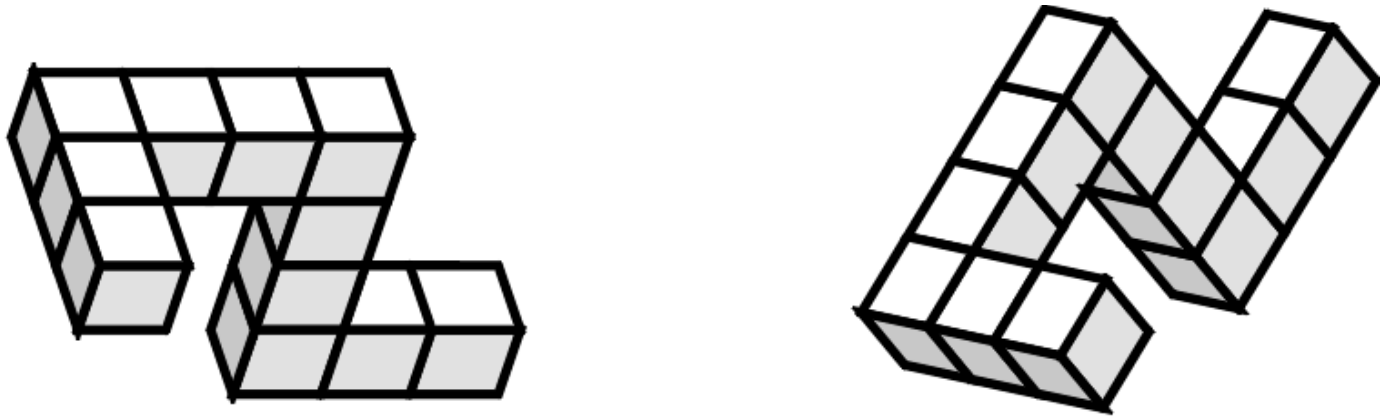
COGNITIVE REVOLUTION – NEW APPROACHES

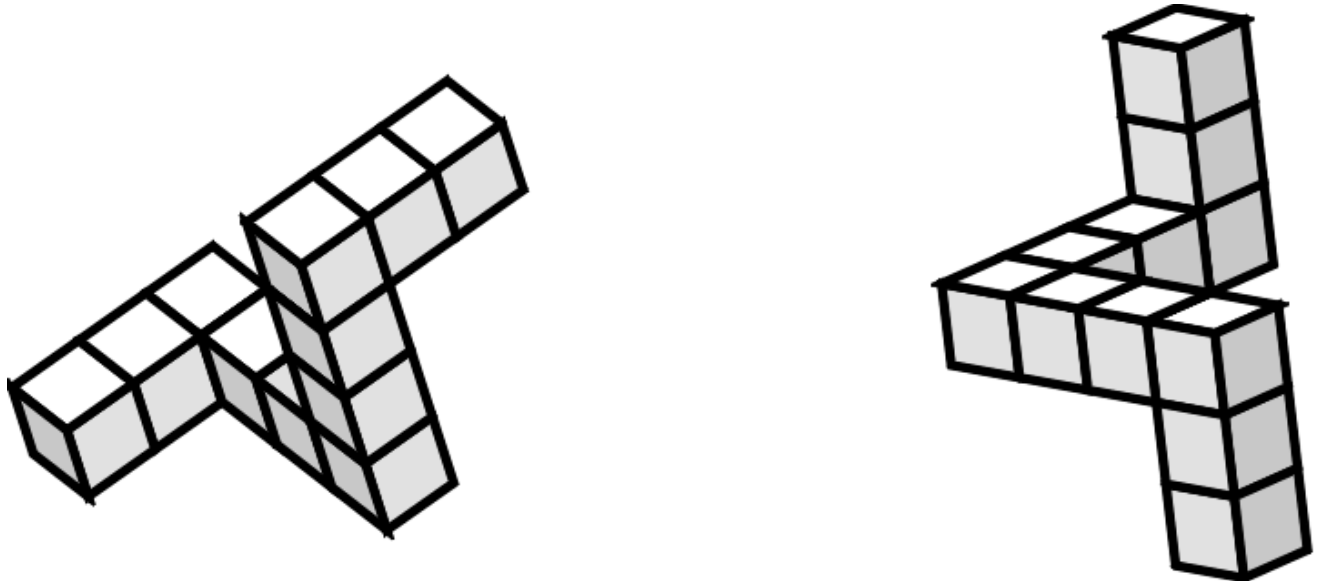
Shepard and Metzler (1971)



SAME OR DIFFERENT?

COGNITIVE REVOLUTION – NEW APPROACHES

Shepard and Metzler (1971)



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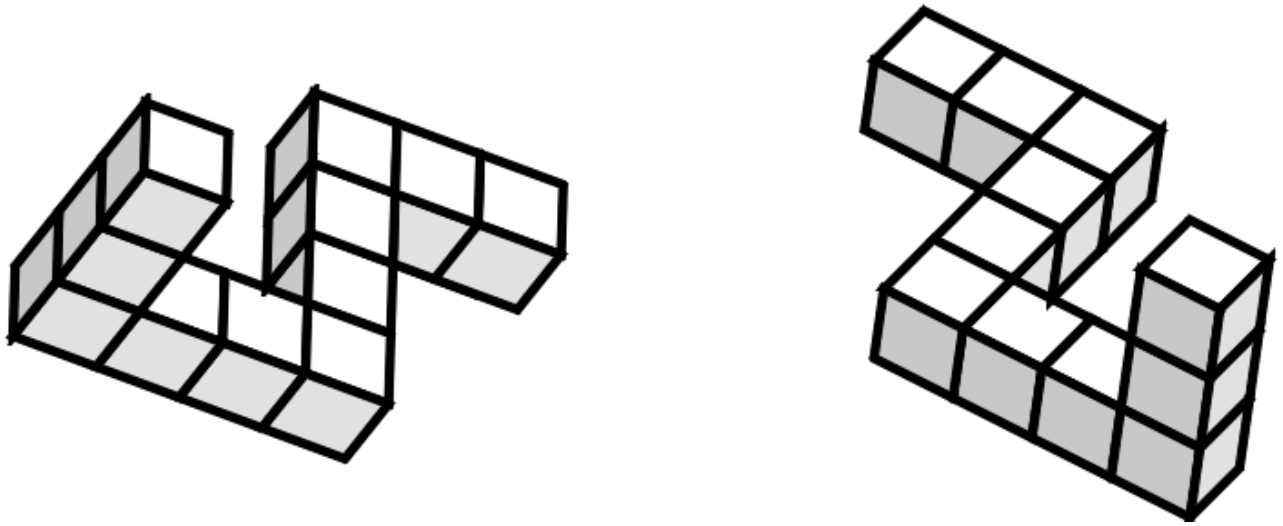
COGNITIVE REVOLUTION – NEW APPROACHES

Shepard and Metzler (1971)



SAME OR DIFFERENT?

COGNITIVE REVOLUTION – NEW APPROACHES

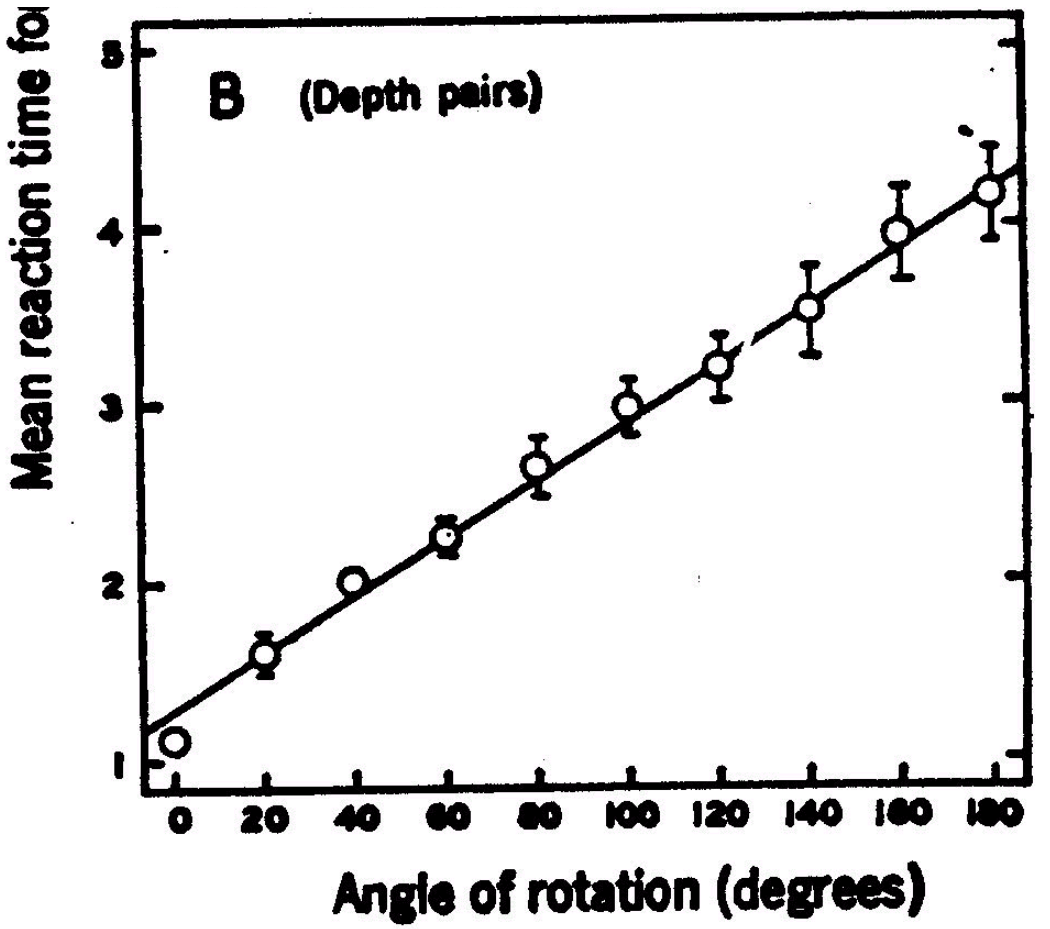
People are slower to respond if the two figures are rotated further from each other (and it's perfectly linear!)

Manipulating mental images takes time

Quantitative measure of *mental imagery*! –A case study in how mental events can be studied scientifically

Compare to introspection approach

(e.g. "clear", "fuzzy")



COGNITIVE REVOLUTION – NEW APPROACHES

Two key ideas in cognitive science/psychology:

- We must study the mental world to understand behavior
- We cannot study the mental world directly

Transcendental method

- Often called "Inference to the best explanation"
- Reason backward from observations to infer the cause
- Observable effects from an unobservable cause

Inferences from the visible to the invisible

- Detective solving a crime
- Physicist studying electrons

COGNITIVE REVOLUTION – NEW APPROACHES

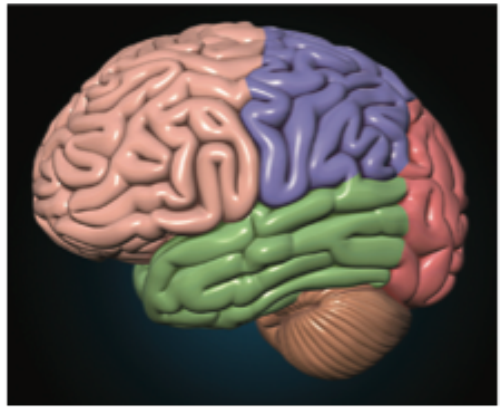
Cognitive models are representations of structures or processes that help us visualize or explain the structure or process.

- Structural models
- Processes models

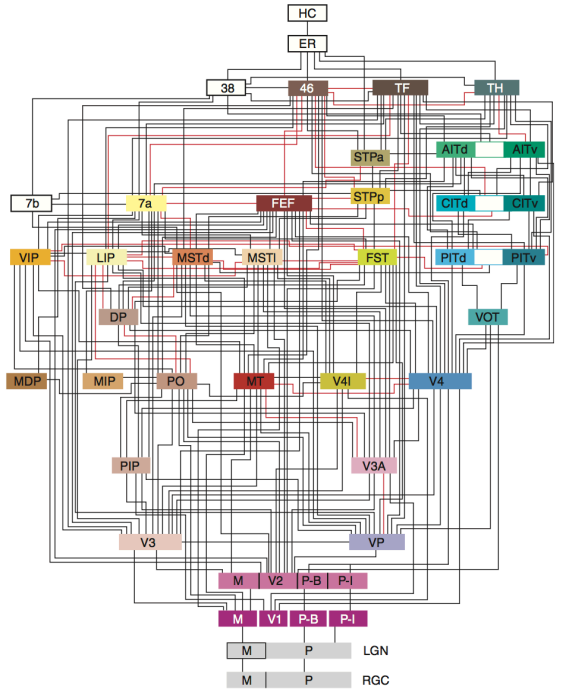
- Models are not identical representations
  - "Essentially, all models are wrong, but some are useful" – George Box

COGNITIVE REVOLUTION – NEW APPROACHES

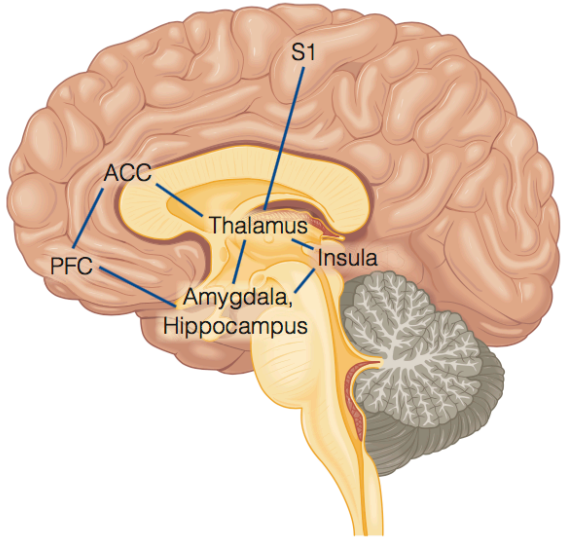
Structural models: representation of a physical structure.



A plastic model of the brain illustrations locations of different brain structures



A model of the visual system representing *connections* between structures

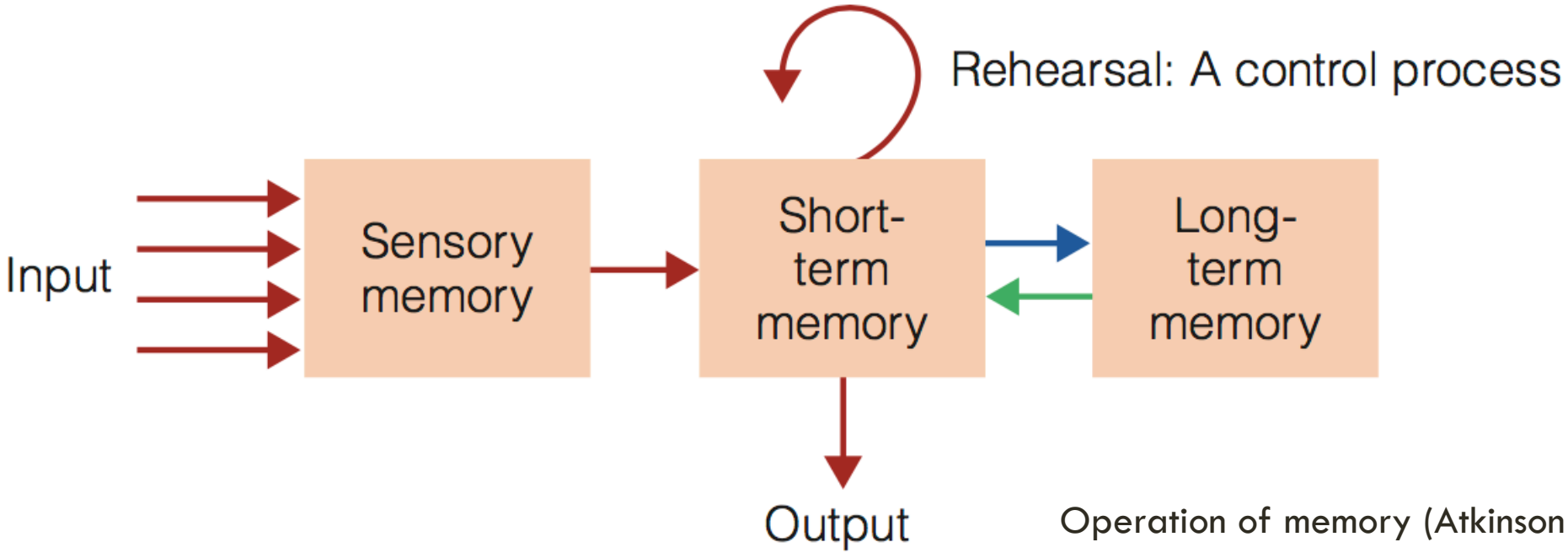


Most are designed to represent the structures invovled in a specific function, eg. this model of the pain matrix

COGNITIVE REVOLUTION – NEW APPROACHES

Process models represent the processes that are involved in cognitive mechanisms, with boxes usually representing specific processes and arrows indicating connections between the processes

Attempt to make complicated systems easier to understand and provide a starting point for research



Operation of memory (Atkinson & Shiffrin, 1968)