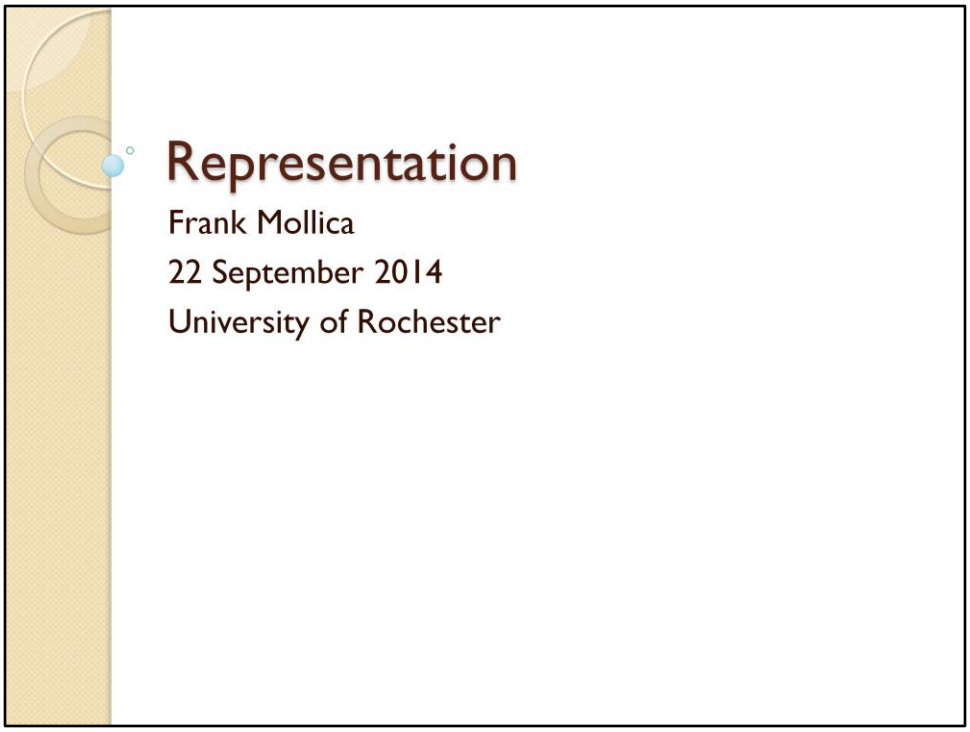
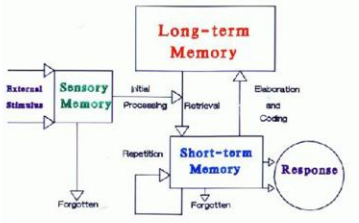
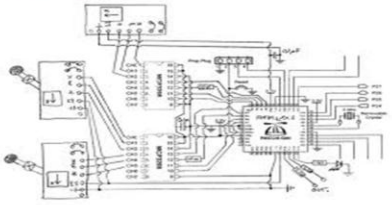
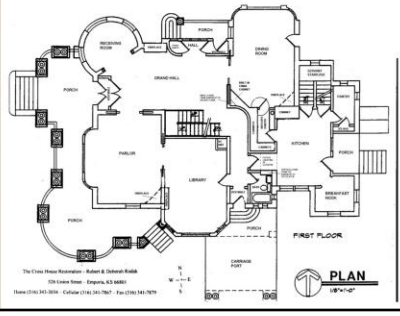


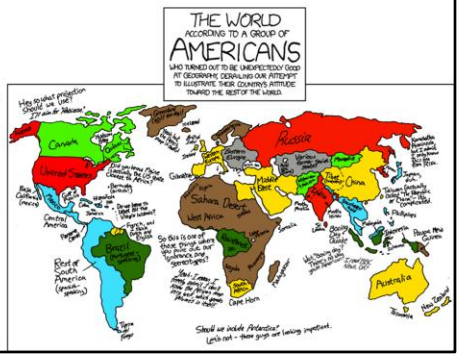
Given the historical readings, my goal is to address the questions: What do scientists mean when they say representation across time. I also want to briefly touch on the significance of representations for cognitive science.

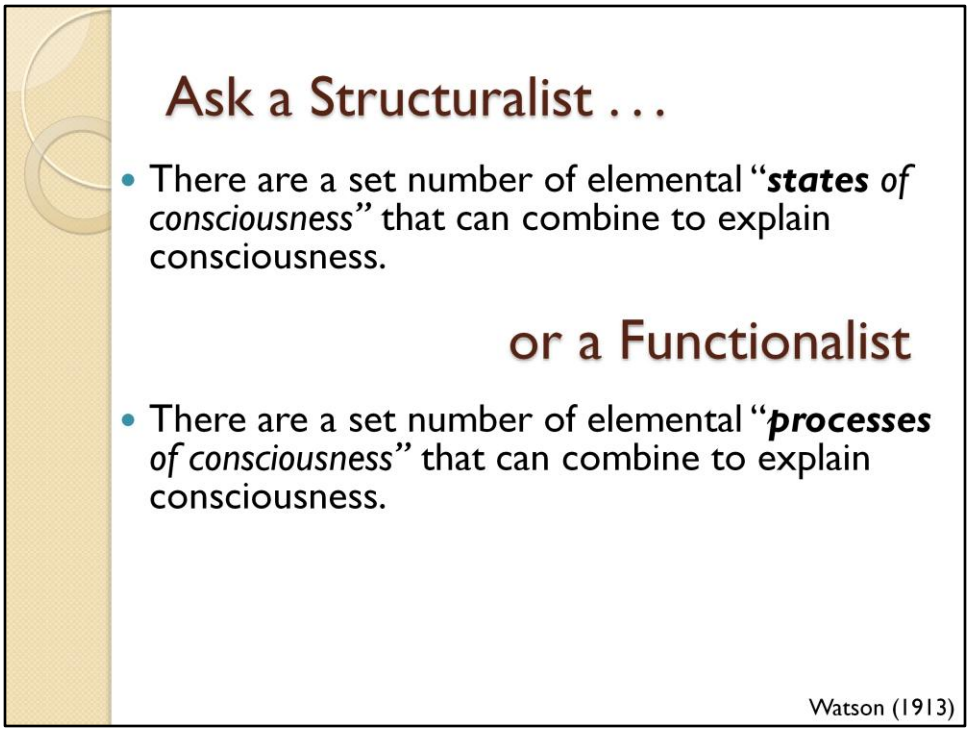
What do scientists mean when they say *representation*?









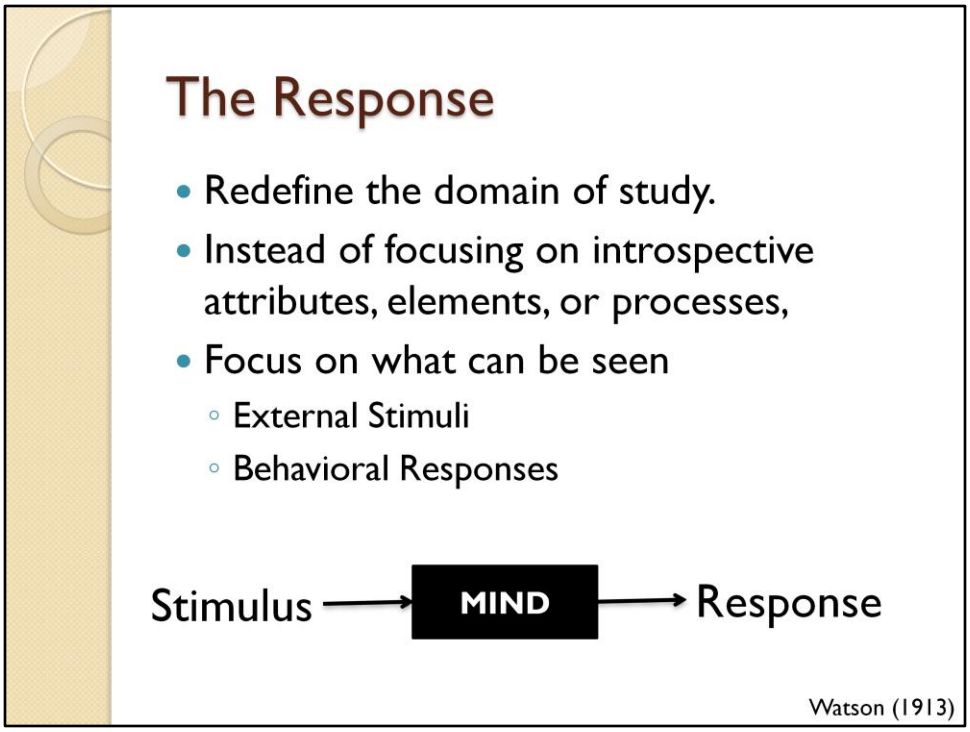


To name a few: quality, extension, duration, intensity. But if you ask another order, clarity, etc.

Implications for Animal Studies

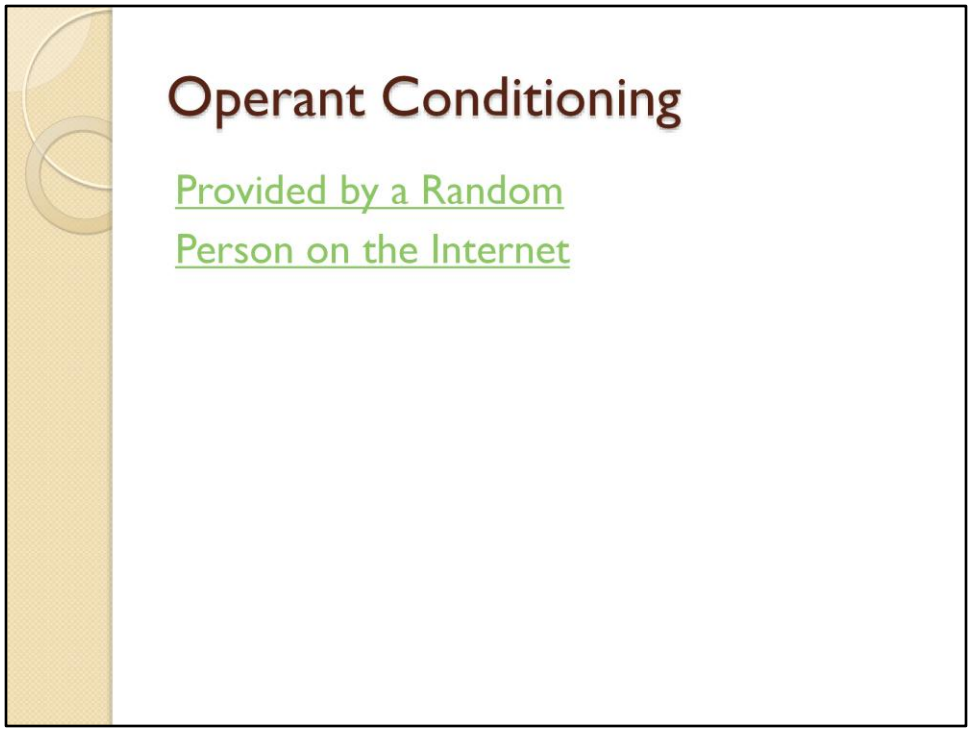
- Consciousness is the tool and the phenomena of study
- Data only has value as it licenses the analogy to human consciousness
- Non-replicability = Faulty Introspection

Watson (1913)

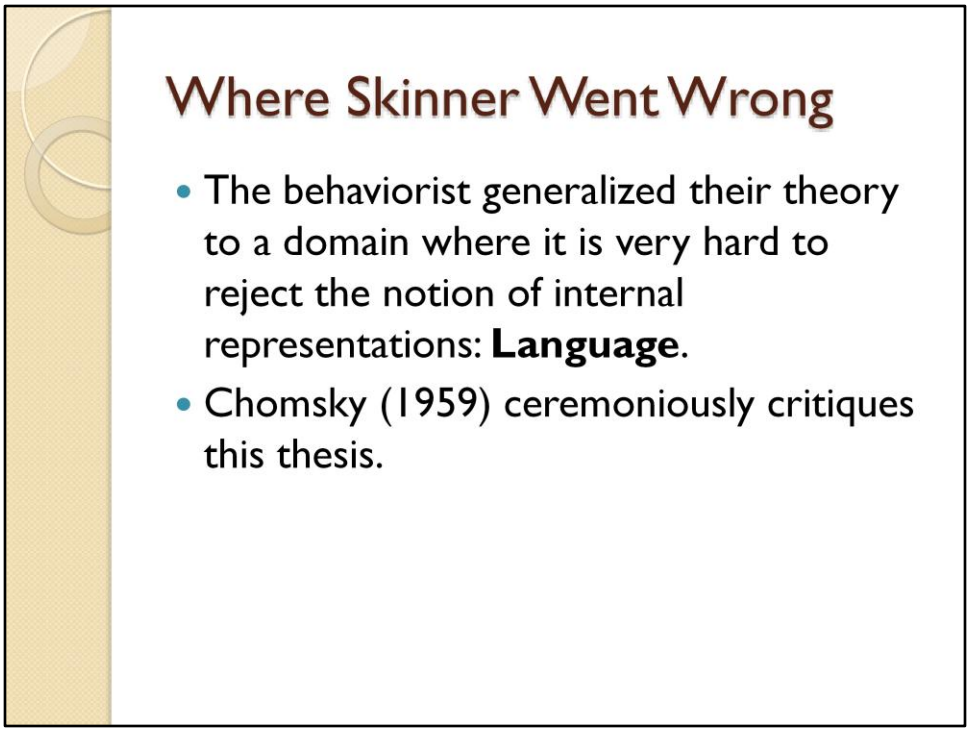


Basically we have removed internal mental representation from the domain of study! Oh no, why am I standing here trying to talk to you about mental representations it's all over!

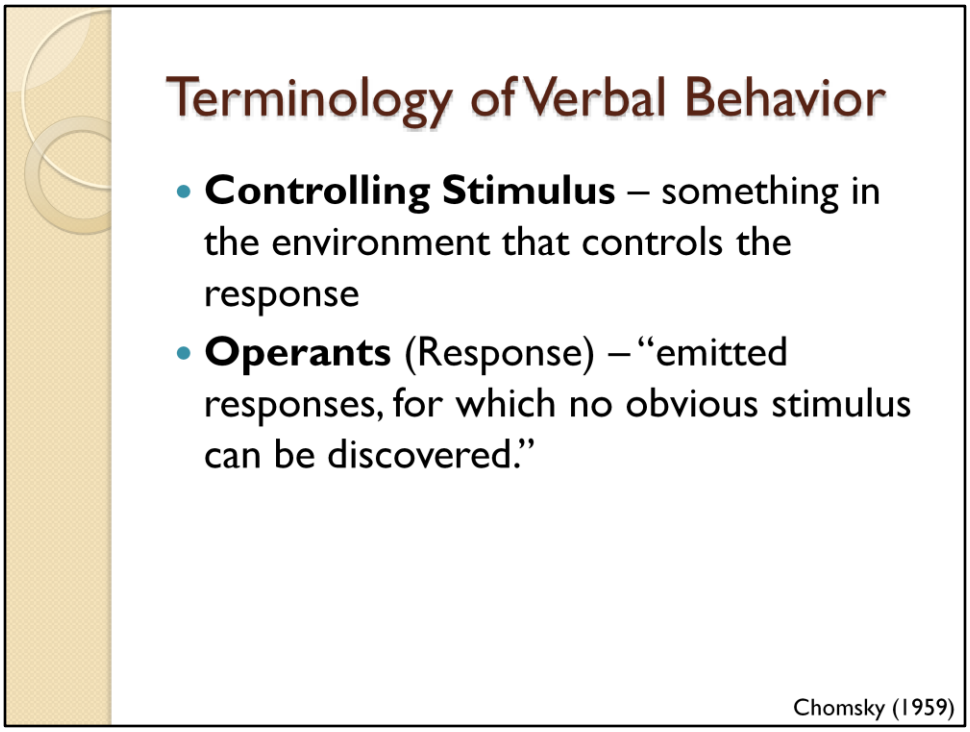
Little Albert (Watson & Rayner, 1920)
US → UR : loud noise → fear
NS → null : white rat → no response
US + NS → UR : white rat + loud noise → fear
Rinse and Repeat
CS → CR : white rat → fear



Statistical Rigor!
Does a good job!

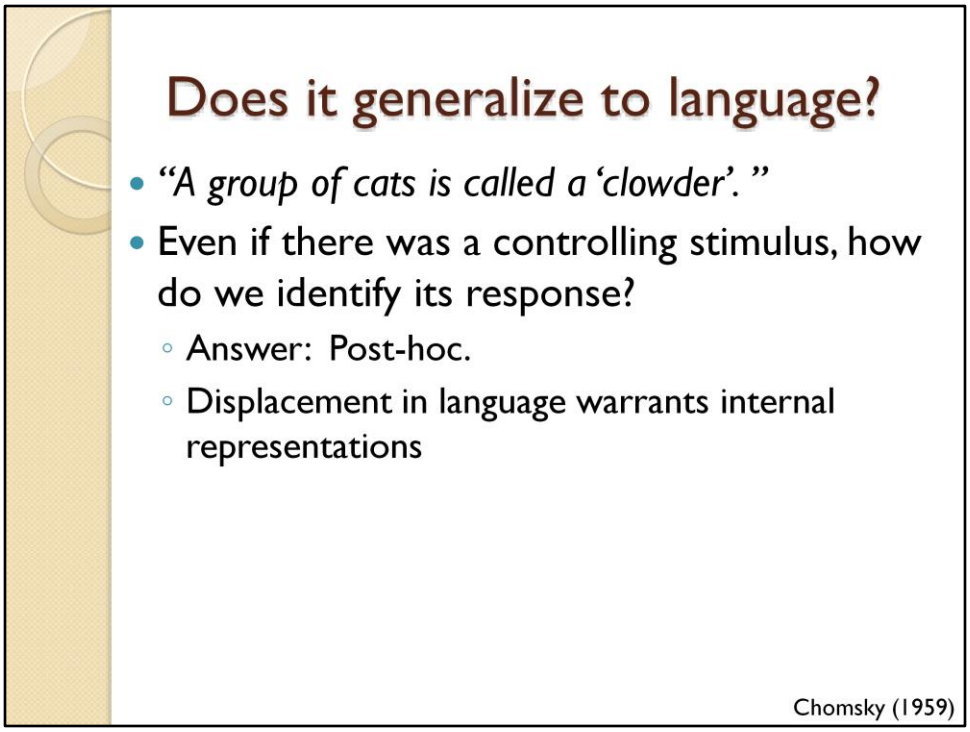


If you haven't read the supplemental, that is a classic paper in language and cognitive science.
Caveat about Strawmen!
The arguments for Skinner's application to speech is well motivated when you look at the evidence he presents.



Narrow (lawful): In the presence of a stimulus, a particular predictable response is realized.
Broad: Something in the environment caused the response.

The not obvious stimulus for operants is normally a reward?



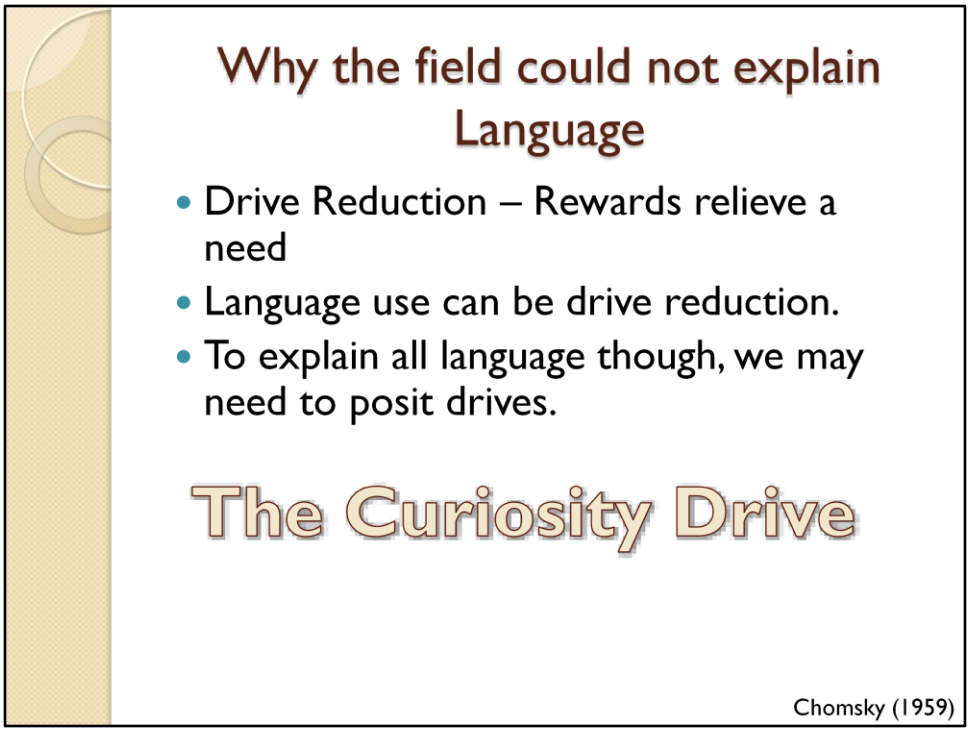
What is the controlling stimulus of my random cat facts?

It is easy to build a strawman and knock it down, but by limiting the evidence Skinner used to build his argument, it is clear that he overgeneralizes his hammer.

Verbal Behavior: Reinforcement

Chomsky (1959)

The application to speech was well motivated, the reinforcing quality of speech was it's ability to affect changes in reality



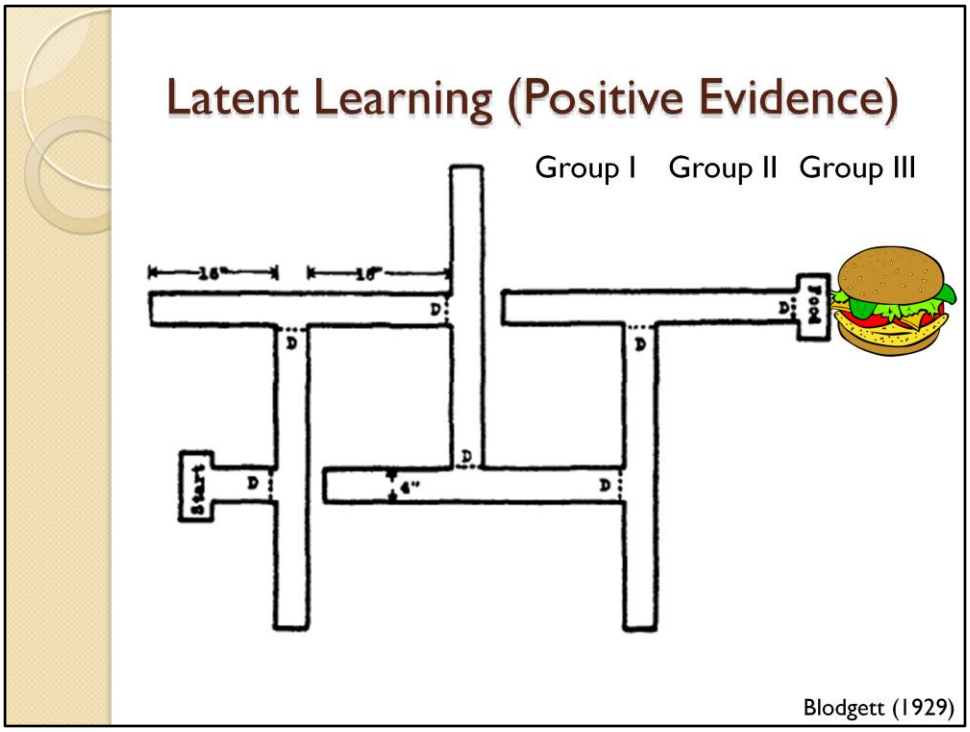
Putting Skinner and operant conditioning aside, the field believed that drive reduction could explain behavior (meaning no need for int rep)?
Bottom Line: Behaviorism cannot explain language. We need internal mental representations. And this was being acknowledged by certain "behaviorists"

Edward Tolman "The Behaviorist"

- Two camps
  - Switchboard Operator (Reflex Chains)
    - ↑ ↓ ↑ ↓ ← → ← → (B A …)
  - Field Maps (Internal Representations)
    - Latent Learning (Positive Evidence)
    - Latent Learning (Negative Evidence)
    - Searching for the Stimulus
    - Spatial Orientation

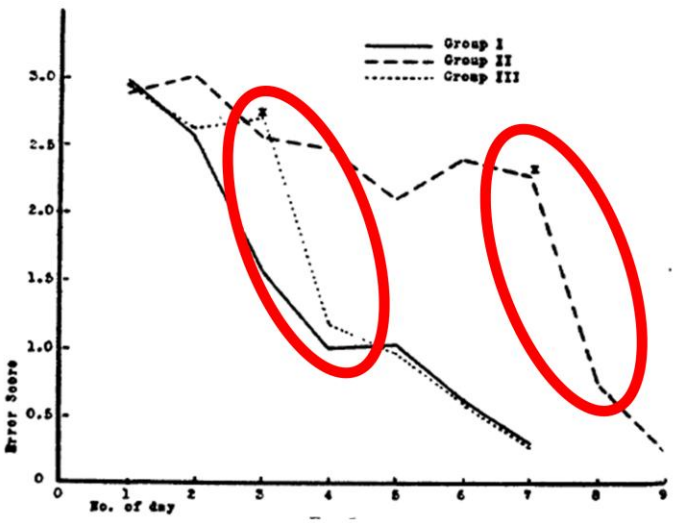
Tolman (1948)

Positive Evidence means learning to reach X.
Negative Evidence means learning to avoid X.

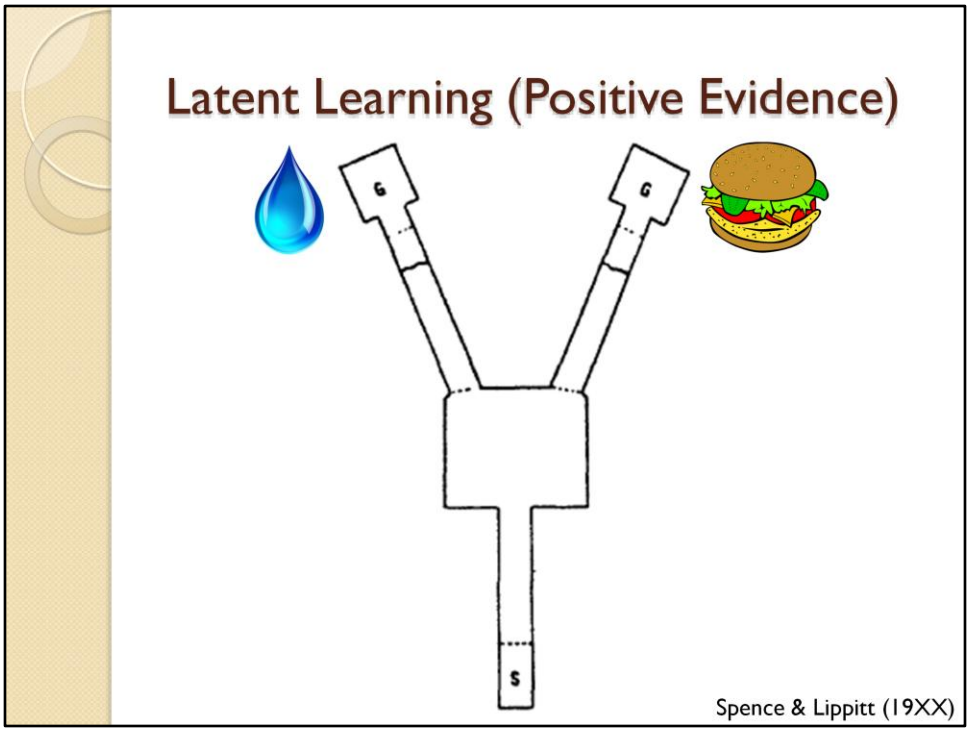


One trial per day
Group I (Control) → Food @ goal every day
Group II (7 days) → Fed in cage for 6 days, food @ goal on day 7
Group III (3 days) → Fed in cage for 2 days, food @ goal on day 3

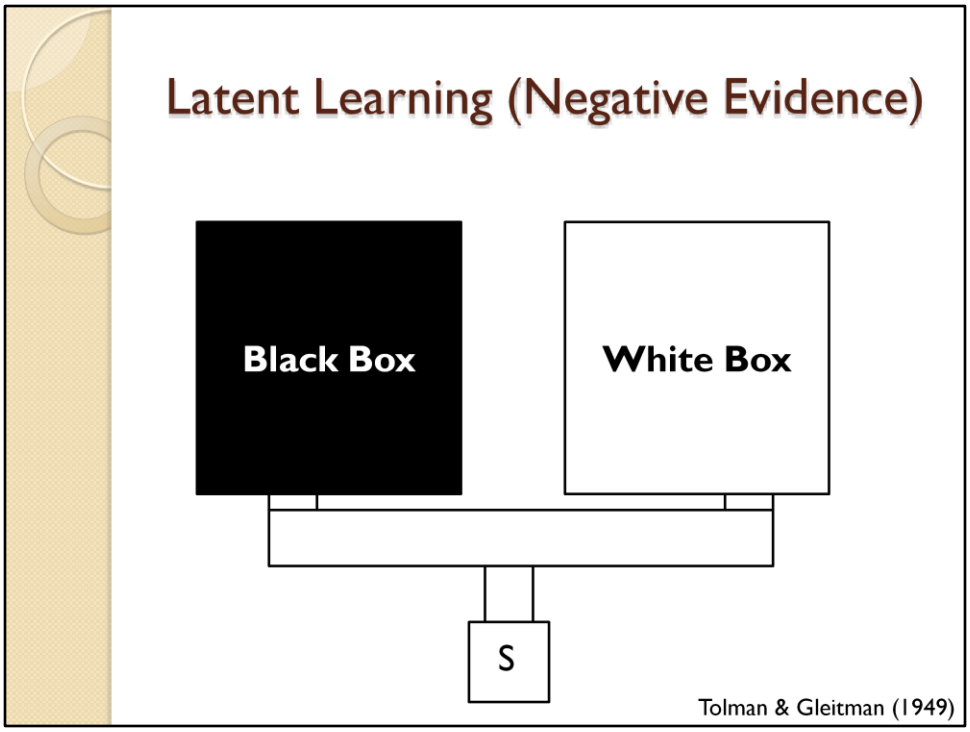
Latent Learning (Positive Evidence)



Blodgett (1929)



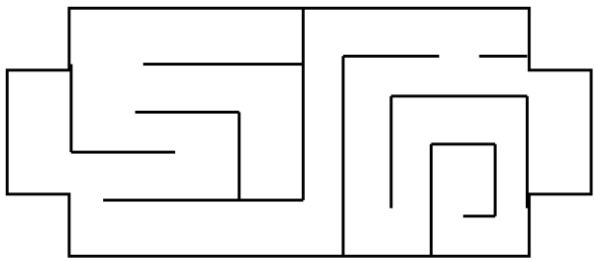
Always satiated before entry to maze. Reward for maze was friend time.
Trained for a week, 4 trials per day. Food and water were counterbalanced but more frequently in one location than the other.



Forced exploration of both boxes
In the detached goal box, animals were shocked
Placed in the maze, most went to the non-aversive box.
Starved One mouse made the wrong decision, realized it before the box, squealed, became visibly distressed and eventually ran back the other way

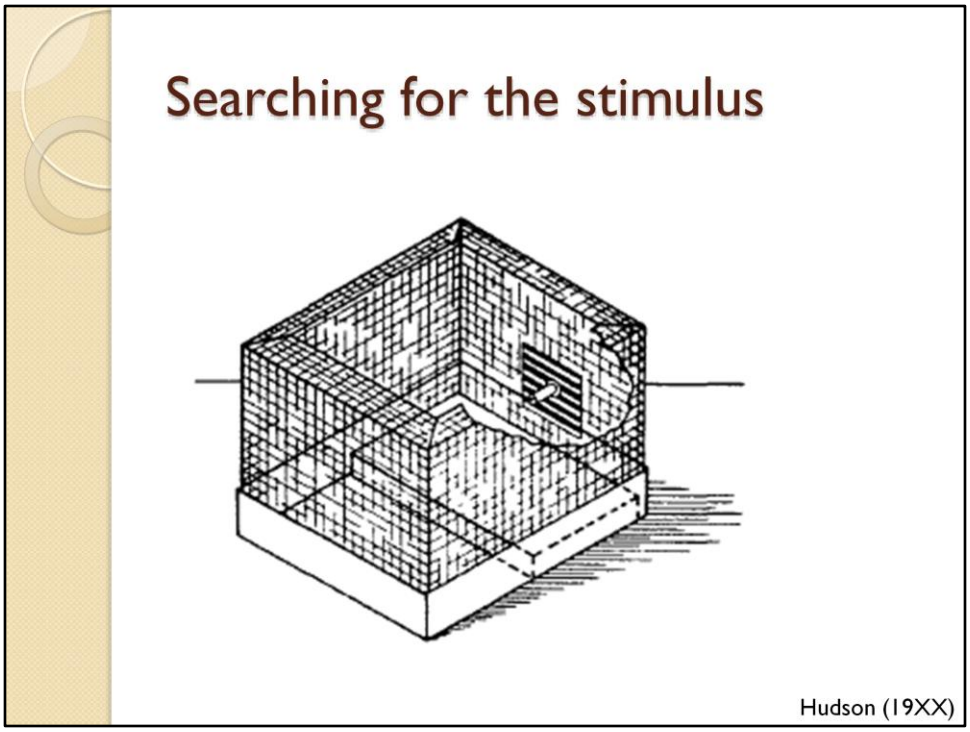
What does this tell us about Representations?

- Rats learn more than just the reflex chain!
- But how far does this field representation or cognitive map go?



Maybe, it might just be that the rats learned several reflex chains
Do we encode stimulus in the environments?
How deeply do we encode these stimuli

Stay tuned . . .



Single Trial Avoidance.

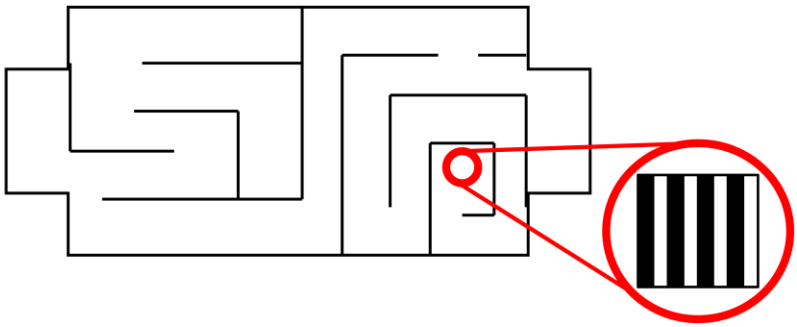
Eat from pattern food → Shock → Avoidance

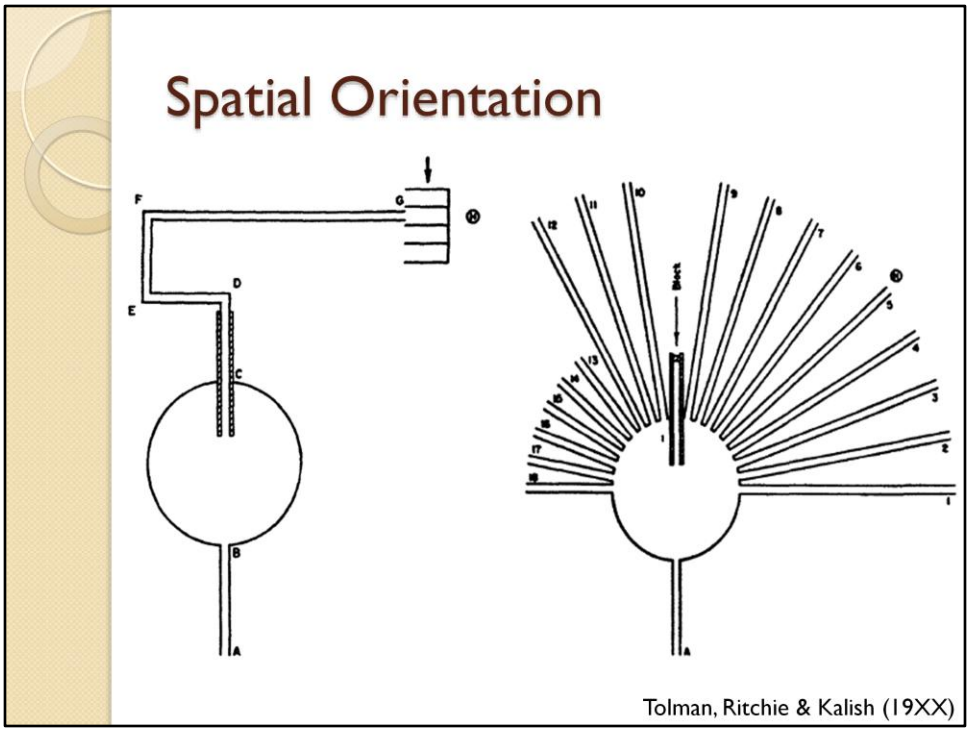
What they are avoiding?

Eat → Shock → Blackout + Pattern (disappear) → No Avoidance

What does this tell us about Representations?

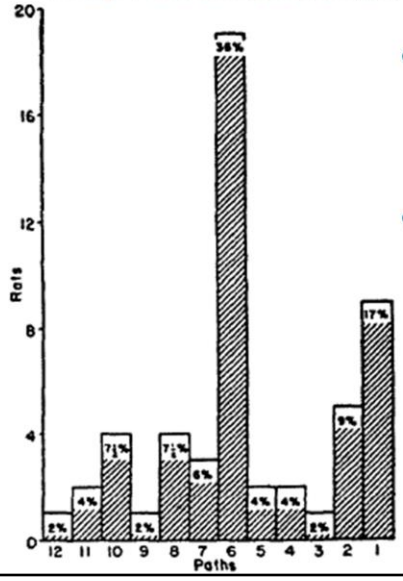
- Rats look for stimuli to encode into their cognitive map!



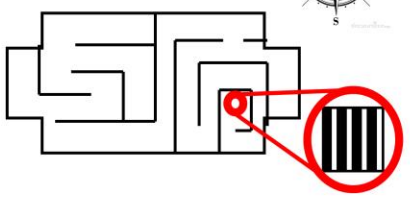


Trained 4 nights, 3 trials per night on the left maze and food was rewarded
Then let loose into the mohawk maze. Walked a few inches and doubled back decided on 1 path.
Histo

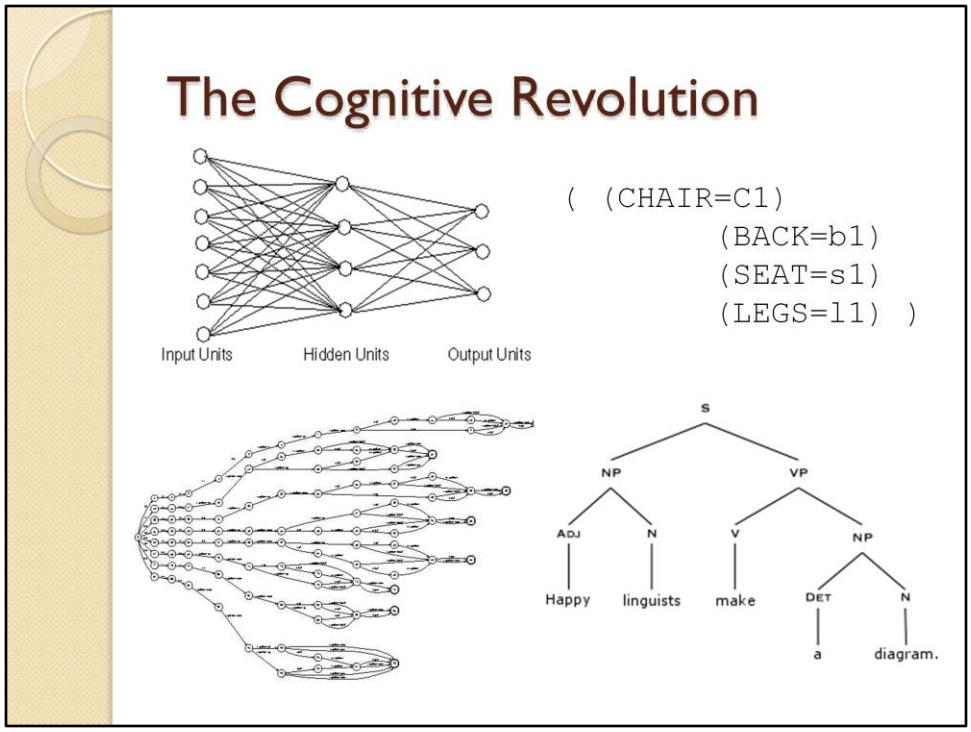
What does this tell us about Representations?



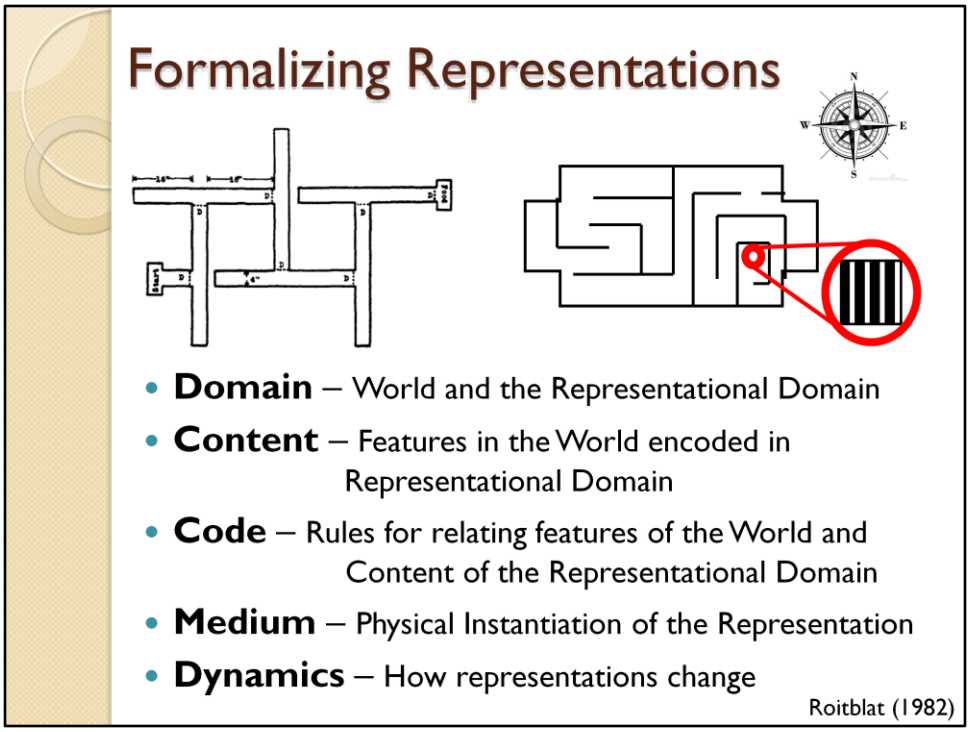
- Rats encode maps, relevant stimuli and spatial orientation.
- Cognitive Maps



Tolman, Ritchie & Kalish (19XX)

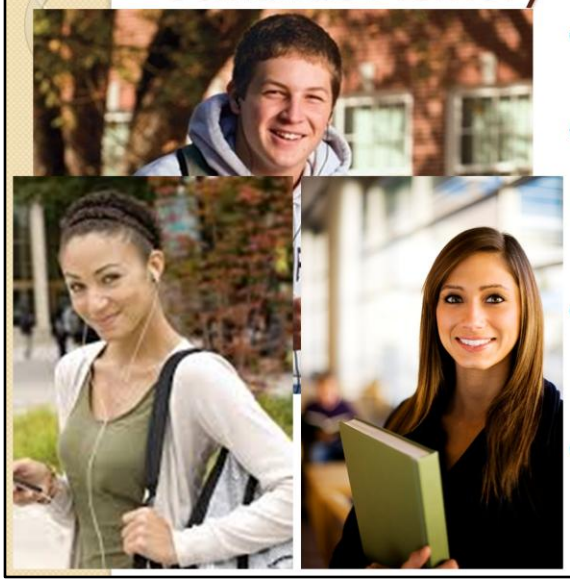


Connectionist Models
Feature Lists
Finite State Autotomata
Syntactic Tree Parsing



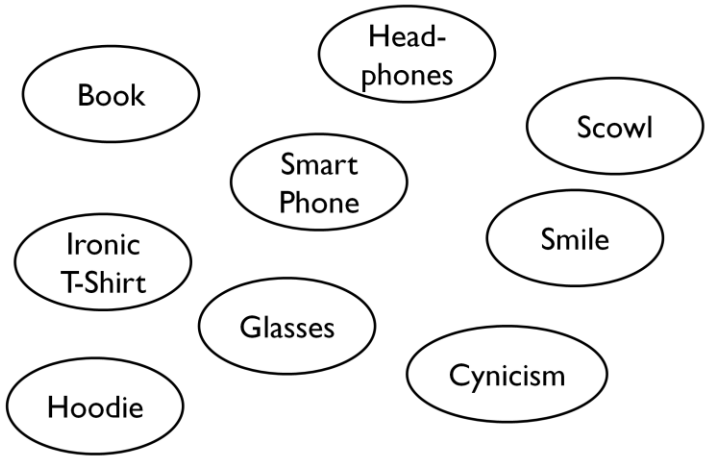
Domain – World and the Representational Domain, but the representational domain is not the full picture of the world. It is delimited by things such as task or features. Why would we want to store the color of the maze? Why might we have wanted to store the illumination of the maze? Based on task, different things are considered in our representational structure.
Content – The features of the represented world that are preserved in representation and any dependecies or information that can be derived from it.

Case Study: Feature Based Model of Semantic Memory

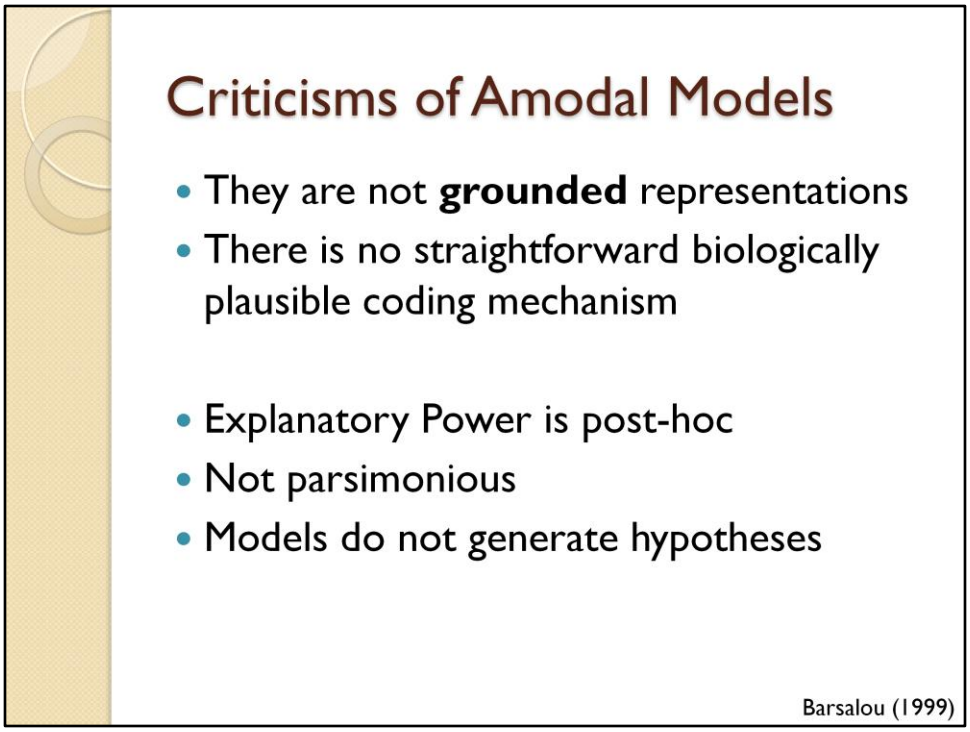


- **Domain**: Identifying fake college students
- **Content:** Book, backpack, smile, headphones, smart phone, hoodie
- **Code**: Salient features get represented
- **Medium**: *<unspecified>*

Case Study: Feature Based Model of Semantic Memory

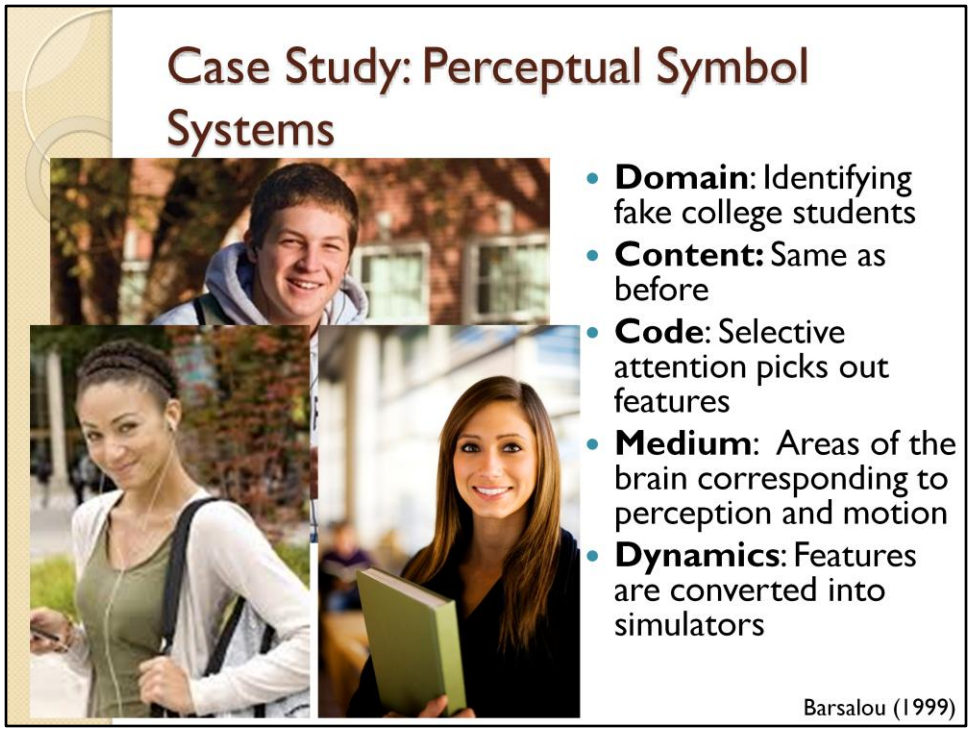


McRae, de Sa, Seidenberg (1997) ; Tyler & Moss (2001)



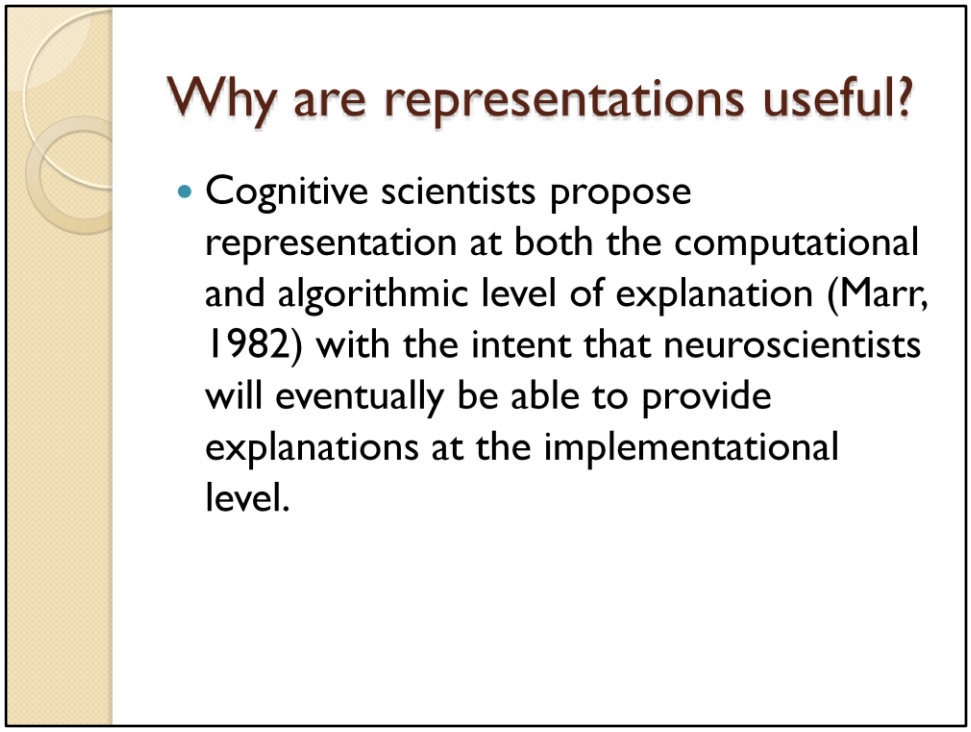
Caveat – Strawman coming up!

This is actually oversimplification (assumed the brain and Hebbian learning) but that is how most strawmen are formed in the introduction of a paper.
Issue of Medium



Not a recording system but an actual conceptual system

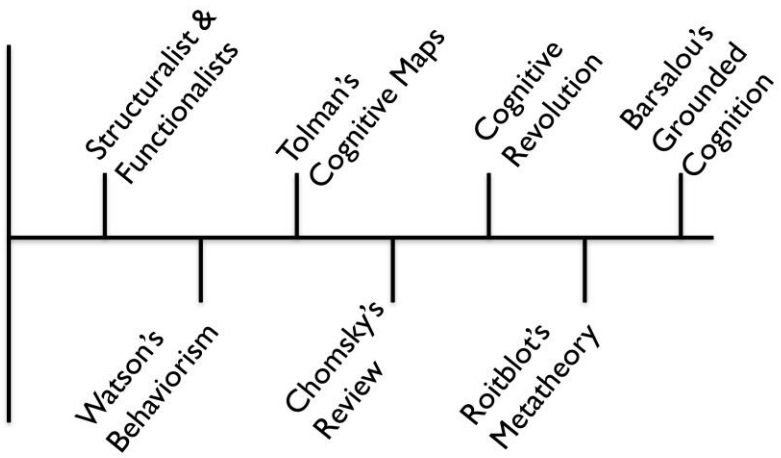
Case Study: Perceptual Symbol



Having representations and proposing changes in representations via mental processes informs the questions that cognitive neuroscientists ask.

Conclusions

- What is a representation?



Conclusions

- Structuralists & Functionalist
  - There are a set number of elemental "***states / processes*** *of consciousness*" that can combine to explain consciousness.
- Watson's Behaviorism
  - Complete **rejection** of internal mental representations
  - Introduced meaningful applications of psychology to the world.

Conclusions

- Tolman's Cognitive Maps
  - Rats have internal mental representations, or **cognitive maps** that include relevant stimuli and are not fixed in spatial orientation.
- Skinner's Verbal Behavior & Chomsky's Review
  - While Skinner's generalization of operant conditioning to language has modest evidence, language cannot be completely explained without internal mental representations.

Conclusions

- The Cognitive Revolution
  - Multiple models, or representational systems, were created based on analogies made to programming languages, linguistics, and formal logic.
  - Most of these models are amodal.

Conclusions

- Roitblot's Metatheory of Representation
  - Domain- the world and the task to be modeled
  - Content- the features of the world represented in the model
  - Code- the rules to go from features in the world to features in the model and vice versa
  - Medium- the physical instantiation of the model
  - Dynamics- how representations change over time

Conclusions

- Barsalou's Embodied Cognition
  - Amodal models typically do not specify their medium.
  - Amodal models do not always specify biologically plausible methods of encoding representations
  - The Embodied Cognition Hypothesis specifies medium and biological encoding as the perceptual system.

Summarizing with the weaker hypothesis

Conclusions

- Why have representations?
  - Representations bridge the gab between Cognitive Science and Neuroscience