

COGS 101B

- Web Page
 - <http://www.cogsci.ucsd.edu/~coulson/101b/>
- Instructor
 - Dr. Coulson
 - Email: coulson "at" cogsci.ucsd.edu
 - CSB 161
 - Thursday: 12-2pm
- TAs
 - Alan Robinson
 - Nate Harrison
 - Zack Weinberg

Slides

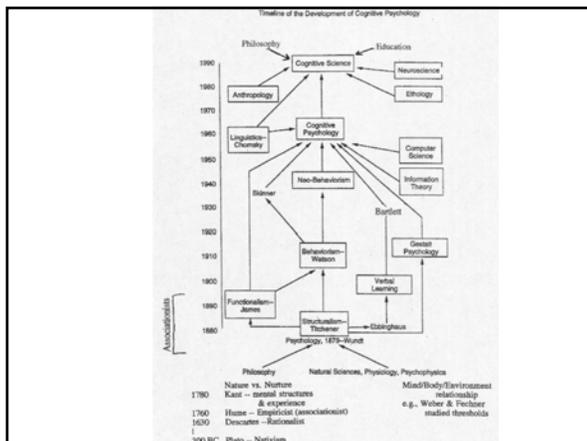
- PDF version of Powerpoint slides available on the course website
 - <http://www.cogsci.ucsd.edu/~coulson/101b/>

Outline

- History
- Methods
- Paradigms

History

- Philosophical Origins
- Structuralism
- Functionalism
- Gestalt Psychology
- Genetic Epistemology
- Behaviorism
- Cognitive Revolution



Descartes



- Epistemology
- Radical Skepticism
- Evil Demon
- “Cogito ergo sum.”
- Leap of Faith

Pros & Cons of Introspectionism

- Creative Synthesis
- Chief Virtue
 - Acknowledged volitional character of human behavior
 - Not mechanistic
- (Not Mechanistic)
- **Irrelevance:** cognitive processes not always available to consciousness
 - People confabulate
- Subjective
 - Not public
 - Not replicable
 - Often results in **contradictory findings**

Functionalism

- Psychology of mental *operations*
 - Not mental *elements*
- Evolutionary Motivation
 - Consciousness must have a function
- Consciousness still central
 - mediates between needs of organism and demands of environment
- Asks
 - What do people do?
 - How do they do it?
 - Why do they do it?

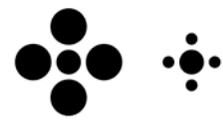
William James

- Dynamic, streaming quality of consciousness
- Consciousness central to life and biological survival
- Respect for individual differences
 - Different people arrive at the same conclusion via different paths
- Wrote *Principles of Psychology*



Gestalt Psychology

- Like functionalists, anti-reductionistic
- The whole of conscious experience is greater than the sum of its parts.
- Discovered many visual illusions
- Characterized principles of perception



Genetic Epistemology

- Piaget
- “Genetic”
 - Not just DNA, but genesis in the larger sense
- “Epistemology”
- Tenets
 - Knowledge arises out of action and has a biological function
 - Knowledge consists of cognitive structures
 - Change via assimilation, accommodation
 - Capacity for abstraction develops over the lifespan

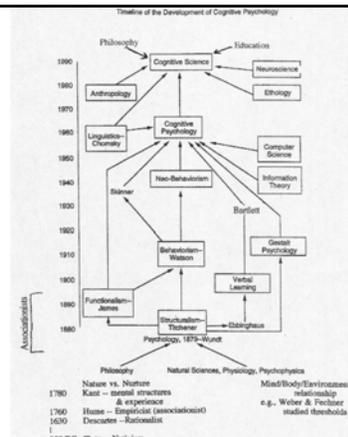
Behaviorism

- Empirically-based science of behavior
 - Experimental analysis of stimulus-response (S-R)
 - Dominant in American psychology
- Mental or cognitive phenomena are not good candidates for scientific inquiry
 - not meaningful to study
 - (almost) impossible notions for scientific investigation
- Carefully controlled lab studies of animal learning

Watson



- Attacked Introspectionism
- Concerned only with *external* behavior
- "...consciousness is neither a definite nor a usable concept."
- "dropped from his scientific vocabulary all subjective terms such as sensation, perception, image, desire, purpose, and even thinking"



Paradigms

- What is a paradigm?
 - Experimental paradigm: p
 - Scientific Paradigm: P

Cognitive Revolution

- Paradigms vs. Hypotheses
- Paradigms organize research programs
- Evaluated based on
 - popularity
 - internal consistency
 - consistency with facts

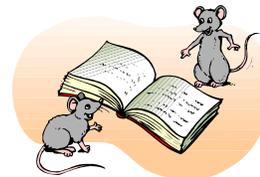
Downfall of Behaviorism

- Differences between animal species
- Need to postulate intervening variables
- Language behavior



Garcia Effect

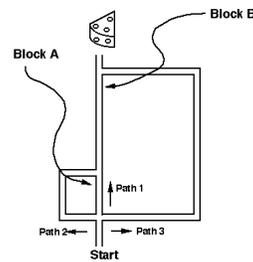
- Does learning proceed the same way in every species?
- *Are all stimuli & responses equally likely to be associated w/one another?*
- Radiation vs. Shock on Taste Aversion vs. Tone Aversion
- Rats drink sweetened water, hear tone
 - Some shocked
 - Some X-rayed (get sick)



Garcia & Koelling

| | | | |
|---------------------|--------------------|---------------------|--------------------|
| Shock | | X-Rays | |
| <i>Saccharine</i> | <i>Loud</i> | <i>Saccharine</i> | <i>Loud</i> |
| <u><i>Taste</i></u> | <u><i>Tone</i></u> | <u><i>Taste</i></u> | <u><i>Tone</i></u> |
| (no effect) | aversion | aversion | (no effect) |

Cognitive Maps



- Tolman's research suggests need for **intervening variables**
- S [int. var.] R
- Path 1 shortest
- A blocked, take 2
- B blocked, now what?
- Flood!!!

Chomsky's Critique



- Behaviorism OK in lab, but what about the real world?
- Painting is stimulus
 - It's Dutch.
 - It's hideous.
 - It's hanging too low.
 - I thought you liked abstract art.
- Concept of stimulus doesn't explain much

What constitutes reinforcement?



- "Your money or your life!"
- What reinforces "your life"?
- If Skinner says, "reinforcement can be imagined," he admits to mental events.

Unicorns

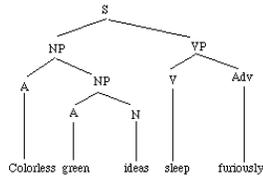
- How do people refer to non-observable phenomena?
- If stimulus must be present for conditioning, it can't explain most language use.



Creative Use of Language

- Most sentences are novel.
- When associated w/ a stimulus?
- "The ketchup bottle was being used as a weight to hold the money down, but when the ace of spades fell from his right sleeve, the bottle became a lethal weapon."
- Speakers can produce and comprehend an infinite number of sentences!!

Rules



- Words + Rules = Infinity
- A stimulus is tied to particular event
- A rule is general
- Rules explain novelty and productivity in
 - Language
 - Thinking
 - Understanding

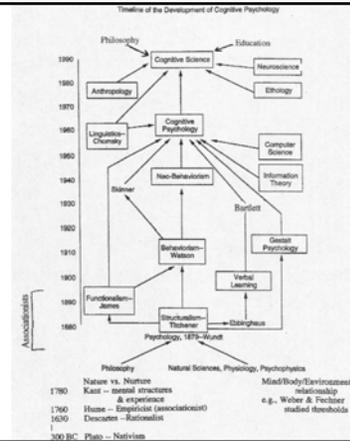
Paradigm Shifts

- Dissatisfaction with current approach
 - Anomalies
 - Absurdities
 - Perceived Omissions
- New approaches attractive because they resolve absurdities
- Phenomena not explained by old paradigm become focus of new



Reemergence of Cognitive Psychology

- Introspectionists – naive belief in power of self-observation
- Behaviorists – naive belief in reducibility of intelligent behavior
- Cognitive Psychologists (middle road)
 - Information Theory
 - Artificial Intelligence
 - Linguistics



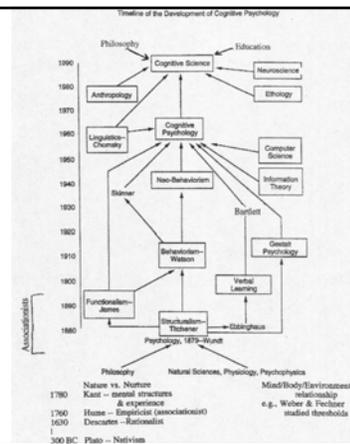
Information Processing v. Behaviorism

Both

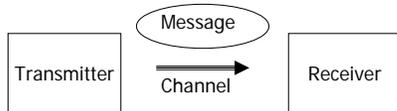
- Committed to theory building
- Believe in scientific observation
- Laboratory experiments with controlled conditions

IP Psychologists

- Fear not the mental
- Shifted emphasis from learning to
 - Perception
 - Memory
 - Thinking
 - Language

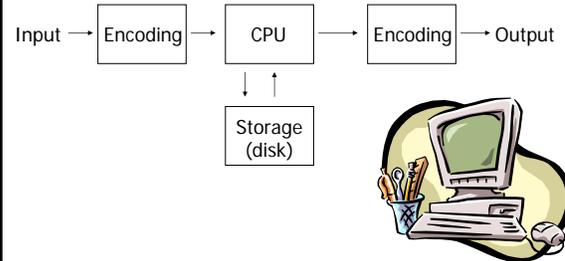


Information Theory



- Coding – rules for transforming messages, codes, etc. from one representation to another
- Channel Capacity – how many signals can the channel carry?
- Serial vs. Parallel Processing – one vs. many messages

The Computer Analogy



The beauty

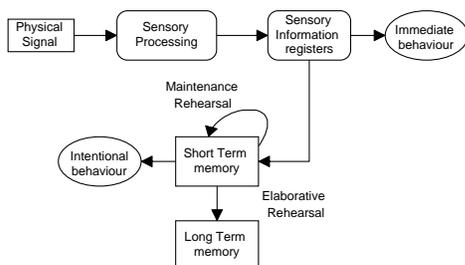
of the computer analogy:

- Computers provide a concrete way of characterizing abstract mental operations.

Minds, Brains, and Computers

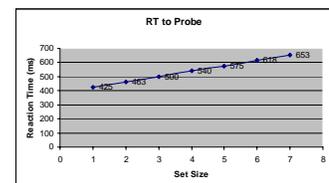
- Abstract
- Concrete
- New Solution to Mind/Body Problem
 - (Don't) Dump the mind
 - Postulate a level of explanation between mind and body
- Marr's Levels of Explanation
 - Computation
 - Algorithm
 - Architecture
 - Program
 - Implementation

Information Processing Model



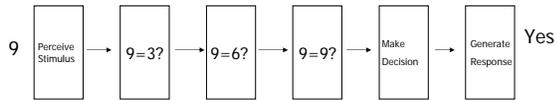
Sternberg Paradigm

- Give subjects a small set of numbers to remember: {3,9,6}
- Probe: 9?
- Task: Respond as fast as possible



$$\text{Time} = 387 + 38s$$

Sternberg's Model



Ways Sternberg's theory exemplifies IP approach

- Discusses IP without reference to brain processes
- Symbolic operations (not subsymbolic, not neural)
- Use of computer metaphor
- Reaction time important for verification
 - Discrete stages
 - Flow-chart

Paradigms

- Information Processing
- Connectionism
- Cognitive Neuroscience
- Evolutionary
- Ecological

Research Methods

- Naturalistic Observation
- Introspection
- Behavioral Experiments
- EEG/MEG Experiments
- Neuroimaging Experiments
- Single Cell Recording

Cognitive Science

- Still often employ computer metaphor
- Characterize cognitive processes in terms of simple computational operations
- Still test theories with reaction time studies
- Parallel processing models popular
- Not exclusively symbolic processes, sub-symbolic processes can be important too
- Also test theories with brain imaging technologies (ERP, fMRI)
- Increased importance of understanding relationship between mind and brain
- Increased importance of social, cultural, and technological contributions