I. What is Cognitive Psychology?

- The study of perception, learning, memory, and thought
- The study of how people attend to, acquire, transform, store, and retrieve knowledge
  - In the 1920s, behaviorism dominated psychology
  - In the late 1950s and 60s, the brain began to be compared to a computer

II. How do We Form Concepts and Solve Problems?

A. Concept Formation

- Easily studied in the lab
  - Participants must form rules that define the concept
    - Positive Instance
    - Negative Instance
  - People define “fuzzy concepts” by using prototypes

B. Problem Solving

- Confronting and resolving situations that require insight or determination of some unknown elements
  - **Exemplars** often used
B. Problem Solving
• Two basic approaches to solving problems
  1. Algorithms
  2. Heuristics
     • Several types
        a. Subgoal analysis
        b. Means-ends analysis
        c. Backward search

II. How do We Form Concepts and Solve Problems?

D. Avoiding Barriers: Be a Critical Thinker
   1. Don’t fixate on availability
   2. Don’t generalize too quickly
   3. Don’t settle for an easy solution
   4. Don’t choose a solution just because it fits preexisting ideas
   5. Don’t fail to consider any possible solution
   6. Don’t be emotional

E. Creative Problem Solving
• Expertise in Problem Solving
   – “Creative problem solvers” and “expert problem solvers” are different
     • “Domain-free” versus “domain-specific” knowledge

E. Creative Problem Solving
• The Investment Theory of Creativity (Sternberg & Lubart, 1999)
  – Six interactive resources
    1. Intelligence
    2. Thinking style
    3. Knowledge
    4. Personality
    5. Motivation
    6. Environment
  – Creative thinkers may have to “sell” their ideas
III. How Do We Reason and Make Decisions?

• **Decision making** means assessing and choosing among alternatives

A. Uncertainty: Estimating Probabilities
   – People are often not very good at accurately estimating probabilities about rare real-world events
   – Can be taught to be more accurate

B. Barriers to Sound Decision Making
   1. Gambler’s fallacy
   2. Belief in small numbers
   3. Availability Heuristic
   4. Overconfidence phenomenon
   5. Confirmation Bias

C. Culture and Reasoning
   – Eastern intellectual traditions
     • Value compromise solutions
     • See reality as a process in flux
     • Embrace contradictions
     • See all things as interconnected
   – Western intellectual traditions
     • See reality as objective and constant
     • See many things as independent

D. Evolution and Reasoning
   – Humans have built-in mechanisms to help
   – The brain may have evolved specific “programs” for processing information
     • These programs make some types of reasoning easier than others
     • Humans may be especially good at detecting “cheaters”

IV. Artificial Intelligence (AI)

• Computers that mimic human cognitive activities

A. The Computer as Information Processor
   – The information-processing approach examines how information is stored in memory
   – Problem-solving is the most widely investigated aspect of AI

B. Neural Networks
   – Information represented in a number of locations simultaneously
   – Signals from widely separated clusters of neural activity come together in **convergence zones** to process information
     • Explains blindsight
B. Neural Networks

- Study of neural networks is based on the concept of parallel distributed processing (PDP)
  - Studied with “artificial neural networks”
  - Can be taught to recognize hand-written letters
    
- Shows that the network has learned a prototype

IV. Artificial Intelligence (AI)

C. Robotics
- Monkeys can move a robot using thought alone
- Robots help us understand human cognition, but they will never take its place

V. The Structure of Language

A. Language and Gender Stereotypes
- English is often used to describe men and women, and their roles, differently
  - Men described with active, positive words
    - Successful, strong, courageous
  - Women described with passive words
    - Gentle, loving, patient
A. Language and Gender Stereotypes

- If people believe in gender-specific abilities, they apply that belief to their decision making
- Gender differences in language are usually context-dependent
- Androgyny
- People can also adapt how gendered their language is depending on to whom they talk

V. The Structure of Language

B. Thought, Culture, and Language

- Language influences, but does not determine, thought
- Culture has a great influence on language and thought

B. Thought, Culture, and Language

- Bilingualism promotes cognitive flexibility
  - However, bilingual people often respond to questions in a culture-bound way
  - Children raised in a bilingual home show no deficits in acquisition of reading skills

V. The Structure of Language

C. Linguistics

- The study of language
- Psycholinguistics is the study of how language is acquired, perceived, understood, and produced
  - How children learn language
  - Initially, receptive vocabulary is greater than productive vocabulary

D. Language Structure

1. Phonology

  - The study of the patterns and distribution of speech sounds and the rules for their pronunciation
  - Phonemes are the smallest units of sound
    - English has 45 phonemes
    - Not the sounds of letters
D. Language Structure

2. Semantics
   – Analysis of the meaning of language
   – Involves the meaning of individual words, relationships among words, and their significance in particular contexts

3. Syntax
   – The way words and groups of words combine to form phrases, clauses, and sentences

3. Syntax
   • Young children communicate with holophrases
   • Later, children use telegraphic speech
   • Ability to use syntax develops later
   • Young children possess and innate grammar

V. The Structure of Language

E. The Biological and Evolutionary Basis of Language
   – In 1957, Noam Chomsky suggested that language is innate
     • Humans have an inborn “universal grammar”
     • Research shows infants respond physiologically to the language to which they are first exposed
     • Infants born deaf also show spontaneous signing

E. The Biological and Evolutionary Basis of Language
   • From an evolutionary view, language developed through natural selection
     – Language has adaptive value

VI. Language Acquisition

• Debate over the roles of nature and nurture
  – If nature is responsible
    • Language ability should be evident early in life
    • Grammar should develop similarly, regardless of language or culture
  – If nurture is responsible
    • The role of learning should be prominent

VI. Language Acquisition

A. Learning Theories
   – Argue that language develops because specific language behaviors are reinforced
   – Explain language development through operant conditioning and social / observational learning
   – However, the ability to form an infinite number of sentences cannot be learned through instruction or imitation
B. Biological Theories

• Sources of evidence for the role of nature in language acquisition
  1. Brain structure and lateralization
     • Lateralization: Particular brain functions are located primarily in one hemisphere
     • Language functions are predominantly left-hemisphere functions
     • However, each hemisphere is important in language

Evidence for the Role of Nature in Language Acquisition

2. Learning Readiness
   – Lenneberg (1967) believed the brain continues to develop to about age 13
     • Children develop language up to age 13
   – Idea of a “critical period” for language acquisition has been criticized

VI. Language Acquisition

C. Do Chimpanzees Have Language?
   – All attempts to teach animals to talk have failed
   – However, chimps have been taught to communicate with humans
     • Washoe, Sarah, Lana, and Nim Chimsky all taught to communicate
     • None showed evidence of true language

C. Do Chimpanzees Have Language?

• Is there a chimp language?
  – Chimps do not
    • Learn to spontaneously name and point at objects as human children do
    • Learn to refer to inner states of thoughts and emotions
    • Culturally transmit language from ape to ape
    • Use generative communication

VI. Language Acquisition

D. Do Dolphins or Whales Use Language?
   – Dolphins communicate with each other through squeaks and groans
   – They also repeat signals from other dolphins
   – However, they do not have language

VI. Language Acquisition

E. Social Interaction Theories
   – Argue neither the learning nor biological view is correct by itself
     • Children are born with a predisposition to develop language
     • They are also reinforced for their language behavior
     • Language is part innate and part reinforced
     • Language use is also affected by the context in which it occurs
Cognitive Psychology

I. What is Cognitive Psychology?
II. How Do We Form Concepts and Solve Problems?
III. How Do We Reason and Make Decisions?
IV. What Does Artificial Intelligence Reveal about Cognition Exist?
V. What is the Structure of Language?
VI. How Do We Acquire Language?