

Cognitive Psychology

Studying Thought and Language

Cognitive Psychology

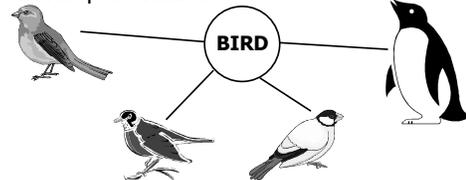
- I. What is Cognitive Psychology?
- II. How Do We Form Concepts and Solve Problems?
- III. How Do We Reason and Make Decisions?
- IV. What Does Artificial Intelligence Reveal about Cognition Exist?
- V. What is the Structure of Language?
- VI. How Do We Acquire Language?

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



- **Concept formation** is how people organize and classify events, usually to 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

II. How do We Form Concepts and Solve Problems?

B. Problem Solving

- Confronting and resolving situations that require insight or determination of some unknown elements
- **Exemplars** often used

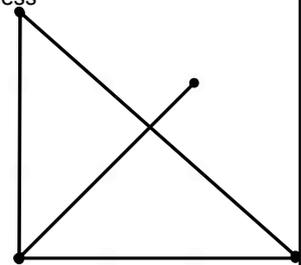
B. Problem Solving

- 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?

- C. Barriers to Problem Solving
- Functional Fixedness
 - Mental Set

Connect these 9 dots by drawing no more than 4 lines, without lifting your pen

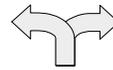


II. How do We Form Concepts and Solve Problems?

- 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

II. How do We Form Concepts and Solve Problems?

- E. Creative Problem Solving
- Generates or recognizes ideas that are original, novel, and appropriate
 - Changes one's culture (Csikszentmihalyi, 2001)
 - Is culture dependent
 - Uses divergent thinking
 - Can be stimulated through brainstorming



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

III. How Do We Reason and Make Decisions?

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

III. How Do We Reason and Make Decisions?

- 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

III. How Do We Reason and Make Decisions?

- 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

IV. Artificial Intelligence (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

A

B. Neural Networks

- What happens when part of a network is destroyed?
 - As in brain injury, it makes mistakes, but the system does not “crash”
- Neural networks learn and remember

Point – Counterpoint

Can Computers Think?

YES

- Computers can solve problems and make decisions
- Computers use reasoning processes similar to those used by humans

NO

- Computers do not use perceptual, intuitive strategies
- Computers can not use multiple strategies or change their minds

What do you think?

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

- **Pragmatics** is the study of how social context affects the meaning of language
- Language:
 - Is symbolic
 - Is structured
 - Represents meaning
 - Is generative
- Language and culture are intertwined

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**

V. The Structure of Language

- 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

1. Phonology

- **Morphology**
 - The study of **morphemes**
 - the basic units of meaning in a language
 - Early morphemes vary by culture
- A language's entire set of morphemes is called a **lexicon**

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 Chimpsky 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

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