Thinking and Intelligence

Key Question: *What Are the Components of Thought?*

Core Concept: Thinking is a cognitive process in which the brain uses information from the senses, emotions, and memory to create and manipulate mental representations, such as concepts, images, schemas, and scripts.

Key Question: *Cognitive process involved in forming a new mental representation by manipulating available information?*

Concepts

Concepts –

Mental representations of categories of items or ideas, based on experience

- *Natural concepts* represent objects and events
- *Artificial concepts* are defined by rules

We organize much of our declarative memories into *concept hierarchies*

Imagery and Cognitive Maps

- Visual imagery adds complexity and richness to our thinking
- Thinking with sensory imagery can be useful in problem solving
- Cognitive maps-a cognitive representation of a visual concept

Frontal Lobe Control

Frontal Lobe is particularly important for coordinating brain activity by:

- Keeping track of the episode (situation)
- Understanding the context (meaning)
- Responding to a specific stimulus

Frontal lobe is also involved in intuition-
making judgments without consciously reasoning

Schemas and Scripts Help you Know What to Expect

Schema –

A cluster of related concepts that provides a framework for thinking about objects, events, or ideas

Key Question: *What Abilities Do Good Thinkers Possess?*

Core Concept: Good thinkers not only have a repertoire of effective strategies, called a*lgorithms* and *heuristics*, they also know how to avoid the common impediments to problem solving and decision making.

Problem Solving

Good problem solvers are skilled at

- Identifying the problem
- Selecting a strategy

Selecting a Strategy

Algorithms –

- Problem-solving procedures or formulas
- Guarantee a correct outcome if applied correctly (recipe)

Heuristics –

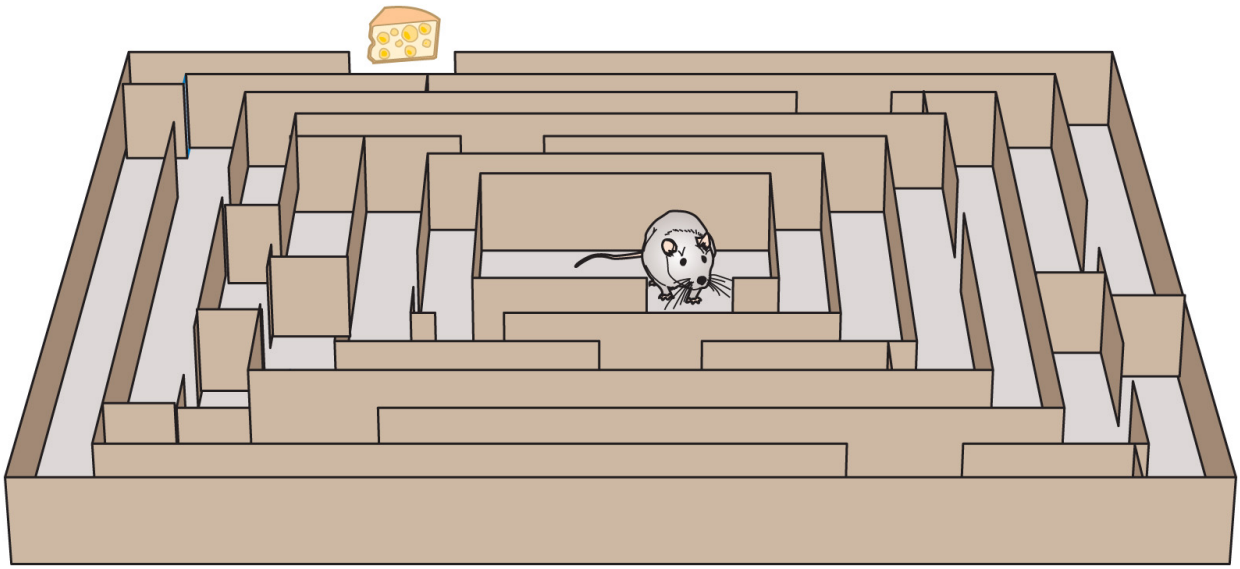
- Cognitive strategies used as shortcuts to solve complex mental tasks
- Do not guarantee a correct solution (rule of thumb)

Heuristics

Useful heuristics include:

Working backward
Searching for analogies
Breaking a big problem into smaller problems

Working Backwards



Obstacles to Problem Solving

Mental set –

Tendency to respond to a new problem in the manner used successfully for a previous problem

Functional fixedness –

Inability to perceive a new use for an object associated with a different purpose

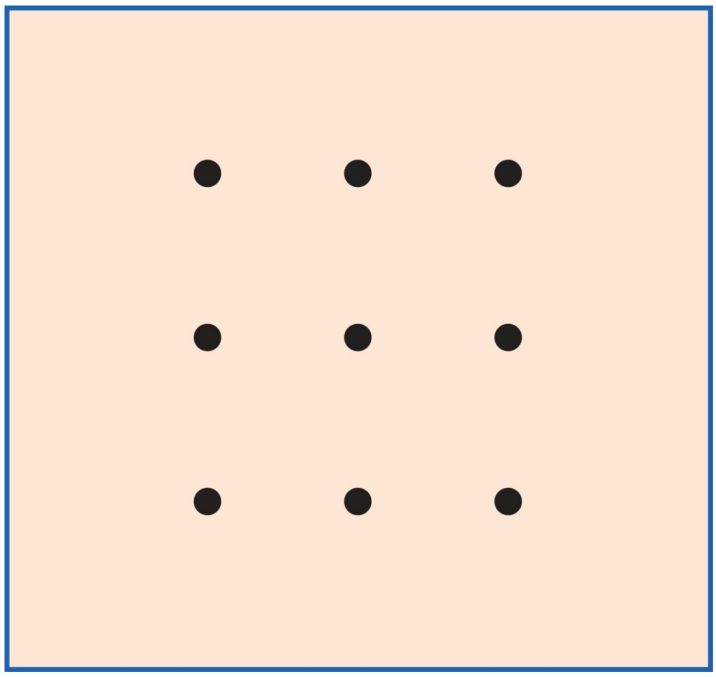
Self-imposed limitations-

Using unnecessary restrictions; Not thinking "outside the box"

Unscramble These Words

nelin	raspe
ensce	klsta
sdlen	nolem
lecam	dlsco
slfal	hsfle
dlchi	naorg
neque	egsta

The Nine-Dot Problem



Without lifting your pen from the page, can you connect all nine dots with only four lines?

Confirmation Bias

Ignoring or finding fault with information that does not fit our opinions, and seeking information with which we agree

Hindsight Bias

Tendency, after learning about an event, to believe that one could have predicted the event in advance

Anchoring Bias

Faulty heuristic caused by basing (anchoring) an estimate on information appearing at the beginning of the problem

Representativeness Bias

Faulty heuristic strategy based on presumption that, once something is categorized, it shares all features of other members in that category

Availability Bias

Faulty heuristic strategy that comes from our tendency to judge probabilities of events by how readily examples come to mind

Tyranny of Choice

Too many choices can interfere with effective decision making, sometimes to the point of immobilizing us.

On Becoming a Creative Genius

What produces extraordinary creativity?

- ❖ Knowledge; expertise

- Aptitude
- Personality characteristics
    - Independence, intense interest in problem, willingness to restructure, preference for complexity, need for stimulating interaction

On Becoming an Expert

Differences between experts and novices:

- Knowledge and how it is organized
  -"tricks of the trade"
- Considerable practice

Key Question: *How is Intelligence Measured?*

Core Concept: Intelligence testing has a history of controversy, but most psychologists now view intelligence as a normally distributed trait that can be measured by performance on a variety of tasks.

Founding of the Intelligence Test

1904, New French law required all children to attend school

Alfred Binet and Theodore Simon

- developed test to identify students needing remedial help
- Measured current performance
- Emphasized training and opportunity could affect intelligence

Key Question: *How is Intelligence Measured?*

Binet-Simon Test calculated a child's *mental age (MA)* and compared it to his or her *chronological age (CA)*

MA: average age at which individuals achieve a particular score
CA: number of years since birth (age)

Determined that remedial help was needed when one's MA was two years behind one's CA

Stanford and Binet's test in America:

Testing became widespread for the assessment of Army recruits, immigrants, and schoolchildren
The Stanford-Binet Intelligence Scale is the most respected of the new American tests of intelligence

- Now measured intelligence quotient (IQ)
- IQ=(MA/CA)*100

Calculting IQs "on the Curve"

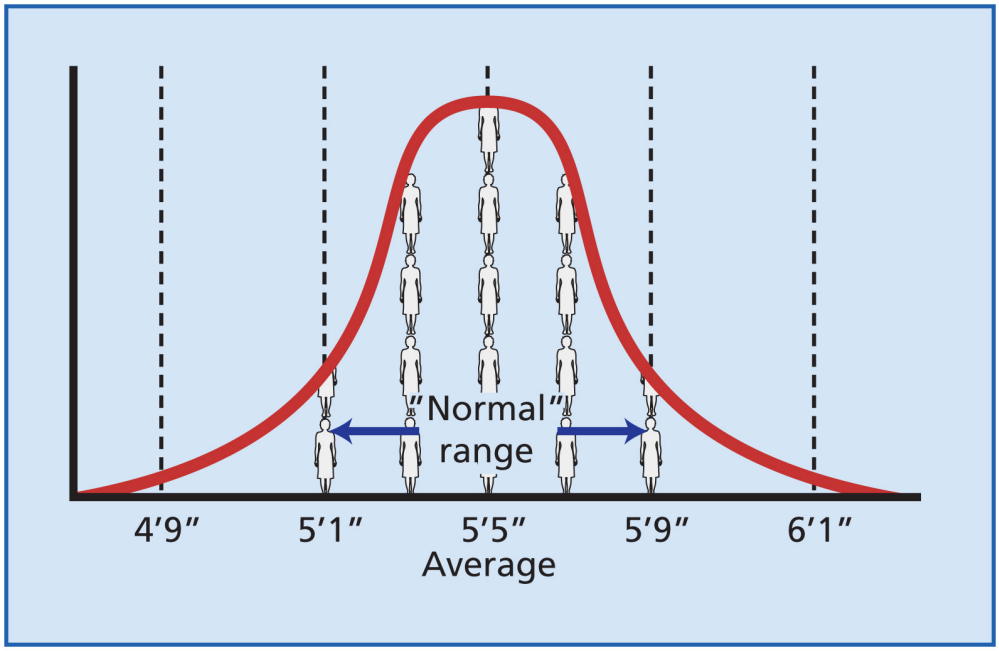
The original IQ calculation was abandoned in favor of standard scores based on the normal distribution

Normal distribution –

Bell-shaped curve describing the spread of a characteristic throughout a population

Normal range –

Scores falling in (approximately) the middle two-thirds of a normal distribution



The Exceptional Child

Mental retardation –

Often conceived as representing the lower 2% of the IQ range

Giftedness –

Often conceived as representing the upper 2% of the IQ range

Key Question: *Is Intelligence One or Many Abilities?*

Core Concept: Some psychologists believe that intelligence comprises one general factor, g, while others believe intelligence is a collection of distinct abilities.

Psychometric Theories of Intelligence

Spearman's G Factor
Cattell's Fluid and Crystallized Intelligence

Cognitive Theories of Intelligence

Sternberg's Triarchic Theory
Gardner's Seven Intelligences

Sternberg's Triarchic Theory

Practical Intelligence

Ability to cope with the environment, "street smarts"; also called contextual intelligence

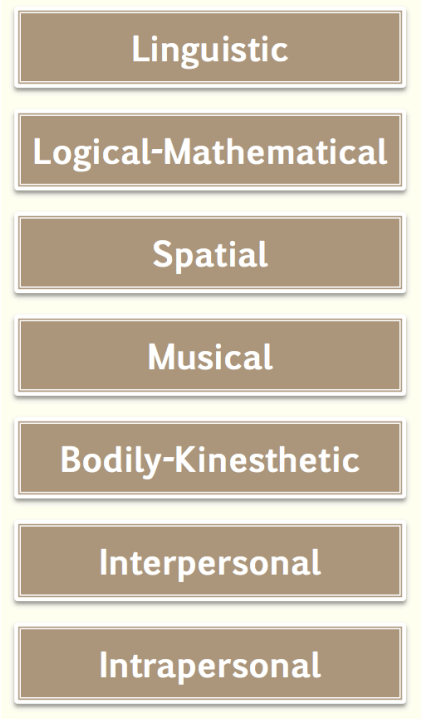
Analytical Intelligence (Logical Reasoning)

Ability to analyze problems and find correct answers, ability measured by most IQ tests

Creative Intelligence

Form of intelligence that helps people see new relationships among concepts, involves insight and creativity

Gardner's Seven Intelligences



Linguistic

Often measured on IQ tests with reading comprehension and vocabulary tests

Logical-Mathematical

Often measured on IQ tests with analogies, math problems and logic problems

Spatial

Ability to form mental images of objects and think about their relationships in space

Musical

Ability to perceive and create patterns of rhythms and pitches

Bodily-Kinesthetic

Ability for controlled movement and coordination

Interpersonal

Ability to understand other people's emotions, motives and actions

Intrapersonal

Ability to know oneself and to develop a sense of identity

Gardner's Three New Intelligences

Naturalistic intelligence
Spiritual intelligence
Existential intelligence

Cultural Definitions of Intelligence

Cross-cultural psychologists have shown that "intelligence" has different meanings in different cultures.

Intelligence and Animals

Animals are capable of intelligent behavior, often tied to particular biological niche

Language in non-humans at surprising level of sophistication

Key Question: *How Do Psychologist Explain IQ Differences Among Groups?*

Core Concept: While most psychologists agree that both heredity and environment affect intelligence, they disagree on the source of IQ differences among racial and social groups.

Hereditarian arguments maintain that intelligence is substantially influence by genetics

Environmental approaches argue that intelligence can be dramatically shaped by influences such as

Health
Economics
Education

Heritability and Group Differences

Heritability –

Amount of trait variation *within a group* that can be attributed to genetic differences

Research with twins and adopted children shows genetic influences on a wide range of attributes, including intelligence

Research has also shown that racial and class differences in IQ scores can be eliminated by environmental changes

- Adoption Studies
- Social Class
- Head Start