

Cognition and Intelligence

Chapter 8



Problem Solving



- Problem solving is an _____ aspect of intelligent thinking
- Problem solving refers to active efforts to discover what must be done to _____ a goal
- Problems can be _____ into three basic types:
 - Inducing structure
 - _____
 - Transformation

Types of Problems



- Problems of _____ structure
 - Discover relationships
 - Series completion and analogy problems
- Problems of _____
 - Need to use criteria to arrange problem
 - Anagrams
- Problems of _____
 - Carry out _____ to reach a goal
 - Hobbits and orcs problem
 - Water jar problem

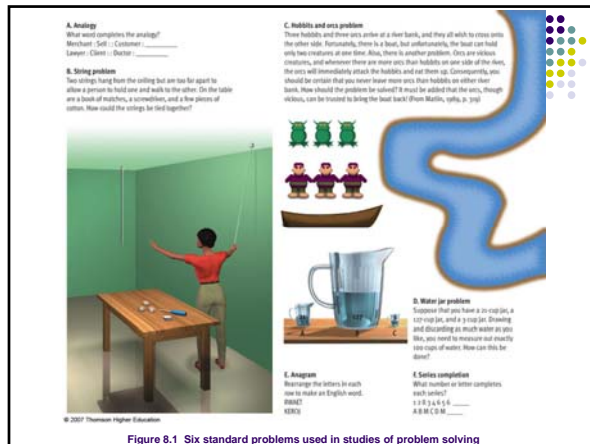
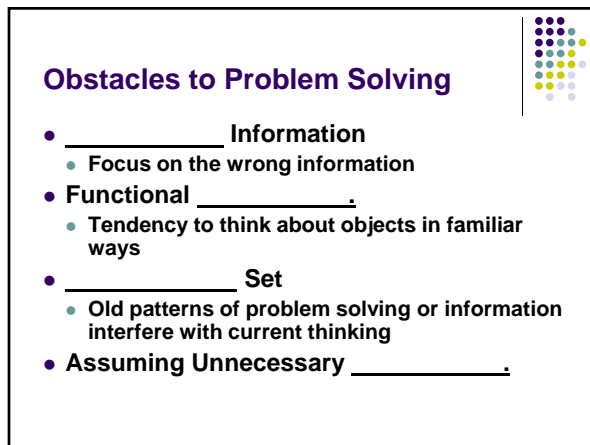
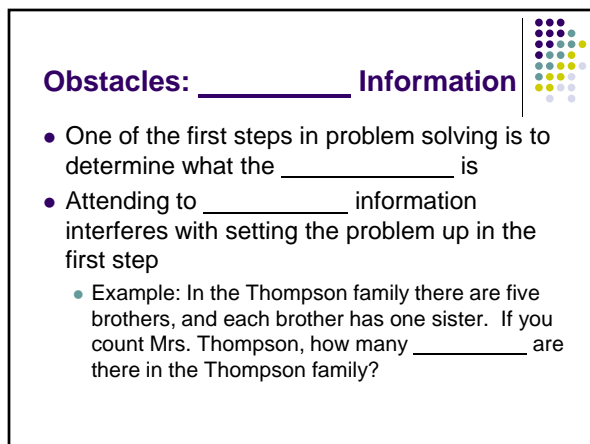


Figure 8.1 Six standard problems used in studies of problem solving





Obstacles: _____ Fixedness


- Rachel's car breaks down while she is driving through the desert. She is terribly thirsty. She finds several soda bottles in the trunk but no bottle opener.



Two-string problem. As hard as Sebastian tries, he can't grab the second string. How can he tie the two strings together?


_____ sets

- Tendency to solve problems using procedures that have _____ before on similar problems
- Very _____!
- But not helpful if the problem requires a _____. solution...
 - When Matt's flashlight hasn't worked in the past, he's just shaken it to get it to work again. One day when it doesn't come on, he shakes it, but it still doesn't work. He would be subject to mental set if he keeps shaking it without checking whether it needs new batteries.




_____ Set Example

- Number Puzzle: In this puzzle try to figure out the pattern for the order of numbers. Why are these numbers arranged in this order?
8, 5, 4, 9, 1, 7, 6, 3, 2, 0



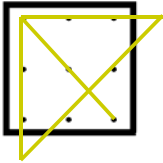
_____ constraints

- Imposing _____ that don't actually exist
- These _____ are not part of the problem, but are _____ by the problem solver
- Example: nine-dot problem

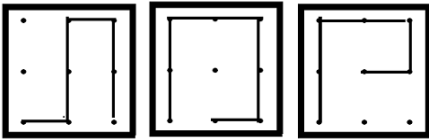



NINE DOT PROBLEM

Connect the nine dots with four straight lines without removing your pen from the page.




Some attempted but incorrect solutions appear below.





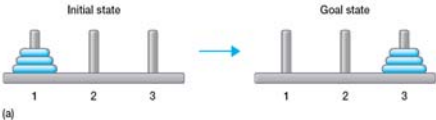
 to Problem Solving

- -and-error
 - Keep trying until you figure out the solution
 - Works if there are possible solutions
- - **Guaranteed solution (math problems)**
- : shortcuts
 - Forming .
 - Searching for analogies
 - Changing the of a problem




 : Forming Subgoals

- : using intermediate steps to solve a problem
- Working both forward and backward
- Example: Tower of Hanoi Problem



(a)



(b)

(a) Initial and goal states for the Tower of Hanoi problem.
 (b) Operators that govern the Tower of Hanoi problem.

Initial steps in solving the Tower of Hanoi problem, showing how the problem can be broken down into subgoals.

(a) Subgoal 1: Free up large disc.

(b) Subgoal 2: Free up third peg.

(c) Subgoal 3: Move large disc onto third peg.

Heuristics: _____.

- _____: A relationship between two similar situations, problems or concepts.
- Examples:
Merchant is to Sell as Customer is to ____.
_____ memory is like RAM in a computer.
A useful heuristic is to find a similar or related situation and build an analogy
 - Often difficult to see the relationship

_____ : Changing the Representation of the Problem

- Your representation of the problem is how you see the problem
- You might represent a problem _____, mathematically, _____.
 - Make lists, use a table, equations, diagrams
- Often helps to _____ how you represent problem

Culture, _____ Style, and Problem Solving



- _____ differences exist in problem solving and may be due to environmental constraints
- Field _____ – rely on external frames of reference
- Field _____ – rely on internal frames of reference
 - Western education inspire field independence
- Holistic vs. _____ cognitive styles

Making Choices: Heuristics in Judging _____



- The _____ heuristic
 - Overestimating the improbable
- The _____ heuristic
 - The tendency to ignore base rates
 - The _____ fallacy
 - The _____ fallacy

_____ : The Availability Heuristic



- Tendency to judge the _____ of an event by how easy it is to think of examples or instances
- _____ of odds of dying in plane accident, _____ of odds of dying in car accident
- Are there more words in the English language that begin with K or have K as their third letter?
 - There are more words that begin with K (easier to think of examples)
 - There are more words that have K as their third letter
 - Both "a" and "b" are about the same (within 5% of each other).

Probabilities: Overestimating the _____.



- Exaggerating the _____.
- We choose the option that best fits with our beliefs, regardless of their actual probabilities
- Example of the _____ heuristic

Probabilities: _____ Heuristic



- Basing estimated _____ of an event on how similar it is to the _____ event

_____ : Base predictions on similarity to other events or situations (but we may ignore other relevant information such as the actual frequency of events)



Assume that all families with exactly six children are surveyed in a city. In 100 of these families the exact order of births of boys (B) and girls (G) was G-B-G-B-B-G. What is your guess as to the number of families in which the exact order of birth was each of the following? Estimate a number for each of the following (adapted from Kahneman & Tversky, 1973):

- | | |
|----------------|--|
| 1. G-G-B-G-B-B | For each of these possibilities, the expected number of families is 100. |
| 2. B-B-B-B-B-B | |
| 3. G-B-B-G-B-G | |
| 4. B-B-B-G-G-G | |

Statistically, all four alternatives are equally likely (50% B, 50% G)

Sex of previous births doesn't affect sex of next birth.

_____ : Which birth orders "look" random?

Most people misunderstand how randomness works.

They expect things to "even out" in the short run.

Heuristic: Base Rates



- When people use the representative heuristic they often _____ **base rates**
- People often feel they can “beat the odds” because the _____ base rates

Imagine that you just met a man named Steve. Steve is very shy and withdrawn, invariably helpful, but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure and a passion for detail. Which statement about Steve is more likely (adapted from Kahneman & Tversky, 1973):

- Steve is a retail salesperson (3,964,680 in the United States)
- Steve is a librarian (139,460 in the United States)
- Both “a” and “b” are equally likely (within 5% of each other)

Approximately 28.4 retail salespersons for every librarian.
Steve is much more likely to be a retail salesperson.
But Steve’s description fits our stereotype of librarians.

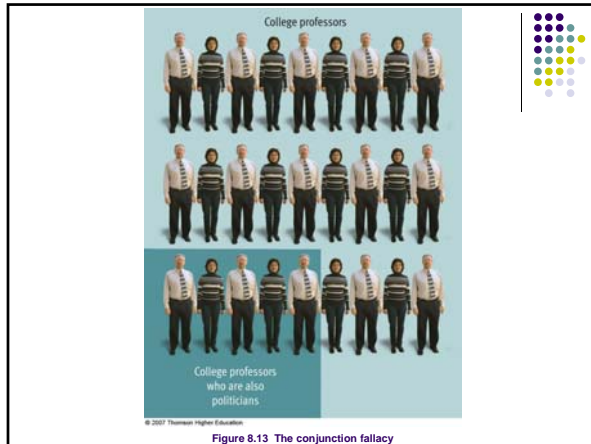
Data from the Bureau of Labor Statistics (2000) survey

Heuristic: Conjunction Fallacy



- The probability of being in a subcategory cannot be higher than the probability of being in the _____ category
- Steve is articulate, _____, power-hungry wheeler-dealer.
 - Do you think it’s more likely that he is a college teacher,
 - or a college teacher who is also a politician ?


Learning Objective 5




Probabilities:

Fallacy

- Belief that the odds of a chance event occurring increase if the event hasn't occurred _____.
- _____ in slots and roulette
- Example of the _____ heuristic



Intelligence



Defining Intelligence



- Intelligence
 - Defined as the ability to _____ from experience, acquire knowledge, think abstractly, act _____, or adapt to changes in the environment
- _____ Factor
 - General intellectual ability _____ by theorists to underlie specific mental _____.

Measuring Intelligence: Psychometric _____.



- _____ = measurement of mental abilities, traits, & processes
- Includes:
 - _____ tests
 - Measure skills and knowledge that have been taught
 - Example: SAT
 - _____ tests
 - Measure ability to acquire skills or knowledge

History of Standardized _____.



- Adolph _____ (1796-1874)
 - Measured the height & chest circumference of Scottish soldiers
 - First to argue for an "average man" using normal distributions
- Sir Francis Galton (1822-1911)
 - First to apply _____ measurement to intelligence
 - First to argue that intelligence of the population should be normally distributed
- Alfred Binet (1857-1911)
 - Developed widely used standardized tests of intelligence using trial-and-error method
 - "Normal" children and _____ children
 - Test stayed popular because it predicted _____ in school (to some degree)

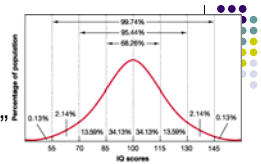
The _____ of Intelligence Testing

- **Lewis Terman** (1916)
 - _____ Intelligence Scale
 - Intelligence Quotient (IQ) = _____ x 100
- **David** _____ (1955)
 - Wechsler Adult _____ Scale



IQ Scores

- “_____ distributed”
 - Bell-shaped curve
- Very high and very low scores are rare
- 68% of people have IQ between 85-115
 - Two standard _____ from the mean
- _____% of people have IQ between 55-145

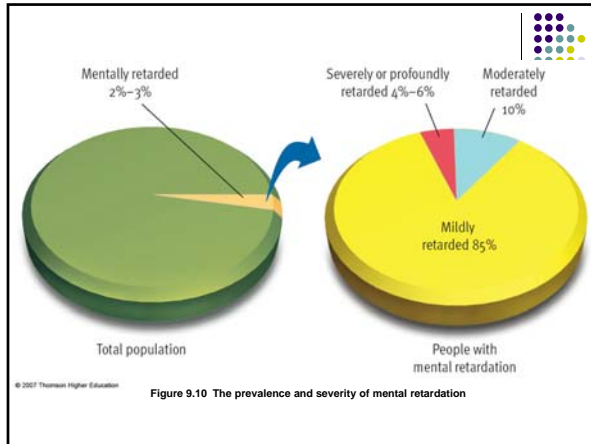


Learning Objective 6

Extremes of Intelligence: Mental Retardation

- Diagnosis based on **IQ and** _____ **testing**
 - IQ 2 or more _____ below mean
 - Adaptive skill deficits
 - Origination before age _____.
- 4 levels: mild, moderate, severe, _____.
- Causes:
 - _____ vs. biological





Extremes of Intelligence: Giftedness

- _____ **issues** – ideals vs. practice
 - IQ 2 SD above mean standard
 - _____, leadership, special talent?
- _____ – weak, socially inept, emotionally troubled
 - Lewis Terman (1925) – largely contradicted stereotypes
 - Ellen Winner (1997) – _____ vs. profoundly gifted

Learning Objective 6

Extremes of Intelligence: _____.

- _____ **and high achievement** – beyond IQ
 - Renzulli (2002) – intersection of _____ factors
 - Simonton (2001) – drudge theory and inborn talent

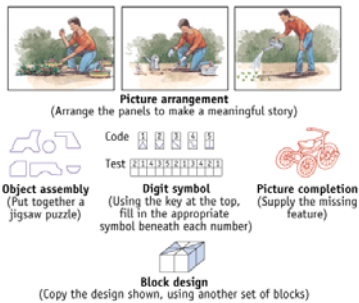
Learning Objective 6

Test Differences

- _____type
 - Different tests for different ages
- But, there are also multiple tests
 - _____-Binet
 - Weschler _____Intelligence Scale (WAIS)
 - Weschler Intelligence _____for Children (WISC)

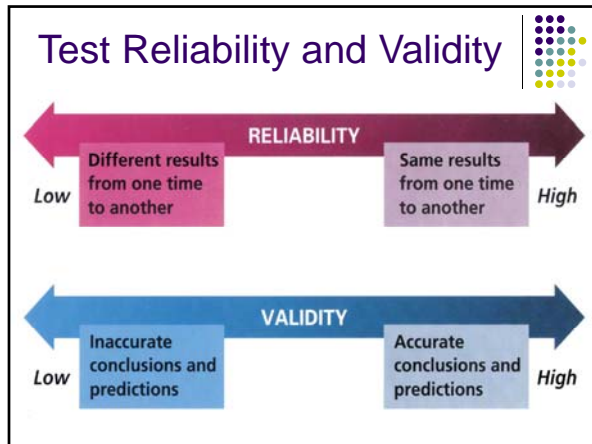
Learning Objective 6

Weschler Test Performance Tasks



What Makes a Good IQ Test?

- _____
 - Is the measurement consistent?
 - Results must be repeatable and stable
 - Low _____before age 7
- _____
 - Does the test _____what you think it measures?
 - Affects the ability to make inferences about the test



Fair Tests

- Was this a “_____” test?
- Elements of a culture _____ test:
 - Items are not reliant on information that is exclusive to a particular group
 - Based more on “_____” ability

Can IQ Be _____?

- Traditional IQ tests favor _____, white, city-dwelling individuals
- Different cultures may have different problem-solving _____.
- Different cultures stress (and therefore, teach) different types of _____.
 - Child in New York city, living in a city loft
 - Child in the Appalachian mountains, living on a farm

_____ and _____ as Determinants of Intelligence

- _____
 - Twin and adoption studies
 - _____ estimates
- _____
 - Adoption studies
 - Environmental deprivation and enrichment
 - The _____ effect
 - IQ scores increase every generation
- **Interaction**
 - The concept of the reaction range

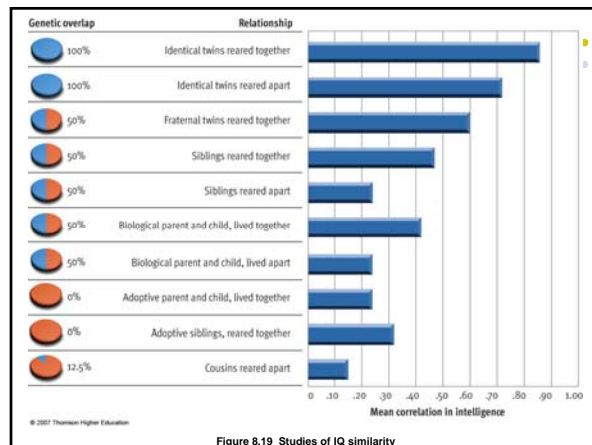


Figure 8.19 Studies of IQ similarity

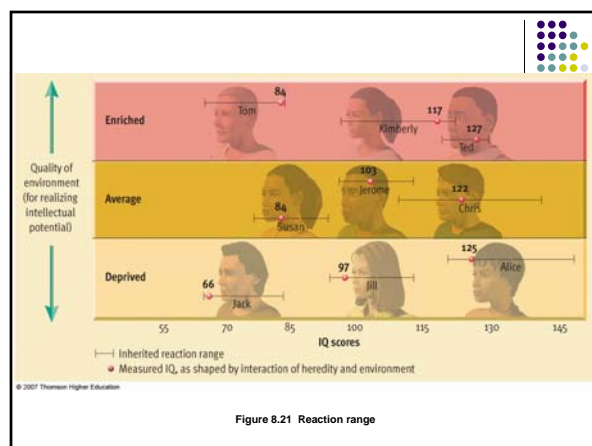


Figure 8.21 Reaction range

Variables _____ IQ Scores



- Expectations for performance
- _____ stereotypes
 - Stereotype threat
 - Doubt felt about _____ due to negative stereotypes
 - Have been shown effects on performance of African Americans, _____, low income populations, _____, & the elderly
 - Negative stereotypes can _____ performance
 - Positive stereotypes can _____ performance

Measuring _____: Cognitive Approaches



- Emphasize _____ strategies
- Includes _____ domains of intelligence
 - Started with _____ multiple intelligences
 - Bodily-kinesthetic, intrapersonal, interpersonal, linguistic, logical-mathematical, musical, naturalist
 - _____ intelligence (EQ)

Sternberg's _____ Theory



- _____ intelligence
 - Internal strategies, including problem recognition & evaluation of problem-solving strategies
 - Requires metacognition
- _____ intelligence
 - Ability to transfer skills to new settings
- _____ intelligence
 - Practical application of intelligence
 - Adaptation to an environment

