

## Chapter 7: Thinking, Language, and Intelligence

### Thought

- Cognition—mental activities involved in acquiring, retaining, and using knowledge
- Thinking—manipulation of mental representations to draw inferences and conclusions
- Mental image—representation of objects or events that are not present

### Concepts

- Concept—mental category of objects or ideas based on shared properties
- Formal concept—mental category formed by learning rules
- Natural concept—mental category formed by everyday experience

### Examples of Concepts

- Formal concept—follows rigid rules, not usually intuitive (definition of a polygon)
- Natural concept—results from everyday experience (name some vehicles)

## Problem-Solving Strategies

### Algorithm

$$\sum y + \sum z = r^2$$

## Problem-Solving Strategies

Heuristic—strategy that involves following a general rule of thumb to reduce the number of possible solutions

## Insight and Intuition

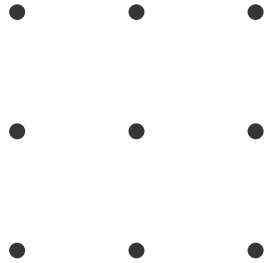
- Insight—sudden realization of how a problem can be solved
- Intuition—coming to a conclusion without conscious awareness of the thought processes involved

## Functional Fixedness

- type of mental set
- inability to see an object as having a function other than its usual one

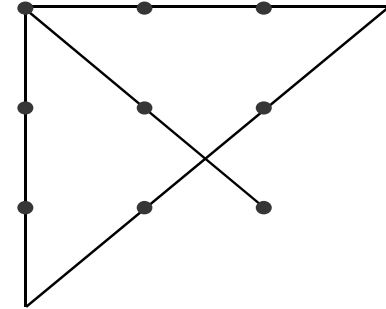
## Nine Dots Problem

Without lifting your pencil or retracing any line, draw four straight lines that connect all nine dots



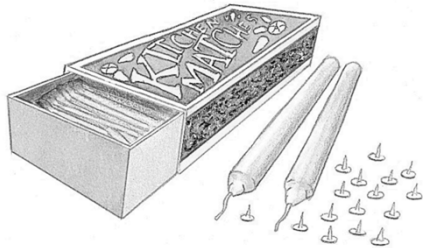
## Nine Dots Mental Set

- Most people will not draw lines that extend from the square formed by the nine dots
- To solve the problem, you have to break your mental set



## Mounting Candle Problem

Using only the objects present on the right, attach the candle to the bulletin board in such a way that the candle can be lit and will burn properly



## Answer to Candle Problem

- Most people do not think of using the box for anything other than its normal use (to hold the tacks)
- To solve the problem, you have to overcome functional fixedness



## Mental Set

Q: Why couldn't you solve the previous problems?

A: Mental set—a well-established habit of perception or thought

## Decision Making

- Single-feature model—make a decision by focusing on only one feature
- Additive model—systematically evaluate the important features of each alternative
- Elimination by aspects model—rate choices based on features; eliminate those that do not meet the desired criteria, despite other desirable characteristics

## Availability Heuristic

- Judge probability of an event by how easily you can recall previous occurrences of that event
- Most people will overestimate deaths from natural disasters because disasters are frequently on TV
- Most people will underestimate deaths from asthma because they don't make the local news

## Representative Heuristic

- Judge probability of an event based on how it matches a prototype
- Can be good
- But can also lead to errors
- Most will overuse this strategy

## Language

- Language and thinking
- Language and social perception
- Language and gender bias
- Animal communication

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*The word duck does not look like a duck, walk like a duck, or quack like a duck, but refers to a duck all the same, because the members of a language community, as children, all memorized the pairing [between a sound and a meaning].*

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Steven Pinker (1995)

## Language and Thinking

- Language is a system for combining arbitrary symbols to produce an infinite number of meaningful statements
- The linguistic relativity hypothesis is the notion that differences among languages cause differences in the thoughts of their speakers

## Animal Communication

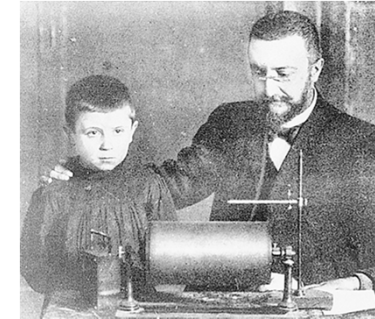
- Animals clearly communicate with each other, but is that language?
- Some trained primates demonstrate the same level of language comprehension as that of an average 2-year-old child
- Nonprimates can also acquire some language abilities (eg, dolphins, parrots)

## Intelligence

The global capacity to think rationally, act purposefully, and deal effectively with the environment

## Measuring Intelligence

- Alfred Binet
- Mental age
- Chronological age
- IQ—comparison of people in similar age groups



## Alfred Binet (1857–1911)

- Intelligence—collection of higher-order mental abilities loosely related to one another
- Did not rank “normal” students according to the scores
- Intelligence is nurtured
- Binet-Simon Test developed in France, 1905

## Modern Intelligence Tests

### The Stanford-Binet Scale

- modification of the original Binet-Simon after it came to the United States
- intelligence quotient (IQ)—child’s mental age divided by child’s chronological age
- still used widely in the United States, but not as much as in the past

## Modern Intelligence Tests

### The Wechsler tests

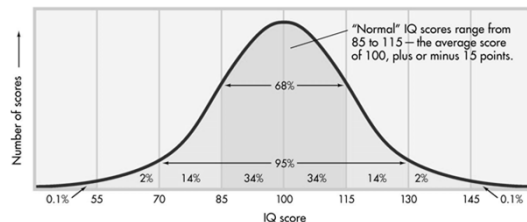
- used more widely now than Stanford-Binet
- modeled after Binet's, also made adult test
  - WISC-III for children
  - WAIS-III for adults

## Qualities of Good Tests

- Standardized—administered to large groups of people under uniform conditions to establish norms
- Reliable—ability to produce consistent results when administered on repeated occasions under similar conditions
- Valid—ability to measure what the test is intended to measure

## Standardized Scoring of Wechsler Tests

- All raw scores converted to standardized scores
- Normal distribution
- Mean of 100
- Standard deviation of 15



## How Valid Are IQ tests?

- Validity—test measures what it's intended to measure
- Does test correlate with other measures of same construct?
- School achievement
  - IQ tests (ie, S-B and the Wechsler) correlate highly
  - BUT they were designed to test what you learn in school
- Prestigious positions
- On-the-job performance and other work-related variables

## What Do IQ Tests Measure About Your Mind?

### Mental speed and span of working memory

- typically use a digit span test to measure this
- more recent studies find significant correlations between reaction times and IQ scores

### Why is this important?

- mental quickness may expand capacity of working memory

## Theories of Intelligence

- Charles Spearman—*g* factor
- Louis Thurstone—intelligence as a person’s “pattern” of mental abilities
- Howard Gardner—multiple intelligences
- Robert Sternberg—triarchic theory

## Howard Gardner’s Multiple Intelligences

<b>Linguistic intelligence</b>	Adept use of language: poet, writer, public speaker, native storyteller
<b>Logical-mathematical intelligence</b>	Logical, mathematical, and scientific ability: scientist, mathematician, navigator, surveyor
<b>Musical intelligence</b>	Ability to create, synthesize, or perform music: musician, composer, singer
<b>Spatial intelligence</b>	Ability to mentally visualize the relationships of objects or movements: sculptor, painter, expert chess player, architect
<b>Bodily-kinesthetic intelligence</b>	Control of bodily motions and capacity to handle objects skillfully: athlete, dancer, craftsman
<b>Interpersonal intelligence</b>	Understanding of other people’s emotions, motives, intentions: politician, salesperson, clinical psychologist
<b>Intrapersonal intelligence</b>	Understanding of one’s own emotions, motives, and intentions: essayist, philosopher
<b>Naturalist intelligence</b>	Ability to discern patterns in nature: ecologist, zoologist, botanist

## Robert Sternberg

- Analytic intelligence—mental processes used in learning how to solve problems
- Creative intelligence—the ability to deal with novel situations by drawing on existing skills and knowledge
- Practical intelligence—the ability to adapt to the environment (street smarts)



## Nature Versus Nurture in IQ

- Are differences between people due to environmental or genetic differences?
- Misunderstanding the question
  - “Is a person’s intelligence due more to genes or to environment?”
  - both genes and intelligence crucial for any trait

## Heredity and Environment

### Heritability

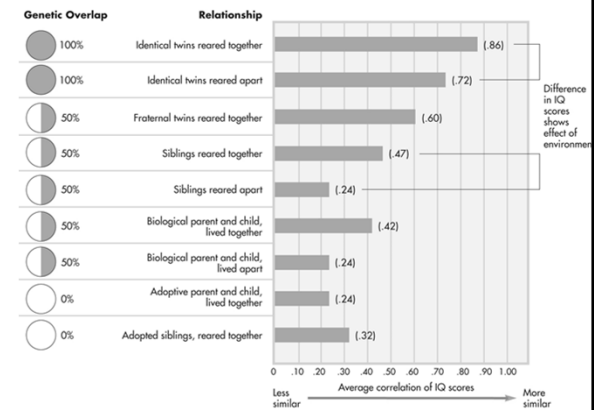
- The degree to which variation in trait stems from genetic, rather than environmental, differences among individuals

### Environment

- The degree to which variation is due to environmental rather than genetic differences

## Twin Studies and Family Influence

- If trait is genetic:
  - closely related more similar than less closely related
- Many close relatives share environments, too
- Types of studies to separate effects
  - monozygotic twins reared together
  - monozygotic twins reared apart
  - siblings/dizygotic reared together
  - siblings/dizygotic reared apart
  - adoptive siblings reared together



## Racial Difference in IQ

- Difference in average IQ among different racial groups can be measured
- More variation in IQ scores *within* a particular group than between groups

## Within and Between Group Differences

- Each corn field planted from same package of genetically diverse seeds
- One field is quite fertile, the other is not
- Within each field, the differences are due to genetics
- Between each field, the differences are due to environment (fertility)

## Other Influences on IQ Scores

- Cross-cultural studies show that the average IQ of groups subject to social discrimination are often lower than the socially dominant group even if there is no racial difference
- Tests reflect the culture in which they are developed; cultural factors also influence test-taking behavior (culture bias)

## Stereotype Threat

A psychological predicament in which you fear that you will be evaluated in terms of a negative stereotype about a group to which you belong; creates anxiety and self-doubt and can lower performance in a particular domain that is important to you

## Creativity

To enhance your creativity

- Creativity as a goal
- Reinforce creative behavior
- Engage in problem finding
- Acquire relevant knowledge
- Try different approaches
- Exert effort and expect setbacks