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 (A polygon is…)
- Natural concept—results from everyday experience (Name some mammals…)

Problem Solving Strategies

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

Algorithm

Problem Solving Strategies

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

Insight and Intuition

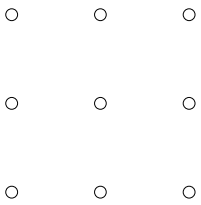
- Insight—sudden realization of how a problem can be solved
- Intuition—coming to a conclusion without conscious awareness of thought processes involved

Functional Fixedness

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

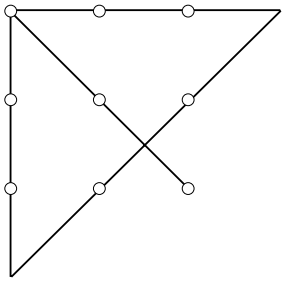
Nine dots problem

Without lifting your pencil or re-tracing any line, draw four straight lines that connect all nine dots.



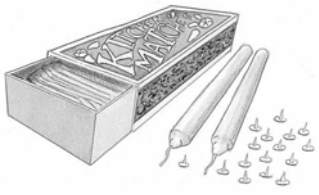
Nine dots mental set

- 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



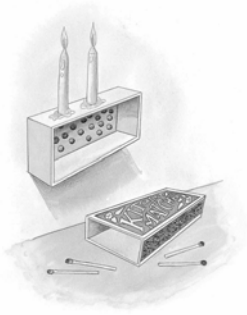
Mounting candle problem

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—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 will overestimate deaths from natural disasters because disasters are frequently on TV.
- Most 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

> *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].*
>
> Steven Pinker (1995)

Language and Thinking

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

Animal Communication

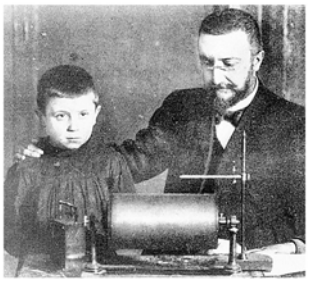
- Animals clearly communicate with each other, but is that language?
- Some primates that have been trained demonstrate the same level of language comprehension as that of an average 2-year-old child
- Non-primates can also acquire some language abilities, i.e., dolphins, parrots

Intelligence

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 original came to US
- intelligence quotient (IQ)—child’s mental age divided by child’s chronological age
- used widely in the US, not as much as previously

Modern Intelligence Tests

The Wechsler tests

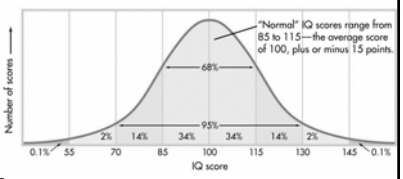
- used more widely now than Stanford-Binet
- modeled after Binet's, also made adult test
  - WISC-III for children
  - WAIS-III for adults

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 (i.e., S-B and the Wechsler) correlate highly
  - but they were designed to test stuff that you learn in school
- Prestigious positions
- On-the-job performance & 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
- Sternberg–triarchic theory

Howard Gardner's Multiple Intelligences

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

Robert Sternberg

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

Nature vs. 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 & intelligence crucial for any trait

Heredity and Environment

Heritability

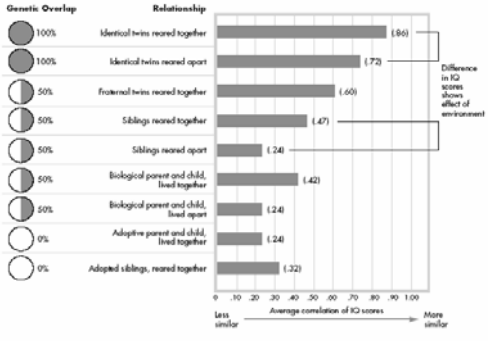
- degree to which variation in trait stems from genetic, rather than environmental, differences among individuals

Environment

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

Twin Studies & Family Influence

- If trait 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

- Racial 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, differences due to genetics
- Between each field, differences due to environment (fertility)

Other Influences on IQ Scores

- Cross cultural studies show that average IQ of groups subject to social discrimination are often lower than 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)

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