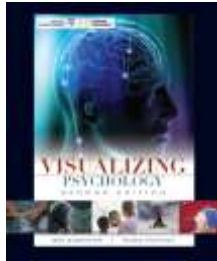




# CHAPTER 8

## Thinking, Language, & Intelligence



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## Lecture Overview

- Thinking
- Language
- Intelligence
- The Intelligence Controversy



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## Thinking

- Thinking, **language**, & **intelligence** are often studied under the larger topic of **cognition** (mental activities involved in acquiring, storing, retrieving, & using knowledge).



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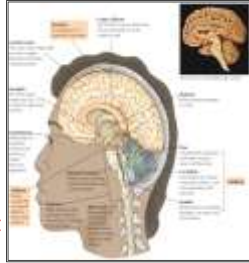
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## Thinking

- Thinking processes are distributed throughout the brain, especially the frontal lobe.



- Cognitive building blocks:
  1. Mental images
  2. Concepts
    - Concrete vs. abstract
    - Artificial vs. natural

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## Cognitive Building Blocks: (1. Mental Image)



1. **Mental Image:** mental representation of a previously stored sensory experience, including visual, auditory, etc.

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## Cognitive Building Blocks

What is this?



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### Cognitive Building Blocks: (2. Concepts)



2. **Concept:** mental representation of a group or category that shares similar characteristics (e.g., the concept of a river groups together the Nile, Amazon, & Mississippi)

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### Cognitive Building Blocks: (2. Concepts)

Concept: **concrete** vs. **abstract**

How do we learn concepts? Three ways:

- **Prototypes:** typical representative
- **Artificial concepts:** formed by logical, specific rules
- **Hierarchies--**grouping concepts into subcategories within broader categories

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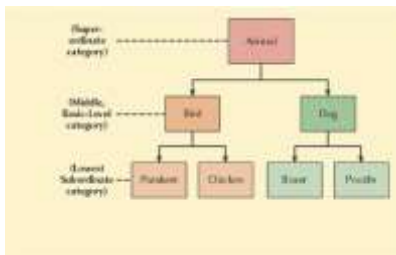
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### Cognitive Building Blocks: Concepts- Hierarchies



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### Pause & Reflect: Assessment



- What kind of cat is this?
- Identifying the kind of cat is an example of using what: a **prototype**, an **artificial concept**, or a **hierarchy**?

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### Thinking: Problem Solving (Three Steps to the Goal)

#### Step 1: Preparation

- **Identifying**: basic, nonnegotiable limits and desires
- **Separating**: negotiable items. Irrelevant or easily compromised
- **Defining the ultimate goal**

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**PREPARATION**

Imagine that you are determined to find a new home close to work. There are at least three separate components to successful preparation.

- 1. Identifying given facts.** Decide what are your most basic, nonnegotiable limits and desires.
  - Must be able to walk to work.
  - I prefer a house to a large apartment building.
  - Must allow cats.
- 2. Separating relevant from irrelevant facts.** What are your negotiable items? What do you consider irrelevant and easily compromised?
  - A fireplace would be a plus.
- 3. Defining the ultimate goal.**


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### Thinking: Problem Solving

- **Step 2: Production** (generating possible solutions, called *hypotheses*, by using
- **Algorithms:** a set of steps that if followed correctly will eventually solve the problem. &/or
- **Heuristics:** a simple rule used in problem solving & decision making that does not guarantee a solution but offers a likely shortcut to it.

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**PRODUCTION**

During the production step, the problem solver produces possible solutions, called hypotheses. Two major approaches to generating hypotheses are algorithms and heuristics.

**Algorithms:** Answers every ad.

An algorithm is a logical, step-by-step procedure (well suited for computers) that will always produce the solution. (For example, an algorithm for solving the problem  $2 \times 4$  is  $2 + 2 + 2 + 2$ .) For complex problems, algorithms may take a long time.

**Heuristics:** Makes decisions about by drawing a 1-mile radius around work to narrow search.

A heuristic is a simple rule or shortcut that does not guarantee a solution. Heuristics include working backward from the solution (a known condition) and creating subgoals, stepping-stones to the original goal.

Figure 8.2 part 1  
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### Thinking: Problem Solving

- **Step 3: Evaluation** (judging hypotheses in Step 2 against the criteria in Step 1)

**EVALUATION**

1. Did your hypotheses work? If not, then you must reanalyze and produce more possible solutions.
2. Take action. Once you have a solution, sign the lease and close the home.

**Insight!**

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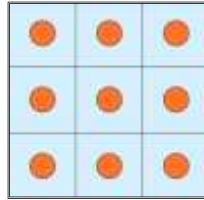
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## Thinking: Five Key Barriers to Problem Solving

1. **Mental Set:** persistence in using strategies that have worked in the past

*Using no more than four lines, can you connect all nine dots without lifting your pencil from the paper?*




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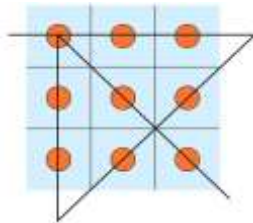
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## Thinking: Five Key Barriers to Problem Solving (Mental Sets Solution)

- To overcome a **mental set** you must literally “think outside the box”!




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## Thinking: Five Key Barriers to Problem Solving

2. **Functional Fixedness:** thinking of an object as only functioning in its usual way

*Can you use these supplies to mount the candle on the wall so that it can be lit in a normal way without toppling over?*




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### Thinking: Five Key Barriers to Problem Solving (Functional Fixedness Solution)

- To overcome **functional fixedness**, think of the matchbox, tacks, & candle all functioning in new ways.




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### Thinking: Five Key Barriers to Problem Solving



2 4 6

3. **Confirmation Bias:** preferring information that confirms preexisting positions or beliefs, while ignoring contradictory evidence



4. **Availability Heuristic:** judging the likelihood of an event based on how readily *available* other instances are in memory

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### Thinking: Five Key Barriers to Problem Solving



5. **Representativeness Heuristic:** estimating the probability of something based on how well the circumstances match (or *represent*) a previous prototype

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### Pause & Reflect: Assessment

- Overestimating the dangers of flying after 9/11 is an example of the **availability heuristic**




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### Thinking: Creativity

- Creativity:** ability to produce valued outcomes in a novel way

Three elements of creativity:

- Originality
- Fluency
- Flexibility




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### Three Elements of Critical Thinking

Explanation	Thomas Edison Examples
<b>Originality</b> Finding unique or different solutions to a problem	After seeing that electricity passing through a substance produces a glowing red or white heat, Edison imagined using the light for practical uses.
<b>Fluency</b> Generating a large number of possible solutions	Edison tested thousands of materials of different materials to find one that would last in the patent of glowing light bulb without burning up.
<b>Flexibility</b> Shifting with ease from one type of problem-solving strategy to another	When he couldn't find a way during material, Edison tried leaving it in a vacuum—finally creating the first light bulb.




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### Thinking: Creativity

- **Divergent Thinking:** producing many alternatives or ideas from a single starting point; linked to **creativity** (e.g., reordering the letters “grevenid” to form many new words)
- **Convergent Thinking:** attempting to find one correct answer; linked to *conventional, non-creative* thinking (e.g.,  $2 + 2 + 6 = ?$ )




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### Resources of Creative People -Investment Theory-

Intellectual ability	Enough raw figures to see problems in a new light	 WPAIC 110621101.0002 p436048484 110621101.0002 p436048484 110621101.0002
Knowledge	Sufficient basic knowledge of the problem to effectively evaluate possible solutions	
Thinking style	Novel ideas and ability to distinguish between the worthy and unworthy	
Personality	Willingness to grow and change, take risks, and work to overcome obstacles	
Motivation	Self-driven motivation to accomplish the task and more personal than external motivation	
Environment	An environment that supports creativity	

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### Resources of Creative People -Investment Theory-

Intellectual ability	Enough intelligence to see problems in a new light	 Which planet can best explain Lady Gaga's phenomenal success?
Knowledge	Sufficient basic knowledge of the problem to effectively evaluate possible solutions	
Thinking style	Novel ideas and ability to distinguish between the worthy and unworthy	
Personality	Willingness to grow and change, take risks, and work to overcome obstacles	
Motivation	Self-driven motivation to accomplish the task and more personal than external motivation	
Environment	An environment that supports creativity	

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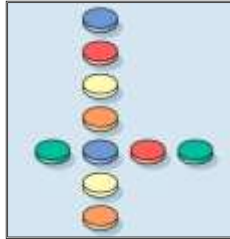
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### Pause & Reflect: Psychology & Life

- Psychology offers fun, do-it-yourself tests.

*Would you like to test your creativity? Arrange 10 coins in this same configuration. By only moving two coins, can you create two rows of 6 coins?*




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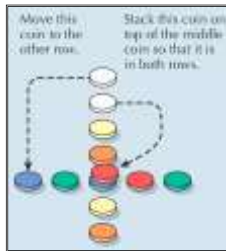
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### Pause & Reflect: Psychology & Life

- How did you do? Did you think of this **creative** solution to the 10 coin problem?




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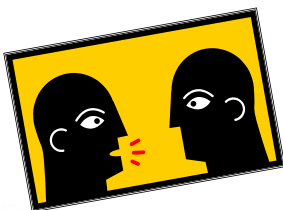
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### Language

- **Language:** form of communication using sounds & symbols combined according to specified rules




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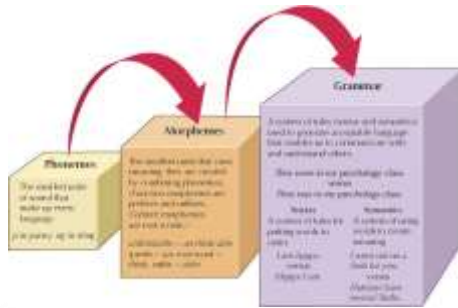
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### Language: Three Building Blocks




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### Language & Thought

• Does the language you speak in determine how you think?

• Chinese vs. English

• Euphemisms

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### Language Development

• **Prelinguistic Stage:** crying, cooing, & babbling

• **Linguistic Stage:** single-utterances, telegraphic speech, & learning the rules of grammar




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Study Organizer 8.1 Language acquisition		NO PLANET B
<p><b>0 to 12 months</b></p> <p><b>FEATURES</b> Crying reflexes in neonates becomes more purposeful Cooing period (as toddler) at 2-3 months Babbling (consonant syllables) at 4-6 months</p> <p><b>EXAMPLES</b> Grunts ("y"), wails ("a"), and gurgles ("oo") "mama", "dada" "babababa", "bababababa"</p>		
<p><b>12 months to 2 years</b></p> <p><b>FEATURES</b> Babbling resembles language of the environment, and child understands context related to meaning Simple variety of one-word utterances Expansion of single words to short phrases and joint focus about objects Emergence of using words to label objects that do not fit the word's meaning</p> <p><b>EXAMPLES</b> "Mama", "dada", "uh" "Daddy walk", "no-right night" "uh-uh" = "No" "uh-uh" = "Yes"</p>		
<p><b>2 years to 7 years</b></p> <p><b>FEATURES</b> Phonological growth (the building blocks of words) (vocabulary growth) Vocabulary increases at a phenomenal rate Child acquires a solid mastery of grammar rules Emergence of narrative (applying basic rules of grammar) soon to learn that are exceptions to the rule</p> <p><b>EXAMPLES</b> "My wheel car" "Daddy get the ball" adding -ed for past tense adding -s for plurals "I goed to the zoo" ("I went")</p>		

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### Language Development



- Baby Sign Language
- Eases frustration
- Speed up process of learning to talk

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### Theories of Language Development

- **Nature Perspective:** language is an inborn capacity that develops primarily by maturation
  - Chomsky's **language acquisition device (LAD)**
- **Nurture Perspective:** language develops from a complex system of rewards, punishments, & imitation




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### Animals & Language



- Some of the most successful nonhuman animal language studies have used American Sign Language (ASL).

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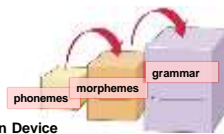
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### Pause & Reflect: Assessment

1. Label language's three building blocks. →



2. Chomsky believes we possess a Language Acquisition Device which is an inborn ability to learn language.




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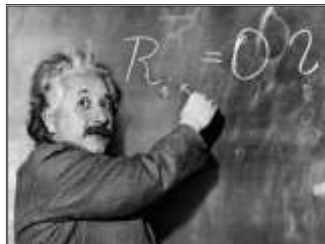
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### Intelligence

- **Intelligence:** global capacity to think rationally, act purposefully, & deal effectively with the environment




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## What Is Intelligence?

Historical views of intelligence:

1. Intelligence is a single, general factor called **general intelligence "g"** (Spearman)
2. Multiple abilities (Thurstone & Guilford)
3. Single ability with two types of "g," **fluid (gf)** & **crystallized intelligence (gc)** (Cattell)
4. **Multiple intelligences** (Gardner & Sternberg)

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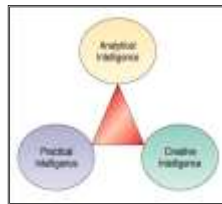


## Intelligence Models

• Gardner



• Sternberg




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Specialized Intelligences - Stern & S.	Facilitate careers
<b>Linguistic</b> Understanding a novel, writing a story Writer, journalist, teacher	
<b>Logical-mathematical</b> Figuring out how to pack multiple glasses Programmer, architect, pilot	
<b>Bodily-kinesthetic</b> Handling soccer and football Athlete, dancer, actor	
<b>Intrapersonal</b> Understanding oneself, such as setting achievable goals or recognizing self-defeating emotions Increased success in school or career	
<b>Logical-mathematical</b> Proving a theorem or statistical analysis, work as following a logical proof or solving a mathematical problem Mathematician, scientist, engineer	
<b>Interpersonal</b> Working a medical treatment Doctor, teacher, manager	
<b>Interpersonal</b> Working with groups of people Subsequent manager, therapist, teacher	
<b>Naturalistic</b> Solving natural problems at sea Biologist, naturalist	
<b>Spiritual</b> Determining meaning of life and death and other conditions of life Philosopher, theologian	

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Stanberg's triarchic theory of successful intelligence Table 8.4

	Analytical intelligence	Creative intelligence	Practical intelligence
<b>Sample skills</b>	Good at analysis, evaluation, judgment, and comparison (IQ)	Good at invention, coping with novelty, and imagination skills	Good at application, implementation, execution, and utilization skills
<b>Methods of assessment</b>	Intelligence tests assess the meaning of words based on context, and those to solve number series problems	Open-ended tasks, writing a short story, drawing a piece of art, solving a scientific problem requiring insight	Tasks requiring solutions to practical, personal problems

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## Emotional Intelligence (EI)

- One's emotions
- Empathizing
- Relationships
- 3 components of emotion
- Fostering EI?




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## How Do We Measure Intelligence?

- **Stanford-Binet & Wechsler** most widely used individual intelligence tests. Both tests compute an **intelligence quotient (IQ)**, a subject's mental age is divided by his or her chronological age & multiplied by 100.

–Original version of Stanford-Binet  
 $(IQ = MA/CA \times 100)$

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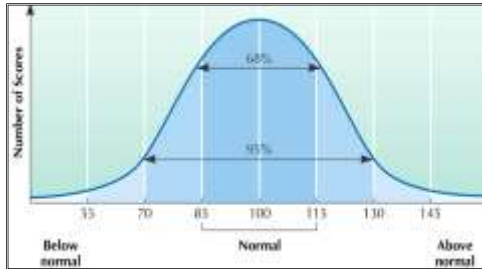
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## Measuring Intelligence: The Normal Distribution of I.Q. Scores




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Sample Wechsler Scales

Test	Description	Example
Block design	Top-down view of information	Identical patterns in front?
Information	Basic understanding of social conventions and ability to evaluate and respond	Why do people need to be socially aware?
Verbal	Open-ended questions through verbal problem	How many more words does it take to draw 100 units of 100 units per unit?
Similarities	How to relate two similar objects or concepts and identify differences between them	How are a catfish and a butterfly alike?
Picture puzzle	How to examine and use memory by solving puzzles that require logical thinking	How are the following numbers related? 2 0 1 1 1 0 0
Similarity	How to identify and define concepts and their uses	What does a rabbit eat?
Block design	How to identify and use spatial information and patterns in a 3D space	5 0 2 0 5 0 0 4
Picture completion	How to identify and use spatial information and patterns in a 2D space	What is missing?
Block design	How to identify and use spatial information and patterns in a 3D space	What is missing?
Picture arrangement	How to identify and use spatial information and patterns in a 2D space	What is missing?
Block design	How to identify and use spatial information and patterns in a 3D space	What is missing?

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## Measuring Intelligence: Three Scientific Standards

1. **Standardization:** establishes norms & uniform procedures for giving & scoring tests
2. **Reliability:** measure of the consistency & stability of test scores when test is readministered
3. **Validity:** ability of a test to measure what it was designed to measure

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**Pause & Reflect:  
Assessment**

1. How does Gardner's theory of intelligence differ from Sternberg's?
2. Briefly explain how **reliability** differs from **validity**.




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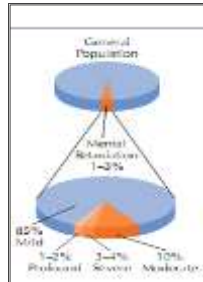
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**The Intelligence Controversy:  
Extremes in Intelligence**

- **Mental Retardation:** significantly below average in intellectual & adaptive functioning
- **Mental Giftedness:** being in the top one or two percent (IQs of 135 & above)




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Level of Retardation	IQ Scores	Characteristics
Mild (85%)	50-70	Usually able to become self-sufficient; may marry, have families, and secure full-time jobs in unskilled occupations.
Moderate (10%)	35-49	Able to perform simple unskilled tasks; may contribute to a certain extent to their individual.
Severe (3-4%)	20-34	Able to follow daily routines, but with continual supervision; with training, may learn basic communication skills.
Profound (1-2%)	below 20	Able to perform only the most rudimentary behaviors, such as walking, feeding themselves, and saying a few phrases.

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### An Unusual Form of Intelligence

- **Savant syndrome:** individuals who generally score very low on IQ tests, but demonstrate exceptional skills or brilliance in specific areas (e.g., rapid math calculation, musical ability, etc.)




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### The Intelligence Controversy: Explaining Differences

- *Is it in the brain?*  
All mental activity (including intelligence) results from neural activity in the brain.
- *Is it genetic or environmental influences?*  
Heredity & environment are important, inseparable factors in intellectual development.




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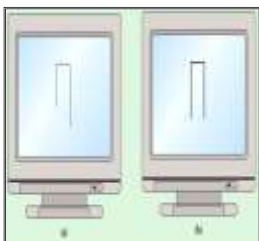
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### An Example of a Brain Test for Intelligence



*Which "leg" of the drawing is longer (a) or (b)?*  
The amount of time individuals require to make a correct choice between quickly flashed items like the ones on this screen may reveal something about their intelligence.

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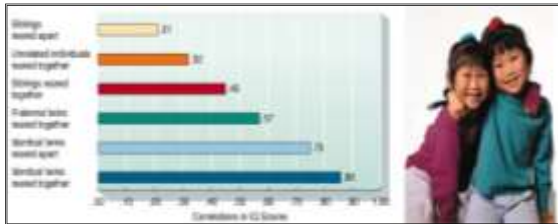
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## Genetic Vs. Environmental Influences on Intelligence




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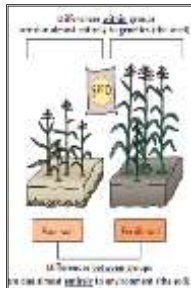
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## The Intelligence Controversy: Are IQ Tests Culturally Biased?

- Some ethnic groups score differently on IQ tests, but there are numerous contributing factors, including **stereotype threat**.




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### Pause & Reflect: Critical Thinking

- Given the controversy over IQ tests, do you believe they should be abolished in public schools? Why or why not?




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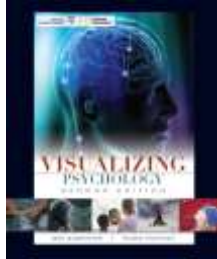
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# End of CHAPTER 8

**Thinking,  
Language,  
& Intelligence**



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