Chapter 7: Cognition, Language and Intelligence

Courtesy Dr. Julie Gralow
LEARNING OBJECTIVES: Part 1

- LO 1 Define cognition and explain how it is related to thinking.
- LO 2 Define concepts and identify how they are organized.
- LO 3 Differentiate between formal concepts and natural concepts.
- LO 4 Describe the biological processes associated with cognition.
- LO 5 Explain how trial and error and algorithms can be used to solve problems.
- LO 6 Identify different types of heuristics used to solve problems.
- LO 7 Define decision making and explain how heuristics can lead us astray.
- LO 8 Define language and give examples of its basic elements.
LEARNING OBJECTIVES: Part 2

- LO 9 Identify the linguistic relativity hypothesis and its relation to language and thought.
- LO 10 Examine and distinguish among various theories of intelligence.
- LO 11 Describe how intelligence is measured and identify important characteristics of assessment.
- LO 12 Define creativity and its associated characteristics.
Early psychologists: Introspection and personal conscious activities
Rise of behaviorism: Focus on behaviors
Cognitive revolution: Cognition and thinking
An accomplished neuroanatomist, Dr. Jill Bolte Taylor had devoted her career to studying the brains of others.

But one winter morning in 1996, she was given the frightening opportunity to observe her own brain in the midst of a meltdown.
## An Introduction to Cognition and Thinking: Part 1

<table>
<thead>
<tr>
<th>Cognition</th>
<th>Thinking</th>
</tr>
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<tbody>
<tr>
<td>- Mental activity associated with obtaining, converting, and using knowledge.</td>
<td>- Mental activity that involves coming to a decision, reaching a solution, forming a belief, or developing an attitude.</td>
</tr>
<tr>
<td>- Cognition is a broad term that describes mental activity, and thinking is a subset cognition.</td>
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</tbody>
</table>
The red zone on the right of the CT scan shows a hemorrhage on the left side of the brain. (Note that the patient’s left is your right.) In Dr. Jill’s case, the bleeding interfered with activity in Broca’s and Wernicke’s areas, impairing her ability to produce and understand language on the morning of the stroke, as illustrated by the difficulty she had in devising a coherent strategy to get medical help.
CONCEPTS

- Include mental representations of categories of objects, situations, and ideas that belong together
- Aid to organize and synthesize information, and to draw conclusions
- Are used in important processes such as memory, reasoning, and language
CONCEPTS

Hierarchies of concepts

- **Superordinate**: Broadest category; encompasses all objects in group
- **Midlevel**: Basic level; general grouping most often used in everyday experiences
- **Subordinate-level**: Narrow; specific
**An Introduction to Cognition and Thinking: Part 4**

<table>
<thead>
<tr>
<th>Formal concepts</th>
<th>Natural concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental representations of categories created through rigid and logical rules, or features.</td>
<td>Mental representations of categories resulting from experiences in daily life</td>
</tr>
</tbody>
</table>
Formal And Natural Concepts

**Formal Concept**
Defined by rigid, precise rules

A circle is a two-dimensional shape in which all points are the same distance from its center.

**Natural Concept**
Defined by general characteristics established through everyday encounters

A couch is a large piece of furniture used for sitting.
What comes to mind when you think of the concept “fruit”? Researchers studying the development of categories organized a group of items from the most prototypical to the least prototypical (Rosch & Mervis, 1975).

How long would it take you to think of an olive?
MENTAL IMAGERY

Mental images

- Descriptions of images from “mind’s eye”
- May be mentally manipulated in three dimensions
Can you tell which object pair is congruent? In order to figure this out, you must hold images of these figures in your mind and mentally manipulate them.

Source: Shepard and Metzler (1971).
MENTAL IMAGERY

Hubbard

- Concluded auditory images are similar to true auditory stimuli in their properties
- Found auditory images involve brain areas used in auditory perception (i.e., right temporal lobe; Broca’s area)
Researchers asked participants to imagine this fictional map and “find” objects there.

As with a real object, it took longer to find objects that were farther apart.

Size of the image is related to how much detail people can see in their mind’s eye. Fewer details can be detected on smaller images.

Source: Kosslyn, Reiser, and Ball (1978).
BIOLOGY OF COGNITION

Cognition and neurons

- Left frontal lobe: Critical for broad array of higher cognitive functions such as processing emotions, controlling impulses, and making plans – Dr. Jill experienced enormous difficulty devising a simple plan to save her own life (for example she was unable to think of calling 911).

- Another major element of cognition is language processing – Dr. Jill could neither create/express language nor understand it.

- Apparently, the stroke had interfered with neurons involved in the retrieval of memories.

- Amazing plasticity of the neurons. Greater excitability of the neurons, rewiring to take advantage of both hemispheres, increases in dendritic connections, and increased efficiency of connections at the synapses.

- Broca’s and Wernicke’s areas: Language centers
BIOLOGY OF COGNITION

Measuring cognition in the brain

- CT scans useful for information about normal cognitive functioning and detecting abnormalities
- PET and fMRI scans
  - Visual cortex can be activated by mental imagery as well as external stimuli.
  - Information processed by visual cortex, which works with other areas of brain to identify images, based on knowledge stored in memory.
  - Imagery and perception use many of same neural mechanisms.
1. **Cognition** is the mental activity associated with obtaining, converting, and using knowledge.

2. If you were to define the **concept** of superheroes, you might suggest that comic book characters in this category have supernatural powers, battle villains, and protect people.
   
a. cognition
   
b. **concept**
   
c. hierarchy
   
d. mental imagery
3. Your instructor explains that the pitch of a sound is defined by the frequency of the sound wave. She is describing a **formal concept**, which is created through rigid rules or features.

a. prototype  
b. natural concept  
c. **formal concept**  
d. cognition
Show What You Know: Part 3

• 4. Give two examples of how biology is associated with cognition.
Answers will vary. Structures in the brain are associated with cognition. For example, the association areas integrate information from all over the brain. Broca’s and Wernicke’s areas work with other parts of the brain to generate and understand language.
The biology of cognition can be found at the neural level as well. For example, changes at the level of neurons make it possible to store and retrieve information. It is also at the neuronal level where we see the plasticity of the brain at work.
Problem solving refers to the variety of approaches that can be used to achieve a goal.

- Initial state to goal state (Newell and colleagues)
- Obstacle recognition (Matlin)
Steps to Problem Solving

Understand the Problem

IDENTIFY INITIAL STATE:
What do you know about the problem situation? What is the goal state?

PROBLEM:
I need to register for classes, but I don’t know what to take.

My major has requirements. Not every class is offered this semester. Some classes have prerequisites.

Choose an Approach

TRIAL AND ERROR: Try every option.

ALGORITHMS: Follow step-by-step procedure to guaranteed solution.

HEURISTICS: Use general strategies that provide shortcuts.

EMPLOY ALGORITHM TO NARROW DOWN OPTIONS:

✓ Using catalog, find courses needed for major.
✓ Eliminate classes with prerequisites I don’t have.
✓ Check course offerings online.
✓ Register for available classes.

Evaluate

PROBLEM SOLVED?
If not, try again.

No, I can’t take Biology. It’s only offered at 9:30pm, when I have to be at work.
APPROACHES TO PROBLEM SOLVING

- Trial and error
- Algorithms
- Heuristics
  - Subgoals or subproblems
  - Means-ends analysis
APPROACHES TO PROBLEM SOLVING

**Heuristics:** Problem-solving approaches that incorporate a rule of thumb or broad application of a strategy

- Subgoals or subproblems

**Means-ends analysis:** Heuristic used to determine how to decrease the distance between a goal (the means) and the current status, leading to the solution of a problem (the end)
APPROACHES TO PROBLEM SOLVING

Insight

- Refers to understanding or solution that occurs in a sudden stroke of clarity (the feeling of “aha!”)
In a classic study, Wolfgang Köhler provided chimpanzees with some out-of-reach bananas and materials that could potentially be used to fetch them.

Resourceful chimps they were, building towers of crates and poking at the fruit with sticks.

Rather than using trial and error to solve the problem, they seemed to rely on insight.
HAPPY MOODS FACILITATE AHA! MOMENTS

Subramaniam and colleagues found that boosting volunteer moods increased the likelihood of an aha moment that helped word association problem solving.

- Sudden insight is accompanied by increased activity in brain’s anterior cingulate cortex (ACC) prior to solving each problem.
- Results from fMRI suggest that people in positive moods had more ACC activity going in to the task—helping to prepare the brain to find novel solutions.

Elizabeth King Humphrey. Reproduced with permission. Copyright © 2011 Scientific American, a division of Nature America, Inc. All rights reserved.
Problem Solving: Barriers to Problem Solving

**Functional fixedness**
Resistance toward using familiar objects in new ways is known as functional fixedness, and it can get in the way of problem solving.

**Think Outside the Box**
Who knew that a paint roller could be used for holding toilet paper and that car tires doubled as planters? Sometimes it’s hard to imagine using objects for unconventional purposes.
PROBLEM SOLVING IN DIFFERENT CULTURES

Güss’s hypothesis

- Highly individualistic countries = action-oriented problem solving
- Collectivist countries = more careful in approach

Conclusions

- Different cultures have varying degrees of tolerance for unpredictability (uncertainty avoidance).
Show What You Know: Part 3

1. Imagine it is the first day of classes, but you forgot to write down the number of the room where your psychology class is meeting. You decide you will try to find your classroom by sticking your head in a random number of rooms until you see the assigned psychology textbook on someone’s desk. This approach to finding your classroom uses:

a. means–ends analysis.
b. an algorithm.
c. trial and error.
d. heuristics.
Show What You Know: Part 4

2. One common barrier to problem solving is _____, which occurs when we can only imagine using familiar objects in their usual way.
   a. functional fixedness
   b. uncertainty avoidance
   c. an algorithm
   d. a goal state
3. Describe how you would use means–ends analysis to choose a topic for your experiment and write a review of the literature.

Answers will vary. A *means-ends* analysis is a heuristic used to determine how to decrease the distance between a goal and the current state. The goal in this example is to complete an assignment in a timely manner. The means could be to break the problem into two subproblems: (1) choosing a topic (for example by reading the textbook for increasing ideas, discussing ideas with your instructor); and (2) conducting a literature review (for example, identifying appropriate databases, finding a library to obtain and read articles).
Decision making involves choosing from alternatives generated from problem solving.

- Predicting the future
- Basing decision on single feature
- Adding additional features to decision criteria
Ineffective heuristic (Kahnerman and Tversky)

- Availability heuristic: Relies on memory and influenced by familiarity, recency, frequency, vividness
The odds of dying in a plane crash are extremely low—lower than perishing in a fall, a drowning incident, or a car accident (National Safety Council, 2012). Still, many people are petrified of flying.

This is partly because people tend to overestimate the likelihood of events that easily spring to mind.

**FEARING THE FRIENDLY SKIES**

- Fear of flying affects many people.
  - This fear may be influenced by risk perception or the result of the availability heuristic.
### Decision Making

<table>
<thead>
<tr>
<th>Representativeness heuristic</th>
<th>Confirmation bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-making strategy used to evaluate degree to which primary characteristics of a person or situation are similar to prototype of that type of person or situation.</td>
<td>Tendency to look for evidence that upholds beliefs and overlook evidence that runs counter to them</td>
</tr>
</tbody>
</table>
Framing effect

- Demonstrates how outcome of decision can be influenced by wording of questions or context of problem
1. **Decision making** refers to the cognitive process of choosing from a variety of alternatives you might use to reach your goal.

2. We often predict the probability of an event happening in the future based on how easily we can recall a similar type of event from the past. This is known as the:
   a. framing effect.
   b. confirmation bias.
   c. representativeness heuristic.
   d. **availability heuristic**.
3. A good friend is terrified of flying. How would you use your knowledge of heuristics to make him feel less afraid?

A heuristic uses a “rule of thumb” or a broad application of a strategy to solve a problem, but it can also be used to help predict the probability of an event occurring. However, heuristics can lead us astray in our assessment of situations or predictions of outcomes. In the current example, you can present information to your friend that indicates flying is the safest form of travel. But you can also describe how the availability heuristic might lead him to believe that air travel is not safe. The vividness of airplane crashes can influence his recall; even though they are rare events, he is likely to overestimate the probability of them happening again due to the ease with which he recalls similar events. Highly detailed media reports of an airplane crash are likely linger in his memory.
4. Your friend just told you about someone she met on the train. He seemed well spoken, thoughtful, and very informed about current events. She asked you to guess whether he was a factory worker or a politician. Your best guess in this situation, based on the base rates of these occupations, would be that he worked in a factory. But you choose politician based on your prototypes of these two occupations. This is a good example of:

a. the representativeness heuristic.
b. the confirmation bias.
c. the availability heuristic.
d. how the wording of a question can influence the outcome.
Language

- Refers to system for using symbols to think and communicate
- Involves 30,000 to 60,000 words for the average English speaker
Language

Phonemes
- Basic building blocks of spoken language

Morphemes
- Fundamental units that bring meaning to language

Syntax
- Collection of rules concerning where to place words or phrases

Grammar
- Rules associated with words and sentence structure

Semantics
- Rules used to bring meaning to words
THE PERKS OF BEING BILINGUAL

- Current research findings suggest that learning two languages does not lead to word mix-ups and other cognitive troubles.
- Bilingualism associated with enhanced creativity, abstract thought, working memory, and more efficient executive control.
- Executive control advantage carries into adulthood.

A sign in French and English outside a restaurant in Canada’s Quebec City, where many people are bilingual. Speaking two languages may boost the brain’s ability to manage many different activities (Bialystok, 2011).
LANGUAGE WITHOUT SOUND

- Chomsky theorized that all children learn language and go through the same stages in basically the same way, including signed language.
- ASL is a language with symbols, syntax, and grammatical structure that parallel spoken language.
- Deaf babies babble with their hands.
The Building Blocks of Language

- **Displacement**: ability to refer to things not present
- **Pragmatics**: social rules, such as expression
- **Syntax**: how words can be combined
- **Semantics**: content, rules affecting meaning
- **Morpheme**: smallest unit of language that carries meaning
- **Phoneme**: basic sound units
Psychologists adhering to the behaviorist perspective believe that language is acquired through reinforcement and modeling.
Language: Thinking What We Say or Saying What We Think?

Whorf: Linguistic relativity hypothesis

- Theorized languages have different effects on thinking and perception
- Observed different color-naming systems across languages

Critics

- Suggest that Whorf exaggerated or underestimated words
- Found that color discrimination across cultures does not consistently indicate color perception differences
Dyslexia

- Characterized by difficulty reading, writing, spelling, and/or pronouncing (IDA)
- Demonstrated although all presumed prerequisites for good reading appear to be in place
- Caused by defects in brain’s ability to retrieve and manipulate certain components of language
1. **Phonemes** are the basic building blocks of spoken language.

2. According to the linguistic relativity hypothesis, language differences lead to differences in:
   a. phonemes.
   b. **thinking and perception.**
   c. the language acquisition device.
   d. displacement.
3. The Dutch word *gezelligheid* does not really have a one-word counterpart in English. It refers to a primary component of Dutch culture: a cozy type of setting that can be quaint, fun, and intimate. Most languages have these types of untranslatable words. How might this phenomenon be an advantage for people who know more than one language?

Answers will vary. Bilingualism is associated with enhanced creativity, abstract thought, and working memory. And knowing more than one language has been found to be associated with more efficient executive functioning, including abilities related to planning ahead and solving problems. Thus, bilingualism may actually improve performance on cognitive tasks, such as deciphering unknown and untranslatable words.
WHAT IS INTELLIGENCE?

- **Intelligence**
  - Is one’s innate ability to solve problems, adapt to environment, and learn from experiences
  - Relates to broad array of psychological factors, including memory, learning, perception, and language
  - Is often defined by variable being measured
WHAT IS INTELLIGENCE?

Intelligence is in part a cultural construct.

- Maasai children in Kenya go through the motions of starting a fire.
- Definitions of intelligence vary according to culture.
- In the United States, intelligence is typically associated with high grades and test scores.
- Elsewhere in the world, being “smart” may have more to do with knowing how to survive and stay healthy.
Please note that contemporary theories of intelligence propose that there may be many multiple forms of intelligence, rather than just one.

**General intelligence (g factor)**
- Spearmann speculated that humans have a singular underlying aptitude or intellectual ability.

**Multiple intelligences**
- Gardner proposed eight types of intelligences or “frames of mind”; suggested partial evidence is apparent in people with brain damage.
## Gardner’s Original Multiple Intelligences

<table>
<thead>
<tr>
<th>Intelligence Type</th>
<th>Examples</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical-mathematical</td>
<td>Scientist, Mathematician</td>
<td>Sensitivity to, and capacity to discern, logical or numerical patterns; ability to handle long chains of reasoning.</td>
</tr>
<tr>
<td>Linguistic</td>
<td>Poet, Journalist</td>
<td>Sensitivity to the sounds, rhythms, and meanings of words; sensitivity to the different functions of language.</td>
</tr>
<tr>
<td>Musical</td>
<td>Composer, Violinist</td>
<td>Abilities to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness.</td>
</tr>
<tr>
<td>Spatial</td>
<td>Navigator, Sculptor</td>
<td>Capacities to perceive the visual-spatial world accurately and to perform transformations on one’s initial perceptions.</td>
</tr>
<tr>
<td>Bodily-kinesthetic</td>
<td>Dancer, Athlete</td>
<td>Abilities to control one’s body movements and to handle objects skilfully.</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Therapist, Salesman</td>
<td>Capacities to discern and respond appropriately to the moods, temperaments, motivations, and desires of other people.</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Person with detailed, accurate self-knowledge</td>
<td>Access to one’s own feelings and the ability to discriminate among them and draw upon them to guide behavior; knowledge of one’s own strengths, weaknesses, desires, and intelligences.</td>
</tr>
</tbody>
</table>

This table reprinted with permission from Gardner and Hatch (1989) presents Gardner’s original 7 intelligences. Each intelligence has associated strengths and capabilities.
Sternberg proposed three kinds of intelligence

- **Analytic intelligence**: Capacity to solve problems
- **Creative intelligence**: Knowledge and skills used to handle new situations
- **Practical intelligence**: Ability to adjust to different environments
# Theories of Intelligence

## Table 7.2  THEORIES OF INTELLIGENCE

<table>
<thead>
<tr>
<th>Theory</th>
<th>Advantages</th>
<th>Further Thoughts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman's general intelligence ((g))</td>
<td>There is a connection among different abilities such as verbal, spatial, and reasoning competencies.</td>
<td>Given the complexity of the mind, can intelligence really be explained by a single general factor?</td>
</tr>
<tr>
<td>There is a general intelligence driving abilities in many areas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gardner's multiple intelligences</td>
<td>Linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, intrapersonal, interpersonal, and naturalist are “frames of mind” that allow humans to succeed.</td>
<td>What differentiates intelligence from skills?</td>
</tr>
<tr>
<td>There are eight types of intelligences, which go beyond academic smarts and scholarship.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sternberg's triarchic theory</td>
<td>Analytic intelligence allows us to solve problems, creative intelligence represents knowledge and skills used to handle new situations, and practical intelligence includes the ability to adjust to different environments, all of which can be assessed.</td>
<td>Are each of these areas separate, or do they share something in common (like a ((g)) factor)?</td>
</tr>
<tr>
<td>Humans have varying degrees of analytical, creative, and practical competencies.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A summary of the main theories of intelligence, each with its own set of strengths and other considerations.
Intelligence: Part 3

Aptitude
- Individual’s potential for learning

Achievement
- Acquired knowledge, or what has been learned
**Binet**: Created way to identify students with difficulties learning in regular classrooms. The first intelligence test was devised by Binet.

Binet’s intelligence test is still used in a heavily revised form.

**Simon**: Worked with Binet to construct intelligence assessment

**Binet and Simon assessment**: Created assessment to compare mental abilities of mental abilities of individual child with group of children the same age
- Mental age (MA)
- Intelligence quotient (IQ)
French psychologist Alfred Binet collaborated with one of his students, Théodore Simon, to create a systematic assessment of intelligence.

The materials pictured here come from Lewis Terman and Maude Merrill’s 1937 version of Binet and Simon’s test. Using these materials, the test administrator prompts the test taker with statements such as “Point to the doll’s foot,” or “What advantages does an airplane have over a car?”. (Sattler, 1990)
- **Stanford–Binet test:**
  - Terman revised Stern’s work.
  - changed and added items
  - developed standards for U.S. children
  - extended test to teens and adults
- **Wechsler tests**
  - Wechsler created intelligence tests consisting of variety of subtests designed to measure different aspects of intellectual ability.
  - The Wechsler Adult Intelligence Scale (WAIS-IV) is the most commonly used IQ test in the United States.
  - Wechsler Intelligence Scale for Children (WISC-IV)
  - Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III)
## Intelligence: Testing The Intelligence Tests – Part 1

<table>
<thead>
<tr>
<th>Validity</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score from an intelligence assessment; originally based on mental age divided by chronological age multiplied by 100</td>
<td>Degree to which an assessment measures what it intends to measure</td>
</tr>
<tr>
<td>Standardization</td>
<td>Normal curve</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Occurs when test developers administer a test to a large sample and then publish the average scores for specified groups</td>
<td>Depicts the frequency of values of a variable along a continuum; bell-shaped symmetrical distribution, with the highest point reflecting the average score</td>
</tr>
</tbody>
</table>
Differences

- IQ scores consistently differ across certain groups of people
- No evidence to support a “genetic hypothesis”; more support for environmental influence and SES

Culture-fair intelligence tests

- Assessments are designed to minimize cultural bias
- Differences exist between culture-fair and culture-relevant tests
How Smart are Intelligence Tests? – Part 1

**fairness**

**IS THE TEST VALID FOR THE GROUP?**

An animal weighing 2 stone is likely to be a:
(a) sparrow   (c) mature lion
(b) small dog  (d) blue whale

Unless you live in the United Kingdom, where the imperial system of weights is used, you probably wouldn’t know that a stone is approximately 14 pounds, and therefore the correct answer is B. Does this mean that you are less intelligent, or that the test is biased against people without a specific background? A test that is culture-fair is designed to minimize the bias of cultural background.
How Smart are Intelligence Tests? Part 2

**Validity**

Does the test measure what it intends to measure?

A shortened ruler would not be a valid measure because it would provide different results than other rulers.

A valid intelligence test will provide results that:

- agree with the results of other valid intelligence tests
- predict performance in an area related to intelligence, such as academic achievement

Is a bathroom scale valid for measuring length?

How about a ruler missing its first inch?
How Smart are Intelligence Tests? Part 3

**reliability**

WILL YOUR SCORE BE CONSISTENT EVERY TIME YOU TAKE THE TEST?

A shortened ruler isn’t valid, but it is **reliable** because it will give the same result every time it’s used.

A reliable intelligence test will provide results that:
- are reproducible (produce a similar score if taken a second time)
- show the first and second halves of the test are consistent with each other

Because most intelligence tests are **standardized**, you can determine how well you have performed in comparison to others. Test scores tend to form a bell-shaped curve—called the normal curve—around the average score. Most people (68%) score within 15 points above or below the average. If the test is reliable, each person’s score should stay around the same place on the curve across multiple testings.
## Intellectual disability

- Delay in thinking, intelligence, and social/practical skills before age 18
- Term “mental retardation” still used in most laws and policies referring to intellectual disability

## Causes

- Half of intellectual disability cases have unidentifiable causes
- Down syndrome (extra chromosome on twenty-first pair)
- Fetal alcohol syndrome
- Fragile X syndrome
- Environmental factors (lead and mercury poisoning, oxygen deprivation at birth, various diseases, prenatal drug exposure)
Chinese conductor Hu Yizhou rehearses for an upcoming concert in Korea.

Yizhou, who has Down syndrome, is part of the China Disabled Peoples Performing Art Troupe.
Monitored 857 boys and 671 girls with IQs from 130 to 200 (Termites)

In childhood: Children were well adjusted socially, showed leadership skills, and were physically healthy and attractive.

In adulthood: Adults earned more academic degrees and achieved more financial success than non-gifted peers.

The IQ of intellectually gifted individuals is 130 or above.

Terman’s long-term study of the intellectually gifted found that the gifted tend to be neither socially awkward nor physically weak.

Remember...A high IQ score does not guarantee success in all areas of life!
Emotional intelligence (Goleman)

- Includes capacity to perceive, understand, regulate, and use emotions to adapt to social situations
- Manifested in people who are self-aware and can effectively judge how to behave in social situations
- Is related to job and school performance
Dr. Jill currently serves as the national spokesperson for the Harvard Brain Tissue Resource Center, where scientists conduct research on brain tissue from cadavers. It took eight years for Dr. Jill to recover from her stroke.

Her bestselling book *My Stroke of Insight* is being adapted for the big screen by Sony Pictures and Imagine Entertainment (drjilltaylor.com, 2010).
WHY DYSLEXIA?

- Many studies confirmed that dyslexia runs in families.
- Dyslexia can be traced to atypical connections in the brain and decreased activity in various areas, including the left parietotemporal region.
- fMRI research suggests this region can be awakened with intensive phonological training.
Heritability

- Includes degree to which hereditary factors (genes) are responsible for a particular characteristic or trait observed within a population.
- Refers to the proportion of variation in a characteristic attributed to genetic factors.
- Applies to groups of people, NOT individuals.

- A persisting issue or controversy in psychology that is especially relevant to the study of intelligence is that of nature vs. nurture.
The most genetically similar people, identical twins, have the strongest correlation between their scores on IQ tests. This suggests that genes play a major role in determining intelligence.

But if identical twins are raised in different environments, the correlation is slightly lower, showing some environmental effect. (McGue et al., 1993)
Creativity in problem solving
- Ability to construct valuable results in innovative ways; the ability to generate original ideas

Divergent thinking
- Ability to devise many solutions to a problem; a component of creativity

Convergent thinking
- Conventional approach to problem solving that focuses on finding a single best solution to a problem by using previous experience and knowledge
Intelligence: Characteristics of Creativity

- Originality
- Fluency
- Flexibility
- Knowledge
- Thinking
- Personality
- Intrinsic motivation
1. Sternberg believed that intelligence is made up of three types of competencies, including:
   a. linguistic, spatial, musical.
   b. intrapersonal, interpersonal, existentialist.
   c. analytic, creative, practical.
   d. achievement, triarchic, prototype.

2. Some tests of intelligence measure **aptitude**, or a person’s potential for learning, and other tests measure **achievement**, or acquired knowledge.
3. Define IQ. How is it derived?

The *intelligence quotient (IQ)* is a score from an intelligence assessment, which provides a way to compare levels of intelligence across ages. Originally, an IQ score was derived by dividing mental age by chronological age and multiplying that number by 100. Modern intelligence tests still assign a numerical score, although they no longer use the actual quotient score.
4. According to findings from the Minnesota twin studies, the heritability for intelligence is around 50 percent. This means that around half of the population-wide variation in intellectual ability may be attributed to genetic make-up.

a. heritability
b. standardization
c. divergent thinking
d. Average

5. An artist friend of yours easily comes up with unique solutions when trying to solve problems. This is one of the defining characteristics of creativity.

Originality