Cognition and Mental Abilities

Links to Learning Objectives

ENDURING ISSUES IN COGNITION AND MENTAL ABILITIES
BUILDING BLOCKS OF THOUGHT
Three basic building blocks of thought
LANGUAGE, THOUGHT, & CULTURE
Cultural influences on thought & language
NONHUMAN LANGUAGE & THOUGHT
Animal communication & thought
PROBLEM SOLVING
Interpreting problems
Strategy & evaluation
DECISION MAKING
Compensatory decision making, intuitive, hasty, & status quo decisions
MULTITASKING
INTELLIGENCE & MENTAL ABILITIES
Theories of intelligence
Intelligence tests
Criticisms of intelligence tests
HEREDITY, ENVIRONMENT, & INTELLIGENCE
Impact of heredity & environment
Flynn effect
Gender & cultural differences in mental abilities
Mental retardation
Giftedness
CREATIVITY
Relationship between creativity & intelligence
Measuring creativity

Enduring Issues

How do measures of intelligence and performance vary as a function of expectations and situations?
Enduring Issues

Do intelligence test scores change over time?

Enduring Issues

What are the differences and similarities in the ways people process information?

The processes whereby we acquire and use knowledge
LEARNING OBJECTIVE: Describe the three basic building blocks of thought and give an example of each. Explain how phonemes, morphemes, and grammar (syntax and semantics) work together to form a language.

The three most important building blocks of thought:

- Concepts
- Images
- Language
Building Blocks of Thought

“When you think of a close friend, you may have in mind complex statements about her, such as “I’d like to talk to her soon”... You may also have an image of her – probably her face, but perhaps the sound of her voice as well. Or you may think of your friend by using various concepts or categories such as woman, kind, strong... When we think, we make use of all of these things – language, images, and concepts -- often simultaneously.”

– Page 217 (Morris & Maisto)
Images

- Mental representations of sensory experiences
  - Allow us to think about things in nonverbal ways

Concepts

- Mental categories for classifying objects, people, or experiences
  - Prototype (or model): mental model containing the most typical features of a concept
LEARNING OBJECTIVE: Summarize the evidence for the idea that people in different cultures perceive and think about the world in different ways. Explain what is meant by “linguistic determinism” and summarize the evidence for and against it.

**Benjamin Whorf**
- **Linguistic relativity hypothesis**: Whorf’s idea that patterns of thinking are determined by the language one speaks.
- **Linguistic determinism**: More general belief that thought and experience are determined by language.

**Critics**
- Softened Whorf hypothesis.
- Language, thought, culture are intertwined.
- Experience shapes language, language affects subsequent experience.

Is Language Male Dominated?

Research supports the idea that words such as **he** or **she** influence our perception of males and females.

The words **he** and **man** are often used to refer to all people.
Learning Objective: Summarize research evidence that supports the statement that nonhuman animals have some humanlike cognitive capacities. Explain the following statement: “All animals communicate, but only humans use language to communicate.”

- All animals communicate in some way.
- Only humans can communicate verbally and in complex ways.
- Research: Some animals have humanlike cognitive capacities.
Three Aspects of the Problem-Solving Process

Interpreting Problems

LEARNING OBJECTIVE: Explain why problem representation is an important first step in solving problems. In your explanation include divergent and convergent thinking, verbal, mathematical and visual representation, and problem categorization.

**Problem representation:**
First step in problem-solving; involves interpreting or defining the problem

Divergent & Convergent Thinking

**CONVERGENT**
Thinking directed toward one correct solution to a problem

**DIVERGENT**
Thinking that meets the criteria of originality, inventiveness, and flexibility
LEARNING OBJECTIVE: Distinguish between trial and error, information retrieval, algorithms, and heuristics as ways of solving problems. Give an example of hill-climbing, subgoals, means-end analysis, and working backward. Explain how "mental sets" can help or hinder problem solving.

**Problem-Solving Strategies**

- Trial and Error
  Works best when choices are limited; wastes time when there are many options to test

- Information Retrieval
  Retrieval of information from long-term memory about how the problem was solved in the past

- Algorithm
  Step-by-step method of problem solving that guarantees a correct solution

- Heuristics
  Problem-solving strategies that are not guaranteed to find a solution but are often used in practice.
Problem-Solving Strategies

Rules of thumb that help in simplifying and solving problems, but do not guarantee a correct solution

- Hill climbing: Moves you closer to the final goal with each step
- Subgoals: Use intermediate, more manageable goals to make it easier to reach the final goal
- Means-end analysis: Aims to reduce the discrepancy between the current situation and the desired goal at a number of intermediate points
- Working backward: Works backward from the desired goal to the given conditions

Implementing Strategies and Evaluating Progress

Obstacles to Solving Problems

- Level of motivation, or emotional arousal
  - Mental set: The tendency to perceive and to approach problems in certain ways
  - Functional fixedness: Perceive only a limited number of uses for an object
    - Brainstorming: Helps to minimize mental sets

Applying Psychology

1. Eliminate poor choices.
2. Visualize a solution.
3. Develop expertise.
4. Think flexibly.
Decision Making

LEARNING OBJECTIVE: Explain how decision making differs from problem solving. Describe the process of compensatory decision making and the use of decision-making heuristics. Explain how framing can affect decisions, and how hindsight bias and counterfactual thinking affect the way we view our decisions after the fact.

Decision making:
Type of problem solving in which we already know all of the possible solutions or choices

Compensatory Decision Making

Compensatory model:
Rational decision-making model in which choices are systematically evaluated on various criteria

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Decision-Making Heuristics

**Representativeness:**
A new situation is judged on the basis of its resemblance to a stereotypical model.

**Availability:**
A judgment or decision is based on information that is most easily retrieved from memory.

**Confirmation bias:**
The tendency to look for evidence in support of a belief and to ignore evidence that would disprove it.

Framing

- Perspective from which we interpret information before making a decision
- Way information is presented can influence a final decision

Explaining Our Decisions

**Hindsight bias:**
The tendency to see outcomes as inevitable and predictable after we know the outcome.

**Counterfactual thinking:**
Thinking about alternative realities and things that never happened.
Multitasking

• With digital technology (i.e., iPods, Internet) multitasking is a way of life.
• According to research, multitasking isn’t always efficient.
• Multitasking may actually interfere with the successful completion of task.
General term referring to the ability or abilities involved in learning and adaptive behavior.

Intelligence is comprised of seven distinct, independent mental abilities. Individuals can excel in certain areas but not in others.

People who are bright in one area are usually bright in other areas as well.

Charles Spearman
- Intelligence is a singular, general quality about a person.
- People who are bright in one area are usually bright in other areas as well.

L.L. Thurstone
- Intelligence is comprised of seven distinct, independent mental abilities.
- Individuals can excel in certain areas but not in others.

Sternberg’s Triarchic Theory

- Analytical: Involves mental processes emphasized by most theories of intelligence.
- Creative: Involves adapting to new tasks and situations, to gain insight.
- Practical: Involves finding solutions to practical and personal problems.
Gardner’s Multiple Intelligences

1. Linguistic
2. Musical
3. Logical mathematical
4. Spatial
5. Bodily-kinesthetic
6. Interpersonal
7. Intrapersonal
8. Naturalistic

Emotional Intelligence

Five traits that contribute to emotional intelligence:
1. Knowing one’s own emotions.
2. Managing one’s emotions.
3. Using emotions to motivate oneself.
4. Recognizing the emotions of other people.
5. Managing relationships.

Comparing Gardner’s, Sternberg’s, and Goleman’s Theories of Intelligence

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LEARNING OBJECTIVE: Describe the similarities and differences between the Stanford-Binet Intelligence Scale and the Wechsler Intelligence Scales, and explain how they differ from group tests, performance tests, and culture-fair tests of intelligence. Explain what is meant by test “reliability” and “validity,” and how psychologists determine whether an intelligence test is reliable or valid.

**Stanford-Binet Intelligence Scale**
- First test developed to measure intelligence yielding an IQ

**Wechsler Intelligence Scale**
- Individual intelligence tests
- Measure verbal and performance abilities and also yield an overall IQ score
- One developed for adults and another for children
  - Wechsler Adult Intelligence Scale: Third Edition (WAIS-III)
  - Wechsler Intelligence Scale for Children: Third Edition (WISC-III)

**Group tests**
- Written intelligence tests administered by one examiner to many people at one time

**Performance Tests**

**Culture-Fair Tests**

**Biological Measures**
Intelligence tests that minimize the use of language

Intelligence tests designed to eliminate cultural bias by minimizing the use of language as well as the use of skills and values that vary from one culture to another

For decades: Attempts by researchers to assess intelligence using biological markers

To date: No biological measure of intelligence approaches the accuracy of psychological tests
Validity: Ability of a test to measure what it is designed to measure

- Content validity: Having an adequate sample of questions measuring the skills or knowledge the test is supposed to measure
- Criterion-related validity: Validity measured by a comparison of the test score and independent measures of what the test is designed to measure

What Makes A Good Test?

Reliability: Ability of a test to produce consistent and stable scores

Split-half reliability: Determines test reliability by dividing the test into two parts and checking the agreement of scores on both parts

Correlation coefficients: Statistical measures of the degree of association between two variables, used to measure reliability
Criticisms of IQ Tests

- IQ tests are controversial because psychologists disagree on the definition of intelligence.
- Critics argue that the tests assess a very limited set of mental skills and that some tests may be unfairly biased against minority groups.
- Poor performance in school may be the result of, rather than caused by, low test scores.
- Psychologists tend to agree on the validity of IQ tests to predict academic grades and obtaining high-status occupations such as M.D.s and lawyers.

Learning Objective: Summarize the criticisms of intelligence tests and the relationship between IQ test scores and job success.

Heredity, Environment, and Intelligence

Is intelligence inherited, or is it the product of environment?

Approximately 50% of the differences in intelligence are due to genetics, and 50% are due to differences in environment.
Heredity

Twin Studies
- Help scientists understand the influence of heredity
- Identical twins raised together – most similar IQs
- Identical twins raised by different families – still have very similar IQ scores

Environment

Influences
Many environmental influences on intelligence:
- Socioeconomic status
- Prenatal nutrition
- Level of environmental stimulation

Intervention programs:
- Milwaukee Project, Head Start
- Seem to have a significant impact on cognition between the ages of 3 and 5.

The IQ Debate: A Useful Model

Learning Objective: What is the “Flynn Effect”? What are some of the explanations that have been offered for it?

Flynn Effect
- IQ scores have increased in the population as a whole.
- Possible explanations:
  - The population is better at test-taking.
  - There have been improvements in nutrition and health care.
  - The modern world is increasingly complex.
“Suppose that you grow one group of randomly assigned plants in enriched soil, and another group in poor soil. The enriched group will grow to be taller and stronger...the difference between the two groups in this case is due entirely to differences in their environment. Within each group of plants, however, differences among individual plants are likely to be primarily due to genetics, because all plants in the same group share essentially the same environment. Thus, the height and strength of any single plant reflects both heredity and environment.”

– Page 245 (Morris & Maisto)

LEARNING OBJECTIVE: Summarize the evidence regarding gender differences and cultural differences in mental abilities.

Gender
- Research: Males and females don’t differ significantly in most cognitive abilities.
- When observed, differences are:
  - Relatively small
  - Concentrated in very specific skills

Culture
- Achievement gap between American and Asian students
- American students lagging behind
- Differences reflect cultural attitudes toward importance of ability and effort
Mental Retardation

- Low IQ and the inability to function independently must both be present
- Causes often unknown, although approx. 25% of cases can be traced to biological causes
- Variety of intervention programs

LEARNING OBJECTIVE: Explain what is required for a diagnosis of mental retardation and summarize what is known about its causes. Describe what is meant by “inclusion” and whether it has been shown to be beneficial.

Extremes of Intelligence

Giftedness

- Special abilities usually exhibited in only a few areas
- Causes often unknown
- Pros and cons to enrichment programs:
  - Intellectually fulfilling
  - Accompanied by social concerns

Creativity
The ability to produce novel and socially valued ideas or objects.

Early research found no correlation between creativity and intelligence, but these early studies focused only on bright individuals.

**Threshold theory**: Creativity and intelligence are linked up to a certain level of IQ, but then the relationship disappears. Support for this theory has been mixed.

**LEARNING OBJECTIVE**: Describe the relationship between creativity and intelligence, and the ways in which creativity has been measured.

**Creativity Tests**

1. Torrance Test of Creative Thinking
2. Christensen-Guilford Test
3. Remote Associates Test (RAT)
4. Wallach and Kogan Creative Battery
Lecture Activities

Tower of Hanoi

Time to solve another problem. The object of the game is to move ALL of the disks onto a different pole. The rules are these:

1) You can only move one disk at a time.
2) A bigger disk can't go on a smaller disk.

See how quickly you can solve the tower in seven moves.

Click the next slide to see the solution.
• Did you use an algorithm or a heuristic to solve that problem?
• What types of day-to-day problems might require algorithmic solutions?
• What types of daily problems could be handled more heuristically?
• What do your conclusions suggest about the nature of problem solving?

A Mental Set
Try this one. On your paper, draw nine dots just like you see up here. Then, see if you can draw four straight lines so that they pass through ALL nine dots without lifting your pencil from the page AND without touching any dot more than once?
Did you solve the problem? Did you experience any “insight”? If not, what was it that kept you from doing so? Was it thinking about the group of circles as a square with solid boundaries? How can you break free from mental sets to “step outside of the box” when you need to?

Breaking Through Functional Fixedness
On the next slide you will see various items on a desk and be presented with a problem to be solved. Let’s see who is able to break through their functional fixedness.

Using only the items on top of the desk, how could you attach the candle to the wall ABOVE the desk, so that when the candle burns, it does NOT drip wax onto the desk?
Perhaps the most elegant solution to this problem is to:
1. Empty the matches out of the box.
2. Tack the empty box to the wall.
3. Place the candle in the box.

This solution requires one to avoid fixating on the normal function of the box as that of holding matches. Avoiding this trap allows one to see more than one use for the box (i.e., as a candle holder).

See Gardner’s list of intelligences. Are there any other types of intelligence Gardner’s list might still be missing?

Intelligence Test Activity
The speed with which an individual can verbally identify simple concepts is a critical measure of intelligence. In this activity, you will be presented with colored stimuli. Your task will be to identify correct colors as quickly as possible. We will go through this as a group.
Was this test a VALID measure of intelligence? Why? Why not?

Was this test a RELIABLE measure of intelligence? Why? Why not?
Intelligence Testing
Could you create a test that is free of cultural bias? What sorts of test items might you incorporate? Math? Picture completion? Explain your reasoning.

Creativity
Time to harness some of that doodling creativity. On a sheet of notebook paper, see how many different pictures you can draw, using this image comprising two circles. Don’t worry about drawing perfect pictures. Just make sure that the circle image is in each of your pictures. Work quickly. You will have 60 seconds.

Time is up! After such a task, a psychologist studying creativity might be interested in answers to the following types of questions:
1. How many pictures did you draw?
2. Were the pictures from different semantic categories (e.g., fruits, sports, cars, etc.)?
3. Were your pictures unique? In other words, did you draw pictures that others probably did not?
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