

Cognitive Psychology

****Important but NOT TESTABLE**** vs. **New this year (24-25), TESTABLE; add to your notes**

In this unit, knowledge surrounding sensation, perception, and learning provides the foundation for an understanding of cognition. Cognitive psychologists focus their research on the complex nature of the brain, particularly the areas of memory processes and intelligence and the influence of mental processes on behavior. Understanding how this information is gathered and processed gives insight into how we make sense of and perceive the world. Some cognitive psychologists attempt to answer how and why cognitive processes fail despite (or because of) the complexity of our biological structures. Other psychologists study intelligence and the reasons for individual differences. This cognitive perspective offers one way to understand how our thinking impacts our behavior, which can in turn provide insight into psychological disorders and their treatment.

Topic 5.1: Introduction to Memory

Learning Target 5A

Compare and contrast various cognitive processes.

Effortful vs. Automatic Processing

- **Automatic Processing:** unconscious encoding of incidental information and of well-learned information, such as the meanings of words.
- **Effortful Processing:** encoding that requires attention and conscious effort.

Automatic Processing

- **Space:** location of items
- **Time:** sequence of the day's events
- **Frequency:** how many times things have happened

Effortful Processing

- **Maintenance Rehearsal:**
 - Simple Repeating keeps it STM
- **Elaborate Rehearsal:**
 - Thinking & Making connections to other learned ideas

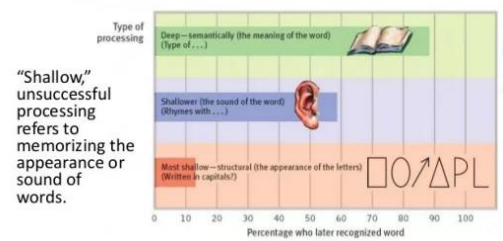
Deep vs. Shallow Processing

- **Deep Processing:** encoding something according to its semantics (meaning).
- **Shallow Processing:** encoding the shapes, looks, or surface structure of things, especially words, not the meanings. It is difficult to remember things if it is only shallowly processed.

Effortful Processing Strategies

Deep/Semantic Processing

When encoding information, we are more likely to retain it if we deeply process even a simple word list by focusing on the **semantics (meaning)** of the words.



Selective vs. Divided Attention

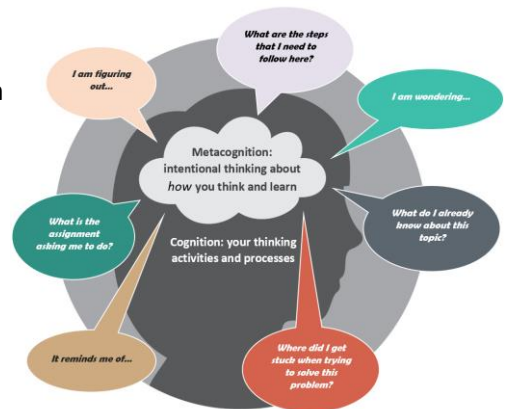
- **Selective Attention:** the process of directing our awareness to relevant stimuli while ignoring irrelevant stimuli in the environment. Allows us to tune out insignificant details and focus on what is important.
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- **Divided Attention:** Occurs when mental focus is on multiple tasks or ideas at once. Also known as multitasking.

See also: structural encoding, phonemic encoding

Metacognition

- Thinking About Thinking
 - The knowledge and regulation of cognitive phenomena which means, you can control your own thoughts. Metacognition includes the ability for you to control, 1) **person variables** (knowledge about one's self, and others' thinking), 2) **task variables** (knowledge that different types of tasks exert different types of cognitive demands), and; 3) **strategy variables** (knowledge about cognitive and metacognitive strategies for enhancing learning and performance).

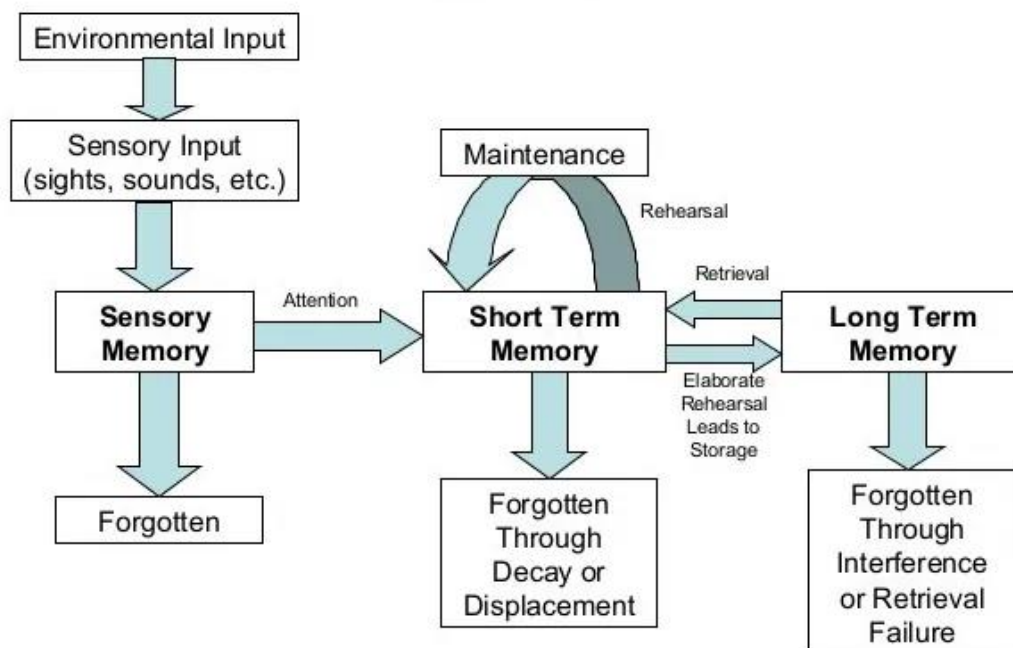


Learning Target 5B

Describe and differentiate psychological and physiological systems of memory.

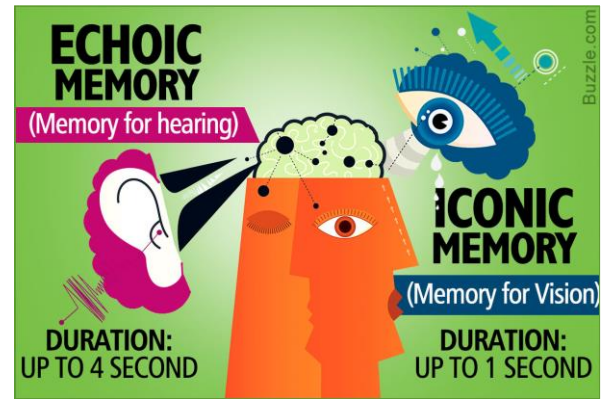
Memory: the persistence of learning over time through the storage and retrieval of information.

Multi Store Model - Atkinson & Shiffrin



Sensory Memory

- A quick, fleeting memory that is activated by the five senses. This information will leave the brain if we don't attend (pay attention) to it.
 - **Echoic memory:** a momentary sensory memory of auditory stimuli; if attention is elsewhere, sounds and words can still be recalled within 3 or 4 seconds
**Remember: an echo is a sound.*
 - **Iconic memory:** a momentary sensory memory of visual stimuli; a photographic or picture-image memory lasting no more than a few tenths of a second. **Remember: an icon is a picture on your computer, iconic means visual.*



Short-Term Memory (STM) / Working Memory

- Activated memory that holds a few items (on the average 7) for a brief time (usually 30 seconds) before the information is stored or forgotten.
- Located in the frontal lobe.
- Very vulnerable to interruption or interference

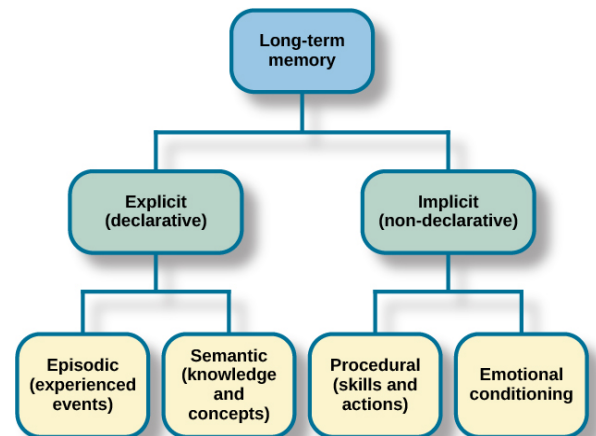
Short term memory has three key aspects:

1. **limited capacity** (only about 7 items can be stored at a time)
2. **limited duration** (storage is very fragile and information can be lost with distraction or passage of time)
3. **encoding** (primarily acoustic, even translating visual information into sounds).

See also: central executive, phonological loop, visuospatial sketchpad, episodic buffer

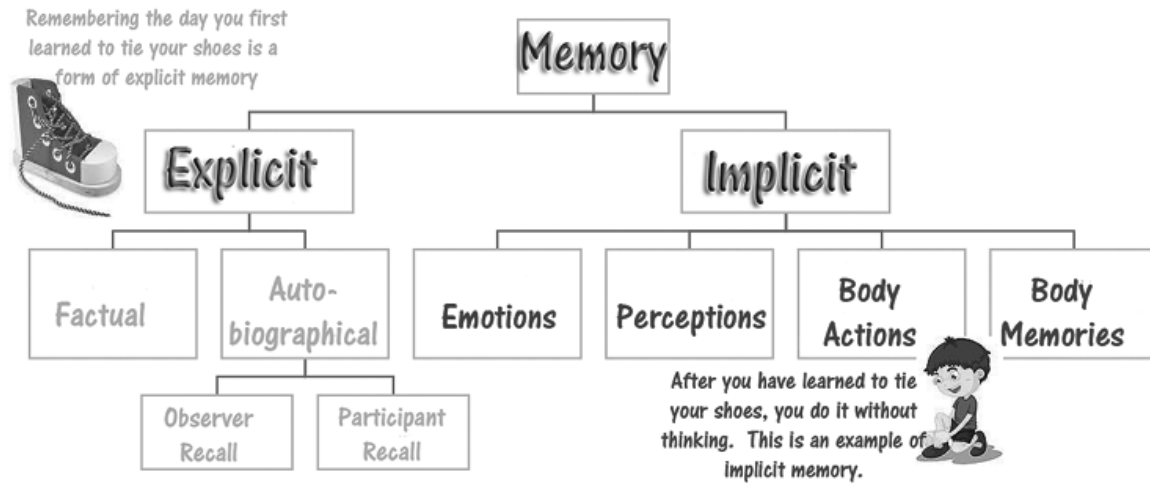
Long-Term Memory (LTM)

- The relatively permanent and limitless storehouse of the memory system that includes knowledge, skills and experiences.
- Most LTMs are located in the cerebral cortex but not all in the same location



Implicit Memory

- Procedural, how-to memory that you don't have to think about, it's independent of conscious recollection.
- Also called nondeclarative or procedural memory.
- Goes through the cerebellum (the part of the brain that plays an important role in forming and storing implicit memories).



Explicit Memory

- Memories of facts and experiences that one can consciously know and “declare”, such as telling about a vacation or giving directions.
- Also called declarative memory.
- Goes through the hippocampus (the part of the limbic system responsible for explicit memories of names, images, and events)
- **Semantic vs. Episodic Memory**
 - **Semantic memory:** fact based Jeopardy-like information.
 - **Episodic memory:** memories of certain episodes/events. Examples: vacations, birthdays, holidays, prom, etc. Not every episodic memory is a flashbulb memory, but every flashbulb memory is an episodic memory.

Explicit Memory

- Are encoded to memory and later retrieved
- Are often formed deliberately through rehearsal
- Can be encoded unconsciously and tied to emotions
- May be drawn into awareness through associations

Other Types of Memory

- **Eidetic memory:** photographic memory, very rare
- **Prospective memory:** remembering not to forget to do something. Example: I can’t forget to call my boss later today.
- **Flashbulb memory:** a clear memory of an emotionally significant moment or event. The memory is as clear as looking at a picture. Ex. Being in the Twin Towers on 9/11, you remember every detail: sights, sounds, smells, etc.

Physiological Systems

- See Topic 5.6, Learning Target 5H - Biological Bases of Memory

Learning Target 5C

Identify the contributions of key researchers in cognitive psychology

Noam Chomsky

- A linguist who argues that young children possess an innate capability to learn and produce speech - called this a **language acquisition device (LAD)**.

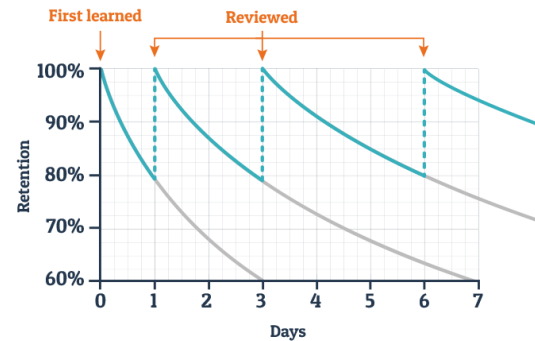
- Believes that children in widely different cultures progress through the same stages of language development at about the same age.

Hermann Ebbinghaus

- In 1885, Ebbinghaus suggested that learned information tends to be forgotten after days or weeks; however, such information will be easily remembered when reviewed. His studies also verified that memory goes down to 40% within the first few days and that the **forgetting curve** is exponential.



Typical Forgetting Curve for Newly Learned Information

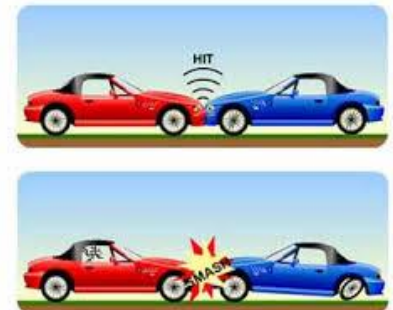


Wolfgang Köhler

- Insight research with Sultan and other chimps
- Placed bananas outside of their reach with some crates in the room
- For the most part, the chimps were unproductive and upset but then suddenly placed the boxes on top of each to reach the bananas → “a-ha” moment

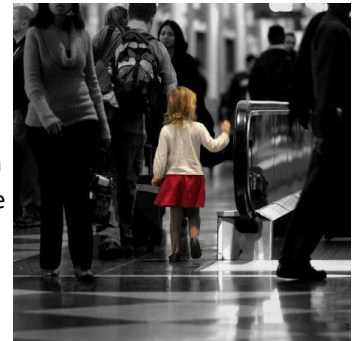
Elizabeth Loftus

- Elizabeth Loftus is an expert on Human Memory.
- The **Misinformation Effect** refers to how people's memories may be changed by what they are told. Loftus demonstrated this in a study where subjects were shown footage of an automobile accident, and were later asked to estimate the speed of the collision.
 - She found that the given estimates varied in proportion to the intensity of the verb used to describe the accident. Participants gave a higher speed estimate when they were asked at what speed the cars were going when they "smashed" into each other, rather than when they were asked at what speed the cars were going when they "hit" each other.



- The Misinformation Effect may cause **False Memories**. Loftus demonstrated that False Memories may be created by means of suggestion by using the Lost in the Mall Technique, where children were asked if they remembered the time when they got lost in a mall and were later rescued.

- Although none of the children studied ever experienced getting lost in the mall, many of them reported that they did remember the event, and some were even able to provide details of the event. Loftus believed that when the children were told of the event, they imagined it happening, thereby creating a false memory where the imagined event was confused with a real event.



George A. Miller

- One of the founders of cognitive psychology; was a pioneer who recognized that the human mind can be understood using an information-processing model
- Also a leader in the study of short-term memory and linguistics
 - Said that language must be a key element of any theory of psychology because it is a means of making private or internal psychological phenomena observable, measurable, and public.
 - The 1956 paper '*The Magical Number Seven, Plus or Minus Two*' is Miller's most famous, and remains one of the most frequently cited papers in the history of psychology. In this classic of cognitive psychology, Miller proposed that short-term memory is subject to certain limits including span and the quantity of information that can be stored at a given time.

Topic 5.2: Encoding

Learning Target 5.D

Outline the principles that underlie construction and encoding of memories.

The Three Stage of Memory (They MUST go in this order!!!):

1. **Encoding:** the processing of information into the memory system.
2. **Storage:** the retention of encoded information over time.
3. **Retrieval:** the process of getting information out of memory storage.

Shallow processing: encoding on the basic level based on the structure or appearance of words

Visual encoding: the encoding of pictures/images.

Acoustic encoding: the encoding of sound, especially the sound of words.

Deep processing: encoding something according to its semantics.

Semantic encoding: the encoding of meaning, including the meaning of words.

Self-referent processing: encoding something based on how it relates to you. This is a type of deep processing.

Effortful and Automatic Processing

- Atkinson and Shiffrin's model focuses on how we process explicit **memories** - the fact and experiences we can consciously know and declare. We encode explicit memories through conscious, **effortful processing**.
 - Strategies that boost our ability to form new memories...
 - **Chunking**: Organizing items into familiar, manageable units. Ex. trying to remember a list or a series of numbers is easier if we break it into smaller pieces
 - **Acronym**: a type of chunking in which a word is made out of the first letters of the to-be-remembered items. Ex. HOMES (the 5 Great Lakes: Huron, Ontario, Michigan, Erie, Superior)
 - **Mnemonics**: Memory aids, especially those techniques that use vivid imagery and organizational devices.
 - **Method of Loci**: A mnemonic that helps people remember things by placing them in a familiar place, such as in your house, on a baseball field, etc.
 - **Peg-word system**: Remembering a peg-word jingle (one is a bun, two is a shoe, etc) and visually associating the peg-words with the to-be-remembered words.
 - **Link method**: Forming a mental image of items remembered in a way that links them together. Ex. making a story out of items.
 - **Hierarchies**: A few broad concepts divided and subdivided into narrower concepts and facts.
 - **Imagery**: Mental pictures, a powerful aid to effortful processing, especially when combined with semantic encoding.
 - **Rehearsal**: the conscious repetition of information, either to maintain it in consciousness or to encode it for storage.
 - **Spacing effect**: Distributed practice. The tendency for distributed study or practice to yield better long-term retention than is achieved through massed study or practice (i.e. cramming)
 - **Testing effect**: Self-assessment / practice testing. Enhanced memory after retrieving, rather than simply rereading, information. Also sometimes referred to retrieval practice effect or test-enhanced learning
- ★ **The most effective way to cut down on the amount of time you need to spend studying is to increase the meaningfulness of the material. If you can relate the material to your own life, it takes less time to master it.**
- Behind the scenes, outside the Atkinson and Shiffrin's stages, other information skips the conscious encoding track and barges directly into storage. This **automatic processing**, which happens without our awareness, produces **implicit memories**.
 - Automatic, procedural skills
 - Classically conditioned associations
 - Space - visualizing locations
 - Time - sequence of events
 - Frequency - how many times things happen

Topic 5.3: Storing

Learning Target 5E

Outline the principles that underlie effective storage of memories.

Much of this is covered in the Learning Target 5H for the Biological Bases of Memory. Here's a quick summary.

- Our long-term memory capacity is essentially unlimited.
- Memories are not stored intact in the brain in single spots. Many parts of the brain interact as we form and retrieve memories.
- The frontal lobes and hippocampus are parts of the brain network dedicated to explicit memory formation.
 - Many brain regions send information to the frontal lobe for processing.
 - The hippocampus, with the help of surrounding areas of cortex, registers and temporarily holds elements of explicit memories before moving them to other brain regions for long-term storage.
- The cerebellum and basal ganglia are parts of the brain network dedicated to implicit memory formation.
 - The cerebellum is important for storing classically conditioned memories.
 - The basal ganglia are involved in motor movement and help form procedural memories for skills.
- **Infantile Amnesia:** Many reactions and skills during our first three years continue into our adult lives, but we cannot consciously remember learning these associations and skills.
- Emotional arousal causes an outpouring of stress hormones, which lead to activity in the brain's memory-forming areas. Significantly stressful events can trigger very clear **flashbulb memories**.
- **Long-term potentiation (LTP)** appears to be the neural basis for learning and memory. In LTP, neurons become more efficient at releasing and sensing the presence of neurotransmitters, and more connections develop between them.

Topic 5.4: Retrieving

Learning Target 5F

Describe strategies for retrieving memories.

Evidence of Memory (Measures of Retention)

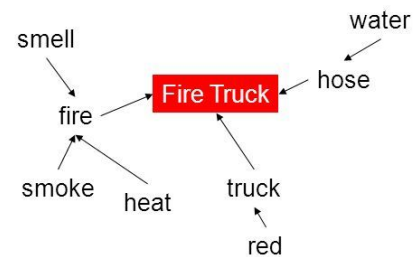
- **Recall:** a measure of memory in which the person must retrieve information learned earlier, as on a fill-in-the-blank test.
- **Recognition:** a measure of memory in which the person need only identify items previously learned, as on a multiple-choice test.
- **Relearning:** a measure of memory that assesses the amount of time saved when learning material for a second time.

Retrieval Cues and Strategies

- **Retrieval cues:** anchor points used to access the information you want to remember later.
- **Priming:** the activation, often unconsciously, of particular associations in memory.
- **Mood-congruent memory:** the tendency to recall experiences that are consistent with one's current good or bad mood.
- **State-dependent memory:** what we learn in one state may be more easily recalled when we are again in that state, such as being happy or sad.
- **Context-dependent memory:** putting yourself back in the context where you experienced something can prime your memory retrieval.
- **Déjà vu:** the eerie sense that "I've experienced this before." Cues from the current situation may subconsciously trigger retrieval of an earlier experience.
- **Next-in-line effect:** a person in a group has diminished recall for the words of others who spoke immediately before or after the person.
- **Serial position effect:** our tendency to recall best the last and first items in a list.
 - **Primacy effect:** information at the beginning of a list is remembered better than material in the middle.
 - **Recency effect:** information at the end of a list is remembered better than the material in the middle.

Retrieval Cues

Memories are held in storage by a web of associations. These associations are like anchors that help retrieve memory.



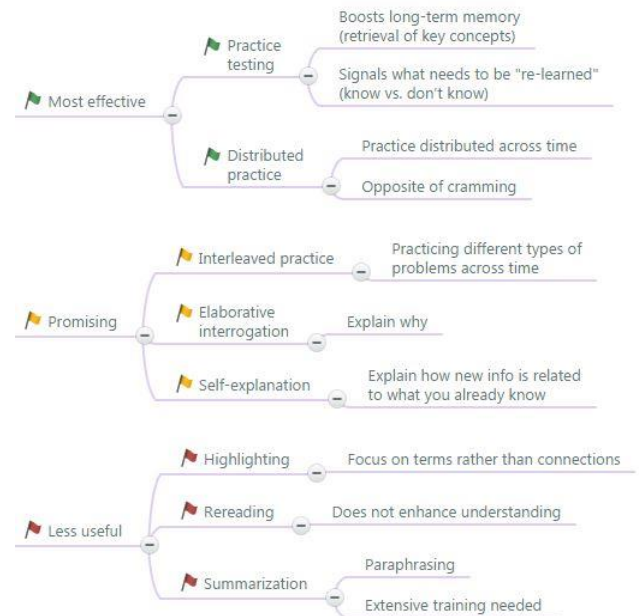
Topic 5.5: Forgetting and Memory Distortion

Learning Target 5G

Describe strategies for memory improvement and typical memory errors.

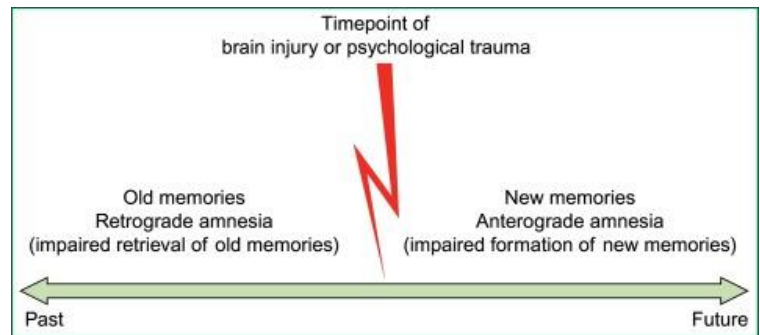
Strategies for Improving Memory

- Memory research findings suggest the following strategies for improving memory:
 - Study repeatedly
 - Make material meaningful
 - Activate retrieval cues
 - Use mnemonic devices
 - Minimize interference
 - Sleep more
 - Test yourself to be sure you can retrieve, as well as recognize, material



Why do we forget?

- **Amnesia:** the loss of memory.
 - **Infantile amnesia:** the inability to remember anything before the age of 3.
 - **Retrograde amnesia:** the inability to remember anything after specific brain surgery or an accident.
 - **Anterograde amnesia:** the inability to form new memories after specific brain surgery or an accident.



- **Encoding Failure**

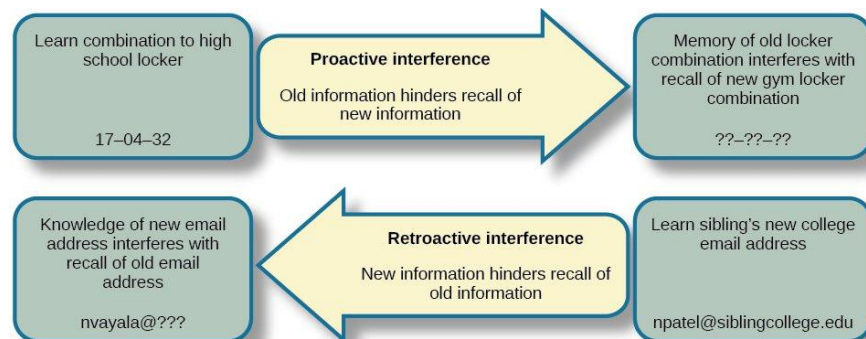
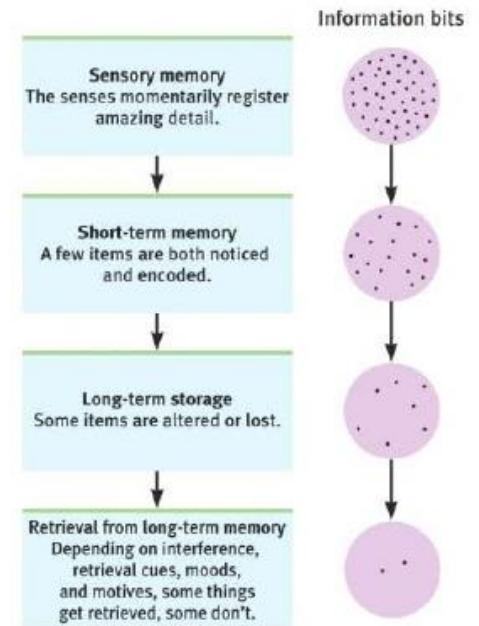
- Affected by age - brain areas for encoding are less responsive in older adults
- Divided attention / trying to multitask = we cannot remember what we have not encoded.

- **Storage Decay**

- The Forgetting Curve (see research by Ebbinghaus)

- **Retrieval Failure**

- **Tip-of-the-tongue Phenomenon:** knowing the answer but not being able to retrieve it.
 - **Motivated forgetting:** when people unknowingly revise their memories.
 - **Repression:** a defense mechanism that banishes anxiety-arousing thoughts, feelings, and memories from consciousness.
 - **Proactive interference:** the disruptive effect prior learning on the recall of new information; forward-acting. Ex. can't remember your new locker combination because you keep remembering your old one.
 - **Retroactive interference:** the disruptive effect of new learning on the recall of old information; backward-acting. Ex. can't remember your old locker combination because you keep remembering your new one.
- **EXCEPTION - Positive transfer:** when old information can facilitate our learning of new information, such as knowing Latin to help learn French.



Memory Construction Errors

- **Misinformation effect:** incorporating misleading information into one's memory of an event.
- **Source amnesia:** attributing to the wrong source an event we have experienced, heard about, read about, or imagined; also known as source **misattribution**. Source amnesia, along with the misinformation effect, is at the heart of many false memories.
- **Confabulation:** the spontaneous narrative report of events that never happened. It consists of the creation of false memories, perceptions, or beliefs about the self or the environment.

Memory-Related Mental Health Disorders

- **Dementia:** a loss of brain function that occurs with certain diseases. It affects memory, thinking, language, judgment, and behavior.
- **Delirium:** sudden severe confusion and rapid changes in brain function that occur with physical or mental illness.
- **Alzheimer's disease:** is one form of dementia that gradually gets worse over time. It affects memory, thinking, and behavior. Usually the body "forgets" to work and eventually shuts down.
- **Dissociative Disorder:** Dis-association of memory, sudden unawareness of some aspect of identity or history.

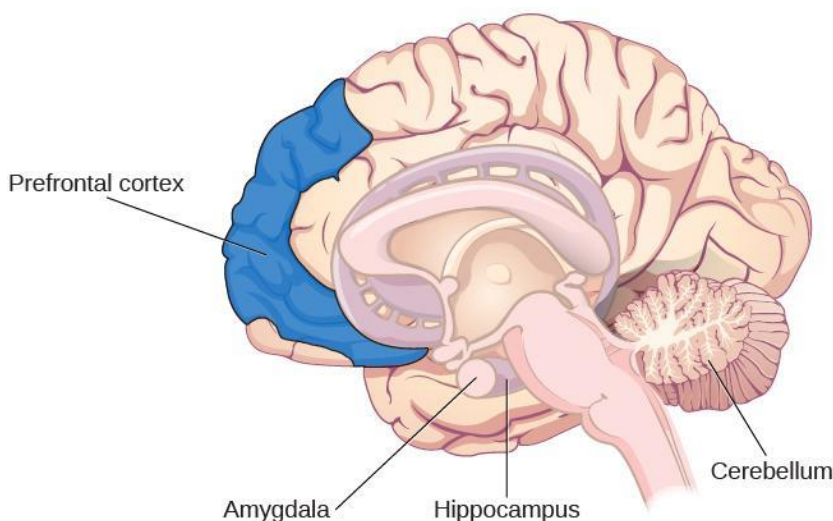
Topic 5.6: Biological Bases for Memory

Learning Target 5H

Describe and differentiate psychological and physiological systems of short- and long-term memory.

Physiology of Memory (The Memory Process)

- Memories are stored in subgroups of neurons that are activated in response to various sensory experiences.
- Interconnections which are formed are subject to continual change.
- The storage of information in LTM is a function of new interconnections and synapses and the production of new protein molecules.
- **Long-term potentiation (LTP):** a lasting strengthening of synapses that increases neurotransmissions; an increase in a synapse's firing potential after brief, rapid stimulation. Believed to be the neural basis for learning and memory.
- **Memory trace:** proof of memory, the neuron physically changes when memories are made.



Parts of the Brain Associated with Memory

The amygdala is involved in fear and fear memories. The hippocampus is associated with declarative and episodic memory as well as recognition memory. The cerebellum plays a role in processing procedural memories, such as how to play the piano. The prefrontal cortex appears to be involved in remembering semantic tasks.

Brain Structure	Connection to Memory
Hippocampus	Long-term potentiation / memory processing Associated with emotion and the transfer of information from STM to LTM

Amygdala	Emotional reactions
Cerebellum	Procedural memories Conditioned responses
Prefrontal Cortex	Storage of short-term/working memories
Basal Ganglia	Memory retrieval and procedural memory - key to creating and maintaining habits

Topic 5.7: Introduction to Thinking and Problem Solving

Learning Target 5I

Identify problem-solving strategies as well as factors that influence their effectiveness.

Topic 5.8: Biases and Errors in Thinking

Learning Target 5K

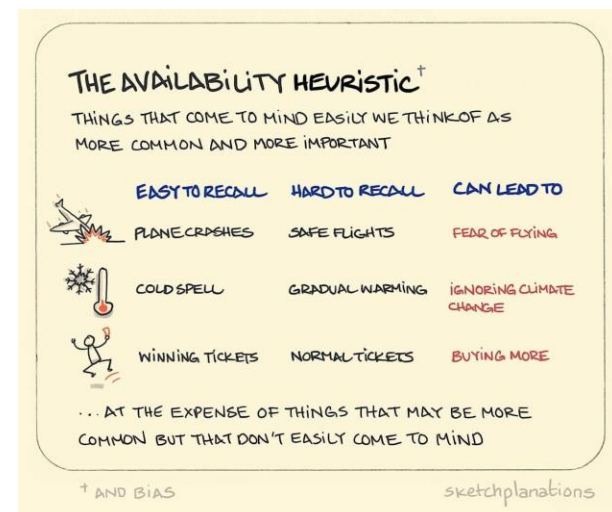
Identify problem-solving strategies as well as factors that create bias and errors in thinking.

Problem Solving Methods

- **Trial and Error:** The process of experimenting with various methods of doing something until one finds the most successful. Example: Typing in random numbers to figure out a pin number for an ATM card.
- **Means-End Analysis:** Breaking a problem into subgoals in order to reach the ultimate goal. Example: Wanting to run a marathon, but you don't go out the first day and run 20 miles. You have to start small, set a goal for a 5K, then a 10K, etc.
- **Algorithm:** A logical, step-by-step procedure that, if followed correctly, will eventually solve a specific problem. Example: Typing in 0000, 0001, 0002, 0003, etc. to figure out a pin number for an ATM card.
- **Heuristic:** A general rule-of-thumb or shortcut that is used to reduce the number of possible solutions to a problem. Usually speedier but more prone to errors than algorithms. Example: Using birthdays for a pin number.
- **Insight:** A sudden realization of a problem's solution; the "aha" moment

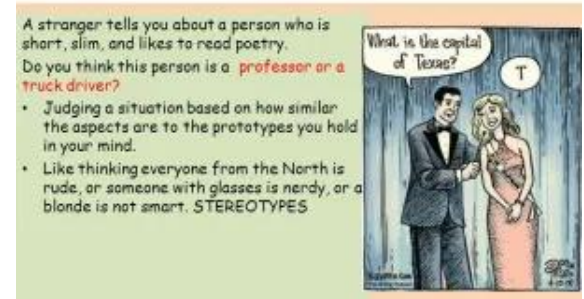
Obstacles to Problem Solving:

- **Fixation:** Having a preoccupation with something, not being able to stop thinking about it.



- **Mental set:** The tendency to continue using belief systems and problem-solving strategies that have worked in the past, even though it may not be working now.
- **Functional fixedness:** The tendency to think of an object as functioning only in its usual way or customary way. As a result, individuals often do not see unusual or innovative uses of familiar objects.
- **Availability heuristic:** Judging the likelihood of an event based on readily available personal experiences or new reports. Example: not wanting to fly after 9/11.
- **Representative heuristic:** Judging the likelihood of an event based on how well it matches a typical example. Example: Not thinking a tall, skinny man who likes to read would be a truck driver.

Representative Heuristic



- **Anchoring effect:** The tendency to be influenced by a reference point. Example: only buying a car because it's the color you want even though it has a lot of miles.
- **Framing:** Posing a question or wording a phrase in such a way to persuade someone's thoughts. Example: buying something because it's 95% fat free sounds better than 5% fat.
- **Bias:** Having pre-existing positions or beliefs about events, people, etc.
 - **Confirmation Bias:** A preference for information that confirms preexisting positions or beliefs, while ignoring or discounting contradictory evidence. Example: only looking at good reviews of something you want.
 - **Belief Perseverance:** Holding onto a belief even after it has been discredited. Example: believing that fad diets work.
 - **Hindsight Bias:** Also known as the knew-it-all-along effect, the inclination to see events that have already occurred as being more predictable than they were before they took place
 - **Overconfidence Bias:** The tendency to be more confident than correct. Example: Hitler thinking he could invade Russia when no one else has ever successfully done it.
 - **Exaggerated Fear:** Being overly fearful of something to the point of a phobia. Availability heuristic plays a part in this.

Learning Target 5J

List the characteristics of creative thought and creative thinkers.

Creativity: The ability to think about a problem or idea in new and unusual ways, come up with unconventional solutions to problems.

Robert Sternberg's Five Components of Creativity



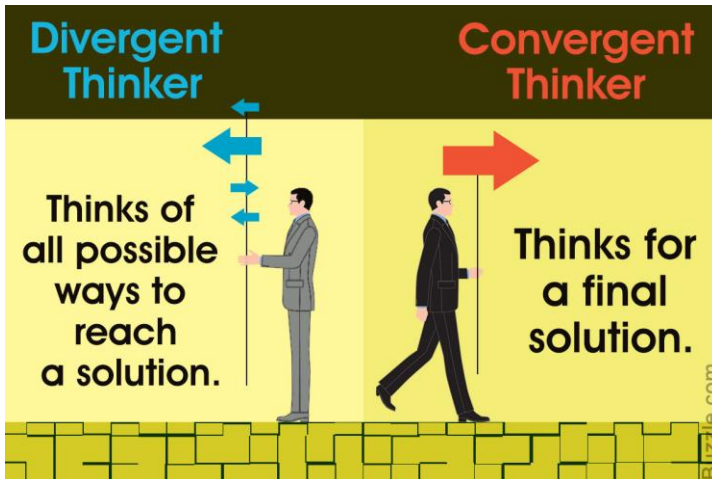
Characteristics of the Creative Person

- ☆ curious
- ☆ seeks problems
- ☆ enjoys challenge
- ☆ optimistic
- ☆ able to suspend judgment
- ☆ imaginative
- ☆ sees problems as opportunities
- ☆ doesn't give up easily



- **Brainstorm:** Coming up with new ideas.
- **Divergent thinking:** A type of thinking in which problem solvers devise a number of possible alternative approaches to problems and multiple solutions, it involves taking risks.
- **Convergent thinking:** Using logic and algorithms to solve problems, there is only one answer, doesn't see things from various perspectives.
- **Inductive reasoning:** Reasoning from the specific to the general. Example: evidence collected in crime scenes is used to figure out what happened.

- **Deductive reasoning:** Reasoning from the general to the specific. Example: all birds have wings, a flamingo is a bird, therefore, it has wings.



LESSON SUMMARY

	Inductive	Deductive
Known as	Bottom-up	Top-Down
Starts with	Conclusion	Premises
Uses	Specific instances	Generalized Principles
Goes from	Specific to General	General to Specific
Accuracy	Leads to a probable conclusion.	The conclusion is true if the premises are true.

Inductive Deductive

Study.com

Topic 5.9: Introduction to Intelligence

Learning Target 5L

Define intelligence and list characteristics of how psychologists measure intelligence.

Intelligence: Mental quality consisting of the ability to learn from experience, solve problems, and use knowledge to adapt to new situations.

Intelligence Test: A measure for assessing an individual's mental aptitudes and comparing them with those of others, using numerical scores.

- **Psychometric psychologists** are skilled mathematicians who statistically analyze the results from intelligence and other types of tests, such as personality inventories.

Intelligence research and testing remains controversial because of disagreements about the meaning of intelligence.

IQ tests were originally developed for children and measured abstract verbal abilities as a way to assess intelligence. Modern IQ tests employ both verbal and nonverbal questions to assess intelligence. When developing intelligence tests, researchers strive for high measures of validity and reliability.

- **Aptitude Tests:** Tests designed to predict future performance in an ability. Examples: SAT, ACT, ASVAB predicts academic/occupational success in military
- **Achievement Tests:** Tests designed to assess current performance in an ability. Example: unit tests, class exams, driver's license test
- **Speed of Processing Tests:** Tests that assess quickness of problem solving by offering many questions in limited time. Raw mental speed is linked with intelligence. For example, the IQ test is a timed test. This leads to the assumption that faster is smarter.
- **Power Tests:** Tests with questions of increasing difficulty, used to assess the highest-difficulty problem a person can solve.
- **Verbal Tests:** Tests that use word problems to assess abilities.
- **Abstract Tests:** Tests that use non-verbal measures to assess abilities. IQ tests contain a diverse mixture of questions that tap **abstract reasoning** skills. They are intended to measure intellectual potential rather than factual knowledge, but they really reflect both.

Aptitude v. Achievement Tests

Aptitude

- Purpose: predict future performance.
- Predictive Validity.
- Evaluate more general competencies that may be innate or acquired in the distant past.

Achievement

- Purpose: assess current performance
- Content Validity.
- Evaluate more specific competencies that have been recently learned.

- **Fluid Intelligence** is our ability to solve abstract problems and pick up new information.

- Tends to decrease with age

- **Crystallized Intelligence** is when we apply that fluid intelligence

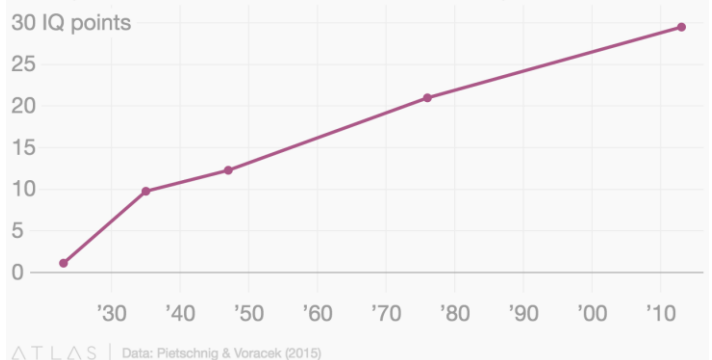
- Increases with age as one's accumulated knowledge and experiences expand

- **Flynn Effect:** Worldwide phenomenon that indicates the average person's IQ is rising; claims that people are getting "smarter" or at least getting better at taking standardized tests.
 - Possible explanations include better nutrition in early life, students taking more standardized tests so they are getting better at taking them, and access to a greater wealth of information available as a result of the Internet and personal electronic devices.

Fluid vs. Crystallized Intelligence (Cattell and Horn)

Fluid Intelligence	Crystallized Intelligence
<ul style="list-style-type: none"> • Inherited ability to reason and think • Neurophysiological base: dependent on the state of the brain and nervous system • Minimal dependence on school learning or acculturation • Inductive reasoning; problem solving • Nature 	<ul style="list-style-type: none"> • Accumulated knowledge and information acquired over a lifetime • Application of skills and knowledge to problem solving • Education dependent • Verbal and general knowledge • Nurture

The Flynn Effect: Gains in mean IQ in the last 100 years



- **Stereotype Threat:** If a member of a group believes that the group tends to do poorly on an assessment, this knowledge may cause anxiety, and the person may fulfill the poor expectation by scoring poorly on the assessment.
 - Possible explanation for why individuals from minority groups (in particular, Hispanics and African Americans) are far more likely to be identified as having lower intellectual scores than Caucasians.
 - Has also been demonstrated with gender
 - Stereotype threat is not an issue when one does not know that the group tends to score poorly on a given assessment.



Savant Skills



The abilities are usually in art, music, calendar calculation, mathematics or spatial skills.

- **Savant Syndrome:** A conditioned characterized by generally low scores on traditional intelligence tests but one or more extraordinary abilities

- **Memorization** - superior memory is a common feature of savant syndrome
- **Lightening calculation** - instantaneous calculation of multiplications, square roots, etc.
- **Calendar calculating** - the ability to identify the day of the week upon which a particular date falls

Learning Target 5M

Discuss how culture influences the definition of intelligence.

The qualities believed to make up intelligence differ from culture to culture. What it means to be “smart” can vary considerably depending on the skills and talents a society values, which can vary over time and place.

A culture’s definition of intelligence will in many ways also define how intelligence is measured.

- When tests of intelligence are used on cultural groups other than the one for which the test was written, the results may be low scores that are likely to be misleading or inaccurate.

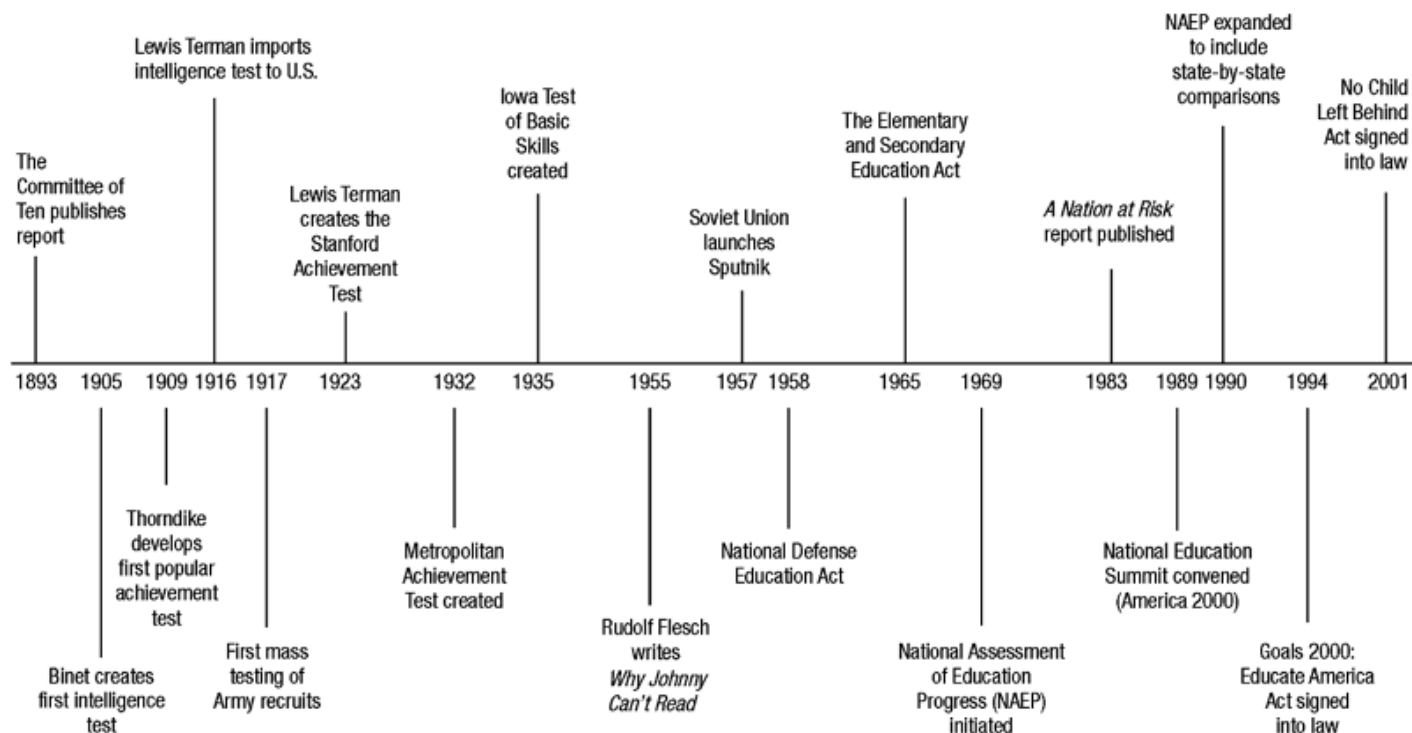
The Major Challenge: balancing the desire to compare people from various cultures according to a standard measure with the need to assess people in the light of their own values and concepts.

Learning Target 5N

Compare and contrast historic and contemporary theories of intelligence.

Learning Target 5O

Identify the contributions of key researchers in intelligence research and testing.



Name	Origins of Intelligence	Name of Test	Summary of Test
Francis Galton (Cousin of Charles Darwin)	Nature - Intelligence comes from good genes. He suggested that smart families should breed and believed in <i>eugenics</i>	None. His attempts were crude and unscientific	<ul style="list-style-type: none"> He looked at successful European families in his book <i>Hereditary Genius</i>
Alfred Binet	Nurture - Assumed low scoring kids could make gains with more remedial help and attention.	Binet's Mental Ability Test	<ul style="list-style-type: none"> Tested French school children to determine their strengths and weaknesses. Provided a mental age, showing the intellectual capabilities of the student. Mental age is the level of performance typically associated with a chronological age. Child who does as well as the average 8-year-old is said to have a mental age of 8.
William Terman, Stanford University	Nature - Also supported <i>eugenics</i> ; encouraged low scoring groups to become sterilized.	Stanford-Binet	<ul style="list-style-type: none"> Revised Binet's Mental Ability Test to create the Stanford-Binet, the widely used American revision of Binet's original intelligence test. First to adopt IQ score IQ = mental age / chronological age x 100 Only included verbal sections and were biased against non-English speakers. Tested immigrants (which led to quotas in immigration policy) and WWI recruits. Here is a link to items included on Lewis Terman's original Stanford-Binet test.

			<ul style="list-style-type: none"> Here is a link to a WWI Intelligence test.
David Wechsler	Nurture - Believed in a broad view of intelligence. "Intelligence is the aggregate or global capacity of an individual to act purposefully, to think rationally and to deal effectively with the environment."	WAIS (for adults) WISC (for children)	<ul style="list-style-type: none"> Most widely used intelligence test Includes 11 sections, including verbal and performance (non-verbal) subtests. Allowed non-English speakers to demonstrate their intelligence on the performance sections

WAIS Examples

VERBAL

General Information

What day of the year is Independence Day?

Similarities

In what way are *wool* and *cotton* alike?

Arithmetic Reasoning

If eggs cost 60 cents a dozen, what does 1 egg cost?

Vocabulary

Tell me the meaning of corrupt.

Comprehension

Why do people buy fire insurance?

Digit Span

Listen carefully, and when I am through, say the numbers right after me.

7 3 4 1 8 6

Now I am going to say some more numbers, but I want you to say them backward.

3 8 4 1 6

PERFORMANCE

Picture Completion

I am going to show you a picture with an important part missing. Tell me what is missing.

'85

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Picture Arrangement

The pictures below tell a story. Put them in the right order to tell the story.

Block Design

Using the four blocks, make one just like this.

Object Assembly

If these pieces are put together correctly, they will make something. Go ahead and put them together as quickly as you can.

Digit-Symbol Substitution

Code

△	○	▱	×	◇
1	2	3	4	5

Test

1	5	4	2	1	3	5	4	1	5

Factor Analysis: a statistical procedure that identifies clusters of related items (factors) on a test

TABLE 10.2

COMPARING THEORIES OF INTELLIGENCE

Theory	Summary	Strengths	Other Considerations
Spearman's general intelligence (<i>g</i>)	A basic intelligence predicts our abilities in varied academic areas.	Different abilities, such as verbal and spatial, do have some tendency to correlate.	Human abilities are too diverse to be encapsulated by a single general intelligence factor.
Thurstone's primary mental abilities	Our intelligence may be broken down into seven factors: word fluency, verbal comprehension, spatial ability, perceptual speed, numerical ability, inductive reasoning, and memory.	A single <i>g</i> score is not as informative as scores for seven primary mental abilities.	Even Thurstone's seven mental abilities show a tendency to cluster, suggesting an underlying <i>g</i> factor.
Gardner's multiple intelligences	Our abilities are best classified into eight independent intelligences, which include a broad range of skills beyond traditional school smarts.	Intelligence is more than just verbal and mathematical skills. Other abilities are equally important to our human adaptability.	Should all of our abilities be considered <i>intelligences</i> ? Shouldn't some be called less vital <i>talents</i> ?
Sternberg's triarchic	Our intelligence is best classified into three areas that predict real-world success: analytical, creative, and practical.	These three facets can be reliably measured.	<ol style="list-style-type: none"> 1. These three facets may be less independent than Sternberg thought and may actually share an underlying <i>g</i> factor. 2. Additional testing is needed to determine whether these facets can reliably predict success.

^^ Disregard Sternberg's triarchic theory above

Topic 5.10: Psychometric Principles and Intelligence Testing

Learning Target 5P

Explain how psychologists design tests, including standardization strategies and other techniques to establish reliability and validity.

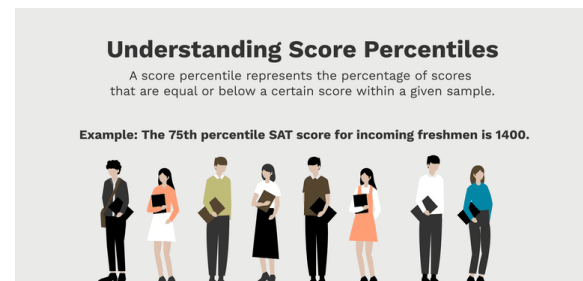
Test Construction

- **Standardization** - Refers to the procedures by which an exam is created, administered, and scored. Allows a researcher to make meaningful comparison by giving the test to a preselected group that is representative of the population. Tests are re-standardized in order to keep the **average at 100**. This enables the test scores to be placed on a **normal curve**, where the standard deviation is 15 IQ points.
- **Norms** - The distribution of scores of a clearly defined group. The group from which norms are determined must be carefully identified to accurately serve as a sample for the entire population taking the test.
 - A **norm-referenced test** is one that allows you to be compared to this sample group of test takers and determine your relative position in the testing group.

- **Percentile Rank** - Ranking of test scores that indicates the ratio of scores higher and lower than a given score

- **Validity** - The extent to which a test measures or predicts what it is supposed to

- **Content Validity** - the extent to which a test samples the behavior that is of interest
 - A driving test measures driving ability
- **Predictive Validity** - the success with which a test predicts the behavior it is designed to predict
 - Aptitude tests have predictive validity if they can predict future achievements
 - Assessed by computing the correlation between test scores and the criterion behavior
- *Are general aptitude tests as predictive as they are reliable?*
 - Academic aptitude tests are reasonably good predictors of achievement for children ages 6 to 12 (about +.6 correlation between intelligence score and school performance). Even closer reliability with achievement tests (+.81).
 - The SAT is less successful in predicting first-year college grades (less than +.5). The GRE correlation is only +.4 (modest but still significant).
 - When we validate a test using a wide range of people but then use it with a restricted range of people, it loses much of its predictive validity.



Types of Validity

CONTENT-RELATED (appropriate content)

face validity: does the test appear to test what it aims to test?

construct validity: does the test relate to underlying theoretical concepts?

CRITERION-RELATED (relationship to other measures)

concurrent validity: does the test relate to an existing similar measure?

predictive validity: does the test predict later performance on a related criterion?

- **Reliability** - The extent to which a test yields consistent results. To test reliability, researchers use the following methods...

- Test-retest
 - A group of people takes the same test twice; score should not change much between testings
 - Example: ACT score
- **Inter-rater** / Inter-scorer
 - Whether the test yields the same results when scored at different times by different people
 - Example: AP Exam Essays
- Split-Half
 - Divide test into two halves and compare the results (like odd v. even)
 - Example: SAT math portions, ACT math portions

Types of Reliability

INTERNAL

(extent to which a measure is consistent within itself.)

split-half method: measures the extent to which all parts of the test contribute equally to what is being measured.

EXTERNAL

(the extent to which a measure varies from one use to another.)

test re-test: measures the stability of a test over time.

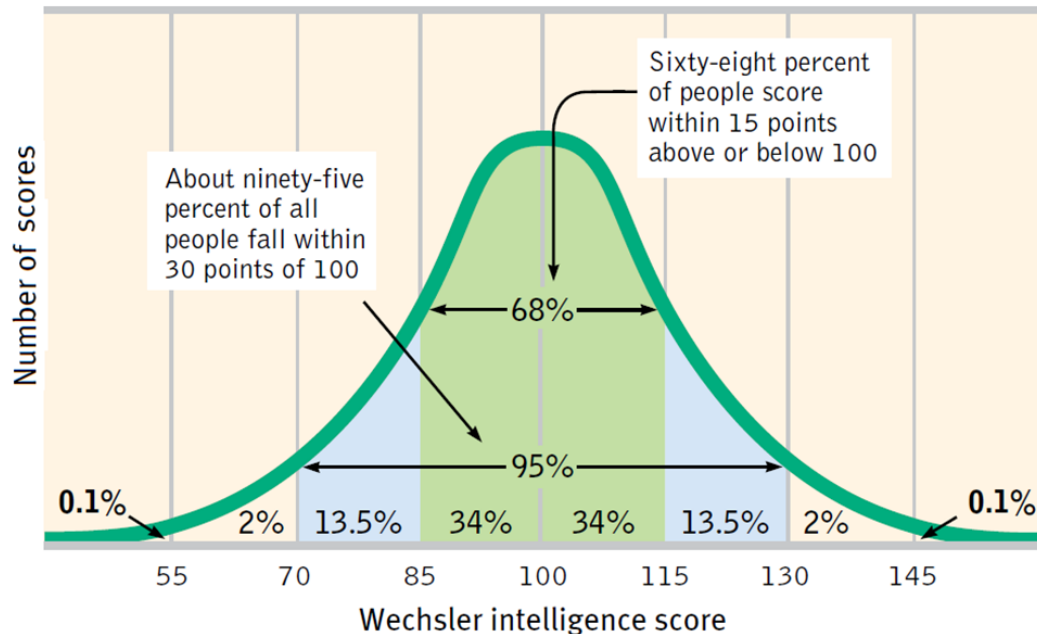
Inter-rater: to the degree to which different raters give consistent estimates of the same behavior

- The higher the correlation between the test-retest and split-half scores, the higher the test's reliability.
- **The Stanford-Binet, the WAIS, and the WISC** all have reliabilities of about +.9 which is very high. In other words, when retested, people's scores generally match their first score closely.

Learning Target 5Q

Interpret the meaning of scores in terms of the normal curve.

Scores on aptitude tests tend to form a normal, or bell-shaped, curve around an average score. For the Stanford-Binet and Wechsler tests, the average score is 100. To keep the average score near 100, the Stanford-Binet and Wechsler scales are periodically restandardized.



Learning Target 5R

Describe the relevant labels related to intelligence testing.

Extremes of Intelligence

● Intellectual Disability (formerly referred to as Mental Retardation)

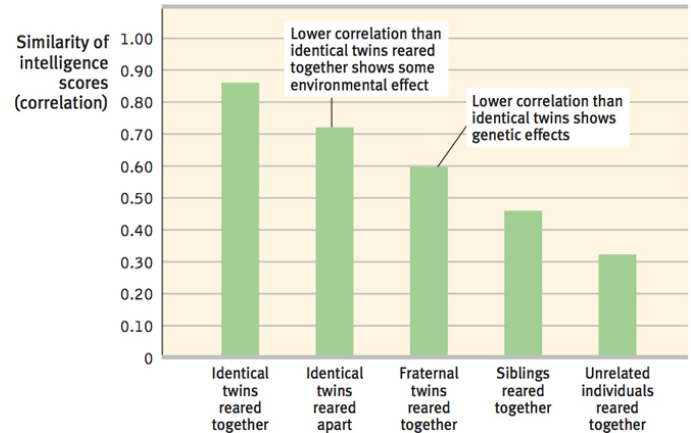
- A condition of limited mental ability
- IQ usually below 70
- Difficulty in adapting to the demands of life
- A developmental condition that is apparent before age 18
 - Can be mild to profound
 - Sometimes there is a known physical cause
 - **Down Syndrome** - caused by an extra chromosome 21 in the person's genetic makeup

● Giftedness

- High-scoring people (over 135) - tend to be healthy and well adjusted as well as unusually academically successful
- Poor and minorities are less represented in this group
- Schools sometimes "track" such children, separating them from students with lower scores. Such programs can become **self-fulfilling prophecies** as both groups live up to - or down to - others' perceptions and expectations.

Genetic and Environmental Influences on Intelligence

- **Genetic Influences** - the most genetically similar people have the most similar scores
- **Heritability of intelligence** - the extent to which variation in intelligence test scores in a group of people being studied is attributable to genetic factors (differences among people)
 - Scores of identical twins reared together are about the same as those of the same person taking the same test twice.
 - A little less for fraternal twins
 - Adopted children tend to have similar intelligence to their biological parents
- **Environmental Influences**
 - Studies of twins, family members and adopted children
 - Fraternal twins raised together are more similar than those of other siblings
 - Scores of identical twins raised apart are less similar than if raised together (although both are still very highly correlated)
 - Studies of children raised in extremely impoverished environments with minimal social interaction indicate that life experiences can significantly influence intelligence test performance.
 - No evidence supports the idea that normal, healthy children can be molded into geniuses by growing up in an exceptionally enriched environment.
- **Group Differences in Intelligence Test Scores**
 - Whites tend to have average intelligence score about 8-15 points higher than Hispanic or African-Americans
 - Asians outperform North Americans on math and aptitude tests
 - Gender
 - Girls are better spellers; more fluent and remember more words; locating objects; more sensitive to touch, taste and color; detect emotions; math computation
 - Boys outnumber girls in counts of underachievement; outperform girls in math problem solving



Topic 5.11: Components of Language and Language Acquisition

Learning Target 5S

Synthesize how biological, cognitive, and cultural factors converge to facilitate acquisition, development, and use of language.

Language: The way we communicate meaning (spoken, written, or gestured) to ourselves and others. **Linguistics** is the scientific study of language.

- **Phonemes:** The smallest distinctive units of sound used in a language.
- **Morphemes:** The smallest units of meaning in a language.
- **Grammar:** The system of rules in a language that enables us to communicate with and understand others.
 - **Semantics:** The set of rules by which we derive meaning from morphemes, words, and sentences. Example: By adding *-ed* to the word *laugh* means that it happened in the past.
 - **Overregularization:** Occurs when children apply a grammatical rule too widely and therefore created incorrect forms. Example: I beated him in the game. I holded the door open for my friend.
 - **Syntax:** The rules for combining words into grammatically sensible sentences. Example: In English, syntactic rule says that adjectives come before nouns; *white house*. In Spanish, it is reversed; *casa blanca*.

Language Acquisition

- Language development's timing varies, but all children follow the same sequence.
 - **Receptive language** (the ability to understand what is said to or about you - Wernicke's area in the brain allows you to understand language) develops before **productive language** (the ability to produce words - Broca's area in the brain allows you to speak).
 - At about 4 months of age, infants ***babble***, making sounds found in languages from all over the world
 - By about 10 months, their babbling contains only the sounds found in their household language.
 - Around 12 months of age, children begin to speak in ***single words***. This one-word stage evolves into ***two-word*** (telegraphic) utterances before their second birthday, after which they begin speaking in full sentences.
- **Noam Chomsky** has proposed that all human languages share a **universal grammar** - the basic building blocks (nouns, verbs, subjects, and objects) of language - and that humans are born with a predisposition to learn language.
 - All people are born with a **language acquisition device (LAD)** - an inborn capacity to learn the language in which they were raised
 - We acquire specific language through learning as our biology and experience interact.

- Childhood is a **critical period** for learning to speak or sign fluently.
- Benjamin's Lee Whorf's **linguistic determinism** hypothesis suggests that language determines thought, but it is more accurate to say that language influences thought. Different languages embody different ways of thinking, and immersion in bilingual education can enhance thinking.

Learning Target 5T

Debate the appropriate testing practices, particularly in relation to culture-fair test uses.

Additional Types of Intelligence Tests

- **Performance Tests**
 - Tests that minimize the use of language
 - Used to test very young children or people with intellectual disabilities
 - Also can be used to test those unfamiliar with English
- **Culture-Fair Tests**
 - Tests designed to reduce cultural bias
 - Minimize skills and values that vary from one culture to another