

# OA

1. Why do you think we worry and overthink when there is an issue?
2. Is overthinking bad for you or good for you? Explain your answer

Half full or half empty?  
**WRONG QUESTION!**



# How heavy is it??



# How long can you hold it?



# Memory and Cognition

8-10%

# I. Memory

# What is Memory?

- Memory is any indication that learning has persisted over time.
- Active System that stores, organizes, alters, and recovers (retrieves) information

# MEMORY CHECK



A



B



C



D



E



F



G



H



I



J



K



L



M



N



O



A



# Think about it...

- How many cars do we see in a day?
- How many voices do we hear in a day?
- How many scents do we smell?
- How many animals or people do we see?



# I. Information Processing

- **Encoding** – processing of information into the memory system
- **Storage** – The retention of encoded information over time
- **Retrieval** – getting the information out of the memory storage

# Memory

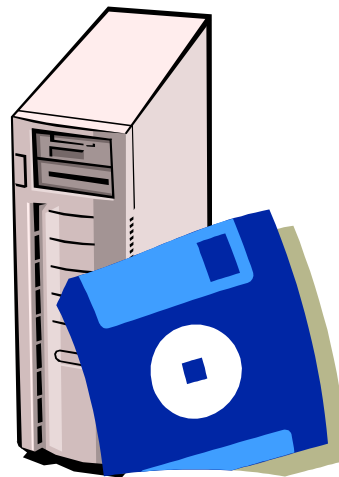
Encoding



Storage



Retrieval



# Information Processing

- **Encoding** – processing of information into the memory system
  - The process of putting information into digital format.
- **Storage** – The retention of encoded information over time
  - Hard Drive
- **Retrieval** – getting the information out of the memory storage
  - Accessing the Hard Drive

# Memory

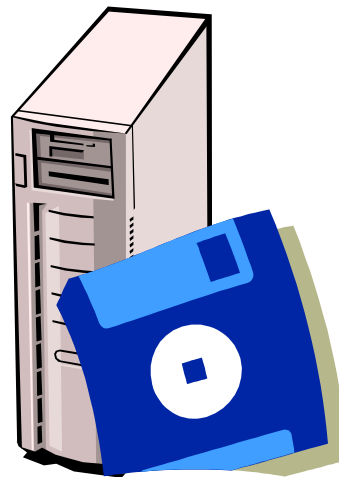
Encoding



Storage



Retrieval



# 1. Sensory Memory

- Storing an exact copy of incoming information for a few seconds (seen or heard)
- First stage of memory
- Iconic memory: fleeting mental image or visual representation
- Echoic memory: form of sensory memory that holds auditory info for one or two seconds

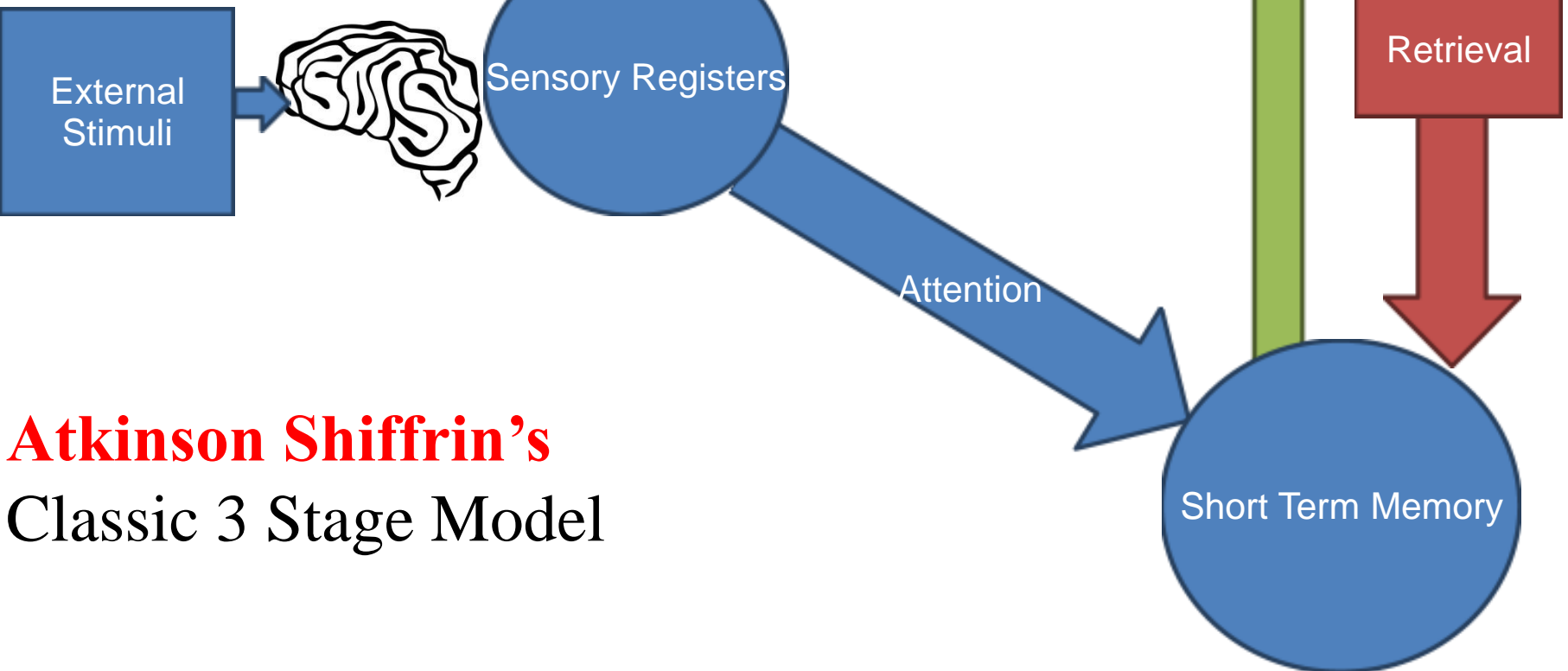
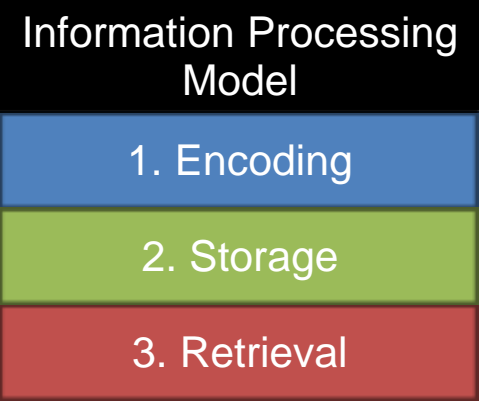
## 2. Short Term Memory (STM)

- Storing small amounts of information briefly
- Requires selective attention: focusing voluntarily on a selected portion of sensory input
  - Recall back to a party when you met a lot of new people
- Very sensitive to interruption (easily lost and interfered)
- Working Memory -- Focus on conscious and active processing of incoming auditory and visual-spatial info



# 3. Long-Term Memory

- Storing information relatively permanently
- Stored on basis of meaning and importance
- For example: you will have difficult time studying or remembering contents from subjects you do not enjoy



**Atkinson Shiffrin's**  
Classic 3 Stage Model

# Processing (Cognitive Activity)

- **Parallel Processing** – The processing of many aspects of a problem simultaneously; this is the brain's natural mode of information processing for many functions.
  - the brain's ability to make sense of several different incoming stimuli at the same time
  - This is NOT multi-tasking!
- **Serial Processing** – step by step processing of conscious problem solving

# Imagine if you are driving

Think about driving your car down the street. Your brain is constantly taking in information through your senses - what you see, hear, and sometimes feel and smell



# Processing (Conscious Activity)

- **Automatic Processing** is the Unconscious encoding of incidental information, such as space, time, and frequency, and of well-learned information such as word meaning
  - It occurs without us giving much thought or effort
  - Sequence of your days events
  - Riding a bike or driving
  - Reading a novel
  - well learned/ rehearsed activities can become automatic

# Processing (Cognitive Activity)

- **Effortful Processing** is encoding that requires attention and conscious effort.
- We can boost our memory through rehearsal
  - Effortful processing works best if one can make connection to what we already know (prior knowledge -- schema) or if it is meaningful

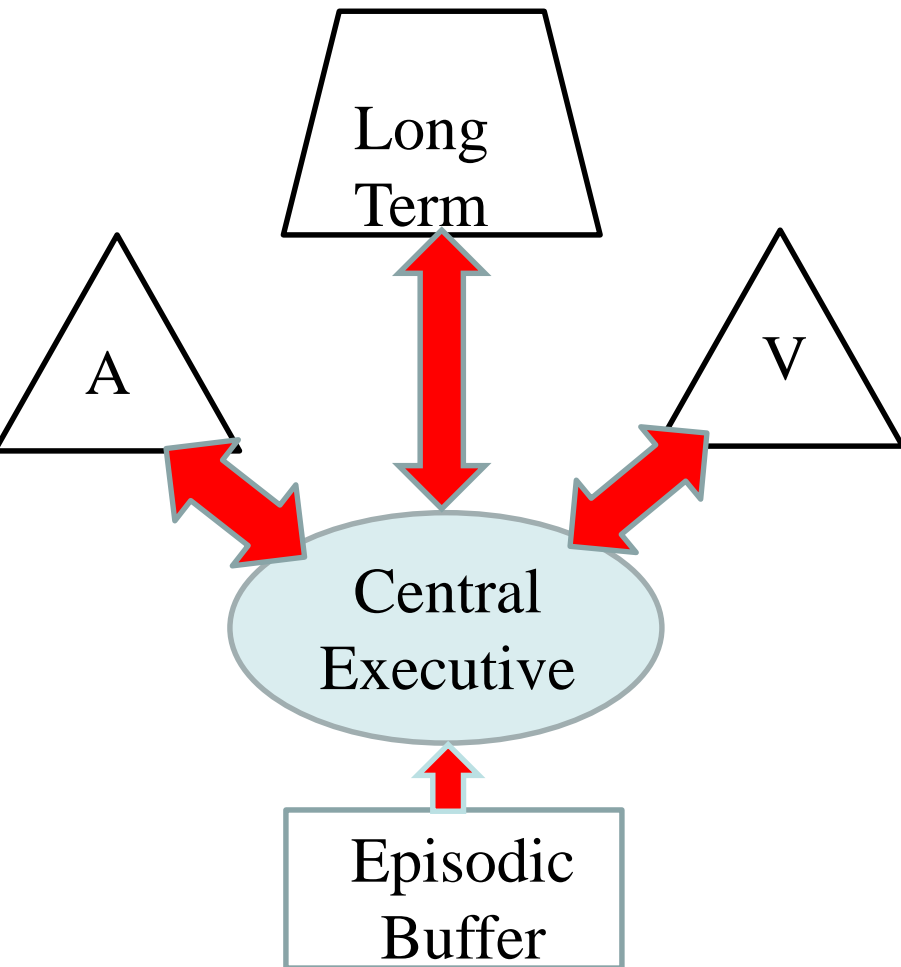
# 3 types of encoding

- Visual encoding – Picture images
- Acoustic Encoding – Sounds
- Semantic Encoding—Meaning, knowledge of facts, concepts
  - Semantic Encoding works the best for word recognition

## II. Short Term Memory Concepts



# Working Memory



Short term memory

Short term memory is created as a result of Auditory and Visual-spatial information and preexisting memory

# A. Working Memory

- **Auditory Rehearsal** (what we hear)
- **Visual Spatial Sketchpad** (what we see)
- **Central Executive** (coordinates information to the long-term memory)
- These elements help pick out what is important
- This creates new short term memory

# Rehearsal

- **Maintenance Rehearsal**
  - Repeating information silently to prolong its presence in STM
  - You are at a party and you meet a lot of people you have never met before. What do you do?
- **Elaborative Rehearsal**
  - Links new information with existing memories and knowledge in Long Term Memory
  - Applying meaningful associations
  - Good way to transfer STM information into LTM

# B. Mnemonic Devices

- <https://www.youtube.com/watch?v=T0q67iN4pOc>
- learning technique that aids information retention in the human memory
- THIS IS NOT A MEMORY!
- IT IS A TOOL to aid memory!

# Chunking

Organizing items into a familiar, manageable unit. Try to remember the numbers below.

1-7-7-6-1-4-9-2-1-8-1-2-1-9-4-1

If you are well versed with American history, chunk the numbers together and see if you can recall them better. 1776 1492 1812 1941.

# Chunking

- Digit Span : test of attention and short-term memory; string of numbers is recalled forward or backward
- **Magic Number 7 (plus or minus 2)**  
information bits (meaningful single piece of information) at once

# Chunking

**Acronyms** are another way of chunking information to remember it. (name mnemonic)

HOMES = **H**uron, **O**ntario, **M**ichigan, **E**rie, **S**uperior

PEMDAS = **P**arentheses, **E**xponent, **M**ultiply, **D**ivide, **A**dd, **S**ubtract

ROY G. BIV = **R**ed, **O**range, **Y**ellow, **G**reen, **B**lue, **I**ndigo, **V**iolet





# Jingle/Song (music mnemonic)

- Phone number
- Lyrics are easier to remember by listening to music/song
  - Religious Hymns
- Commercials



Injured?

**Text 8**

**Don't Wait, Call 8**

**888-8888**

**Cellino & Barnes**

16 W. Main St., Rochester

# Method of Loci / Memory Castle

- <https://www.youtube.com/watch?v=VclfKkhc6B0>
- mnemonic device or technique in which a person visualizes the items they're trying to learn in different spatial locations. To do this, the person associates the items with landmarks in some familiar place, which helps them recall the items later.
  - Picture a place you are familiar with
  - Incorporate information into that environment
  - Stranger the better

# Peg-Word Method

- In this strategy one makes an association with numbers to remember the new information.
  - The strategy is most efficient for remembering a list of information in a particular order.
  - One is a bun
  - Two is a shoe
  - Three is a tree
  - Four is a door
  - Five is a hive
  - Six is sticks
  - Seven is heaven

# Ebbinghaus and Rehearsal

**Effortful learning**  
usually requires  
rehearsal or conscious  
repetition.

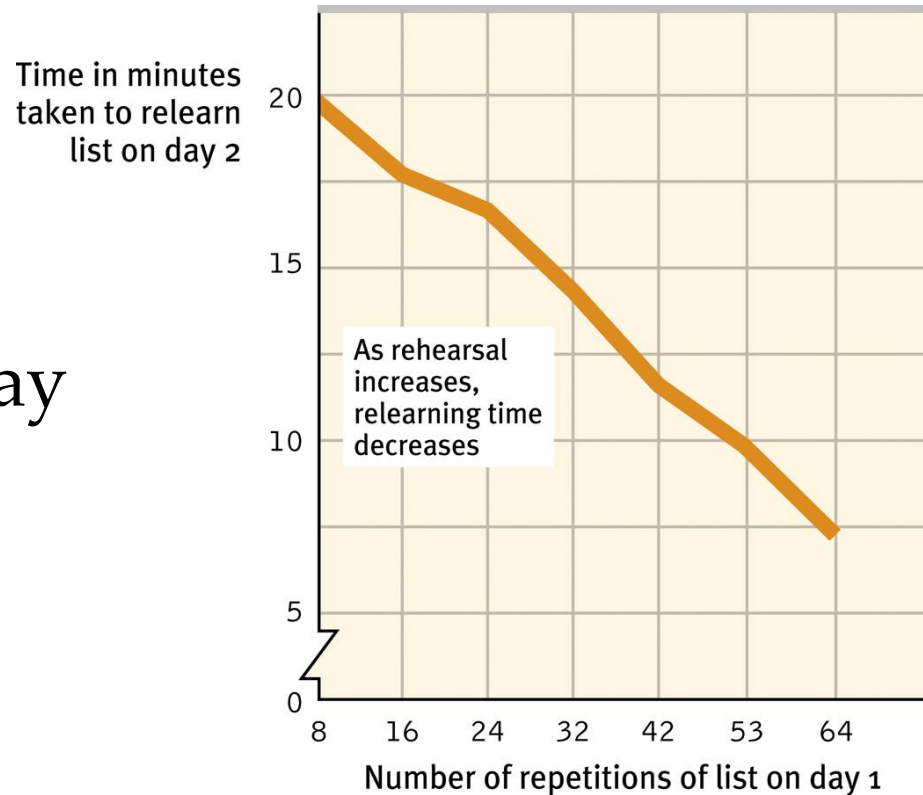
Ebbinghaus studied  
rehearsal by using  
nonsense syllables:  
TUV YOF GEK XOZ



Hermann Ebbinghaus  
(1850-1909)

# Retention Model

- The more times the nonsense syllables were practiced on Day 1,
- the fewer repetitions were required to remember them on Day 2.



# Retention Model

- According to Ebbinghaus' Retention model (Retain/continue to have or use), The amount remembered depends on the time spent learning.
- The more time you practice/study initially the faster you will relearn/remember later.

# The importance of reviews and Studying before an exam

- Why do you think AP teachers review HEAVILY before THE exam?
  - I give at least one full day of review in class
  - We will have 3-4 weeks of heavy review in this class for the AP exam
- Why do you think I give you practice questions?
  - **Testing Effect** – Testing an individual's memory makes the memory stronger and easier to retrieve.

# OA

1. Use either the method of Loci or come up with an acronym to remember your grocery list
  - Bacon
  - Milk
  - Waffles
  - Eggs
  - Apples
  - Carrots
  - Grapes



# Long Term Memory Concepts

# Different Types of LTM

- **Implicit Memory**—Unconscious Recognition (well learned skills) riding bike/ texting/
- **Explicit Memory**—Memory of facts and experiences with conscious recognition

# Different Types of LTM

- **Procedural (Skilled) Memory** – LTM of conditioned responses and learned skills.
  - Examples: Riding a bike, typing, and driving
  - Also called implicit memory (it's done unconsciously)

# Different Types of LTM

- **Declarative** (facts) **Memory** – LTM factual information
- Also called **explicit** memory (consciously)
- Two types
  - **Semantic Memory** – Impersonal facts and everyday knowledge, words and definitions (Vocabulary words)
  - **Episodic Memory** – Personal experiences linked with SPECIFIC time and place (The time you went to concert or camping)

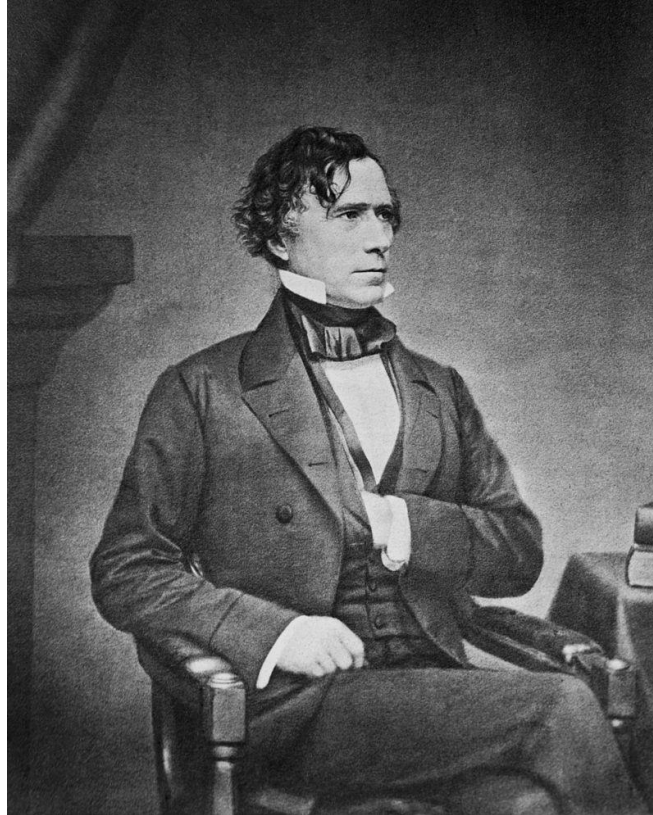
# Flashbulb Memories

- Strong/vivid memories are created in times of emotionally charged experiences
- Positive or negative
  - First kiss
  - 911
- Not always accurate (subjective)
- (amygdala – emotion)
- <https://www.youtube.com/watch?v=evj6q0eCd8&feature=related>
- <https://www.youtube.com/watch?v=QQUA4M1p6dU>

# Quick question

1. List as many U.S. Presidents as you can remember

# Did anybody remember Franklin Pierce?



## *Serial Position Effect*

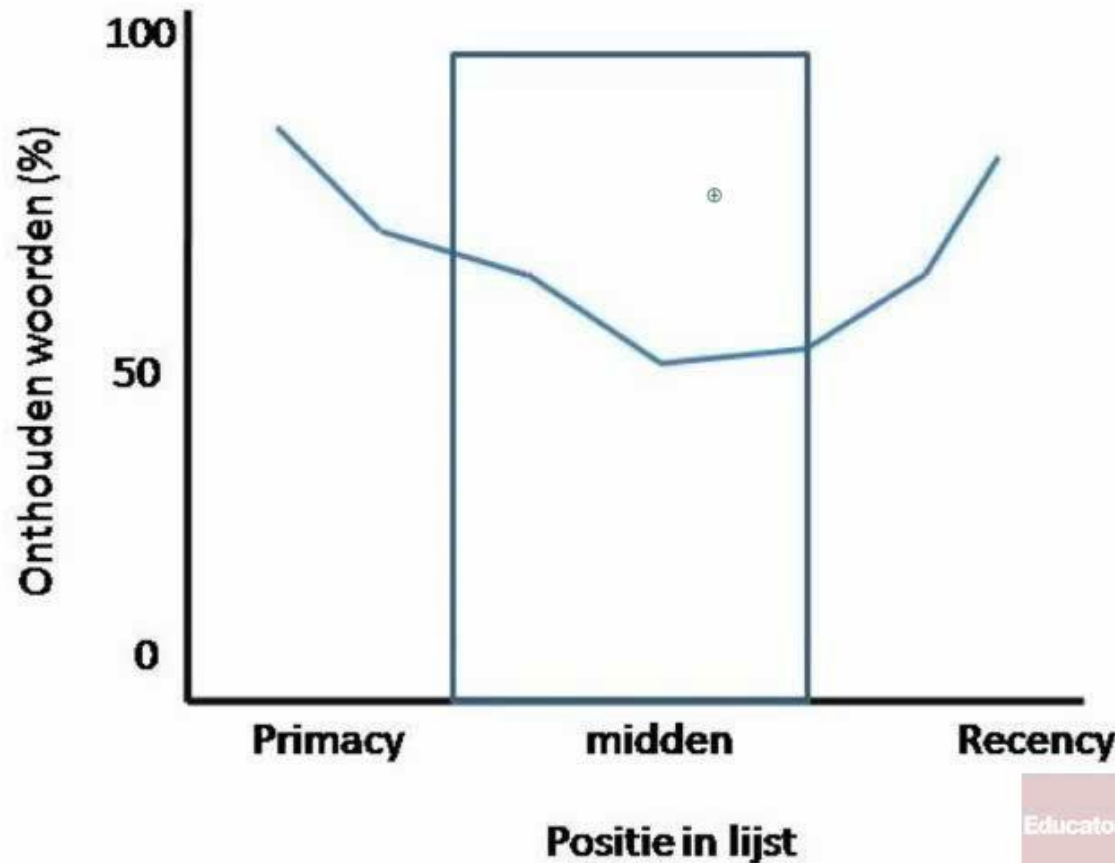


Image courtesy: [http://commons.wikimedia.org/wiki/File:Serial\\_position.jpg](http://commons.wikimedia.org/wiki/File:Serial_position.jpg)

- We remember the beginning (**Primacy Effect**)
- and we remember info. At the end (**Recency Effect**)



# State Dependent Theory

- Information is more likely to be recalled if the attempt to retrieve it occurs in a situation similar to the situation in which it was encoded.
  - If you study psychology terms while you listen to music, it will be easier for your to remember those terms if you listen to music.
  - If you learned a joke while you were drunk, it will be easier to remember that joke when you are drunk again.

# Emotion & Memory

- **Mood-Congruent memory**
  - the greater likelihood of recalling an item when our mood matches the mood we were in when the event happened
  - When we are sad we remember sad events of our past

# Measuring Memory

# Measuring Memory

- **Recall**—Measure of the memory in which person must retrieve information learned earlier without a cue
  - fill in the blank
  - Easiest to remember last items
  - Hardest recall items in the middle of a list
- **Recognition**—a measure of memory in which the person must retrieve information learned earlier with a cue
  - multiple choice

# Measuring Memory

- **Tip-of-the Tongue Phenomena**
  - Feeling that a memory is available but not quite retrievable
- **Feeling of knowing**
  - Feeling that allows people to predict beforehand whether they'll be able to remember something
- **Relearning**
  - learning something again that was previously learned. (much easier the second time)

# Cramming does NOT work!

- **Spacing effect** – learning is greater when studying is spread out over time, as opposed to studying the same amount of content in a single session.
- Spaced practice is better than massed practice
- Cramming is ineffective!

# Priming

- The activation of memory unconsciously due to particular associations in memory is called priming.
- When cues are used to activate hidden memories

RED

BLUE

ORANGE

YELLOW

GR\_\_\_\_

PLUM

NECTARINE

PEAR

APPLE

GR\_\_\_\_

# Deja Vu

- Déjà vu: the eerie sense that “I’ve experienced this before.” Cues from the current situation may
- Subconsciously trigger retrieval of an earlier experience.
  - Memory association (Priming)



# Eidetic memory

- an ability to recall images, sounds, or objects in memory after only a few instances of exposure, with high precision
- Also called “photographic” memory
- Children lose this ability as they get older
- <https://www.youtube.com/watch?v=bsJbApZ5GF0>
- <https://www.youtube.com/watch?v=8YYSl8iXuA0>

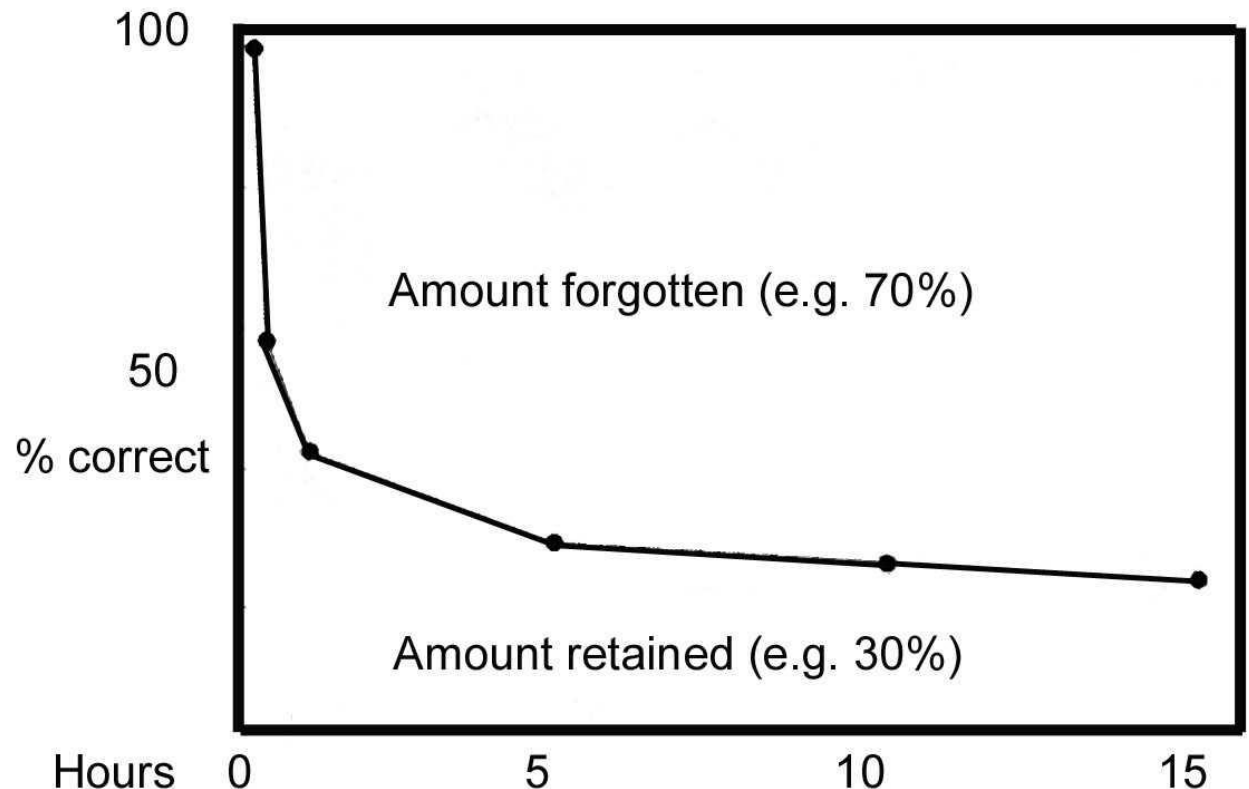
Forgetting

# Ebbinghaus's Forgetting Curve

**Novel information fades quickly then it levels out**

Nonsense syllables

He wanted to see  
how much of the  
information he  
retained



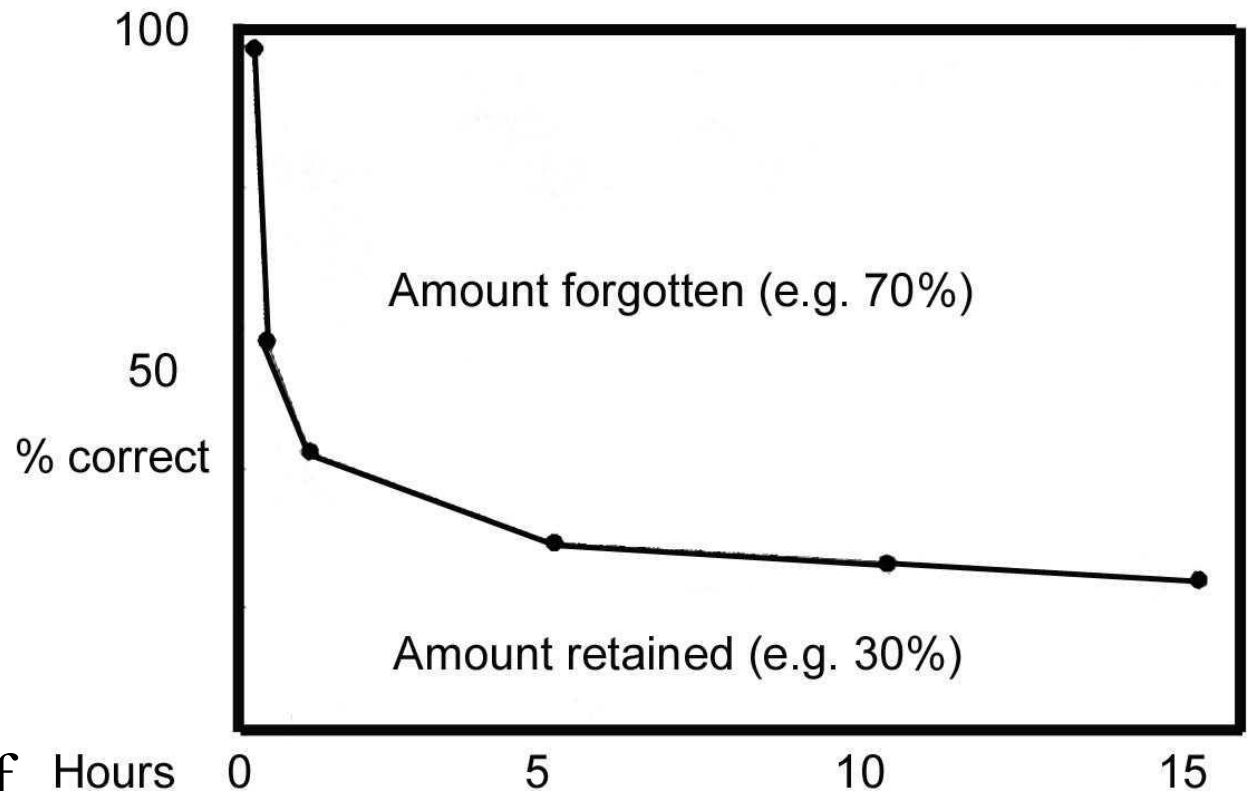
# Ebbinghaus's Forgetting Curve

**Novel information fades quickly then it levels out**

This is the danger  
of taking the exam  
on a later date.

Within the **first  
hour** you lose  
enormous amount  
of info.

You wait few days  
later... you are  
sabotaging yourself.

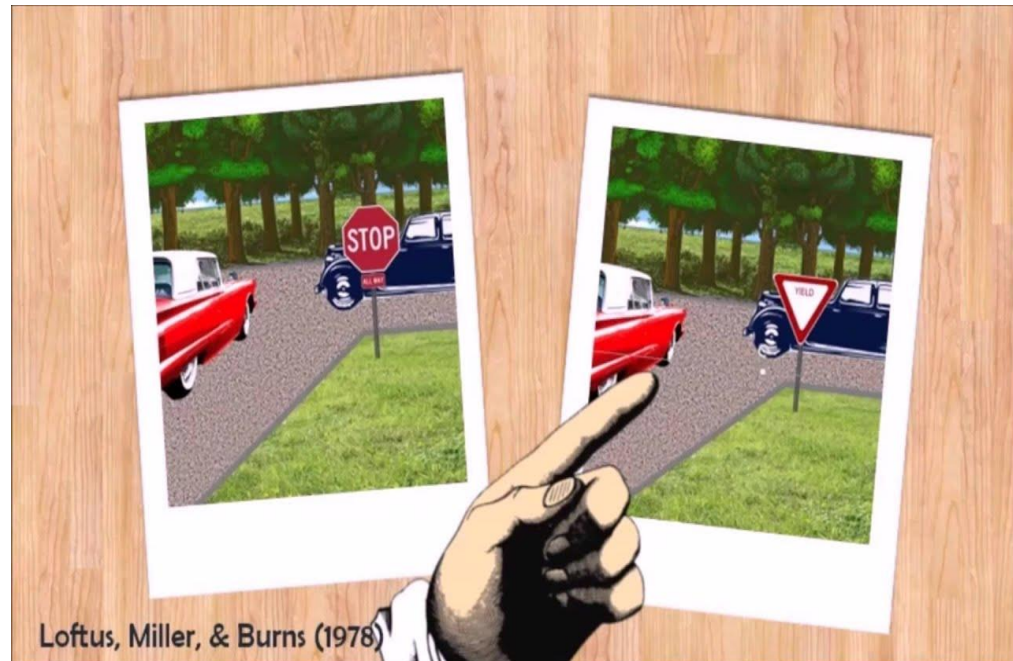


# Interferences

- **Proactive Interference** – something you learned earlier disrupts something you experience later.
- **Retroactive Interference** – something new you learned disrupts recall of old information.
- P.O.R.N.
  - **P**roactive → **O**ld Memory interferes
  - **R**etroactive → **N**ew Memory interferes

# Misinformation Effect

- person's recall of episodic memories becomes less accurate because of the interference of post-event information.
  - We are very sensitive to creating inaccurate or false memories
  - Elizabeth Loftus



# Reconstruction & False Memories

- Memory reconstruction occurs when we fit together pieces of an event that seem likely to have occurred
  - Our bias & stereotypes
  - Our emotions
  - Our creativity to “fill in the gaps”
  - Other peoples’ influence



Study by Leo and Drizin (2003) found that there have been 125 proven false confession cases that involved police interrogating juveniles

- **Encoding Failure**
  - When a memory was never formed in the first place.
  - Example: Hard to identify penny because you can't remember the specific details correctly. It's not that you forgot, but instead you never learned the details in the first place
- **Decay theory**
  - When memory traces become weaker due to time; fading or weakening of memories over time.
  - Weak theory, because it can't explain long-term memory
- **Disuse theory**
  - Theory that memory traces weaken when memories are not used, rehearsed or retrieved
  - You "use it or lose it"



# Amnesia – loss of memory



- Retrograde Amnesia: Forgetting events that occurred before an injury or trauma
- **Anterograde Amnesia**: Forgetting events after an injury or trauma
- **Source Amnesia**  
inability to remember where, when or how previously learned information has been acquired, while retaining the factual knowledge

# Hormones

- stress hormones affect memory by producing more glucose energy which can fuel brain activity
- Amygdala—emotion processors-- boosts activity in the brain's memory forming areas
- Maybe your first date or kiss with that significant other.

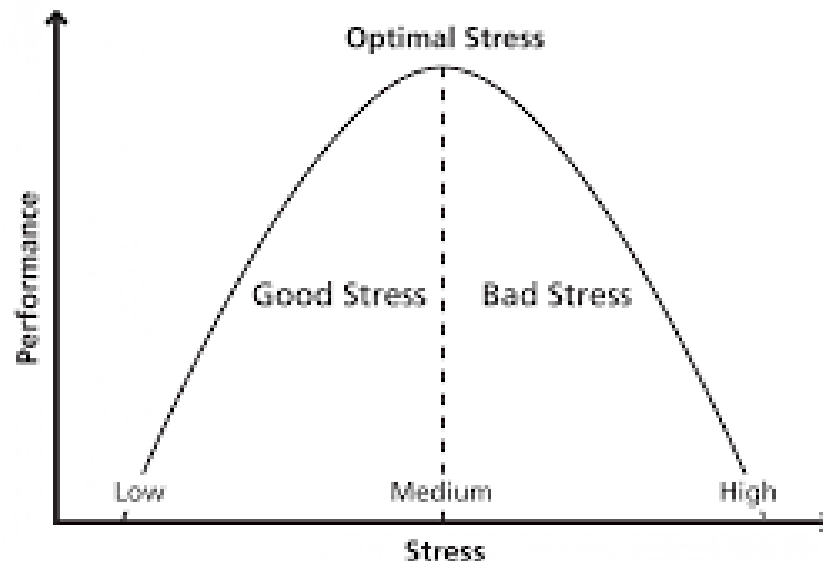
# Stress and Memory

- The prolonged stress of sustained physical abuse may inhibit memory formation by shrinking the Hippocampus
  - Children who experienced traumatic events
- Hippocampus is responsible for formation of long-term memory

# Hormones

- Emotion / stress triggered hormonal changes help explain a lot about why we remember exciting and traumatic events.
- However, extreme stress (extreme arousal) can undermines learning and later recall

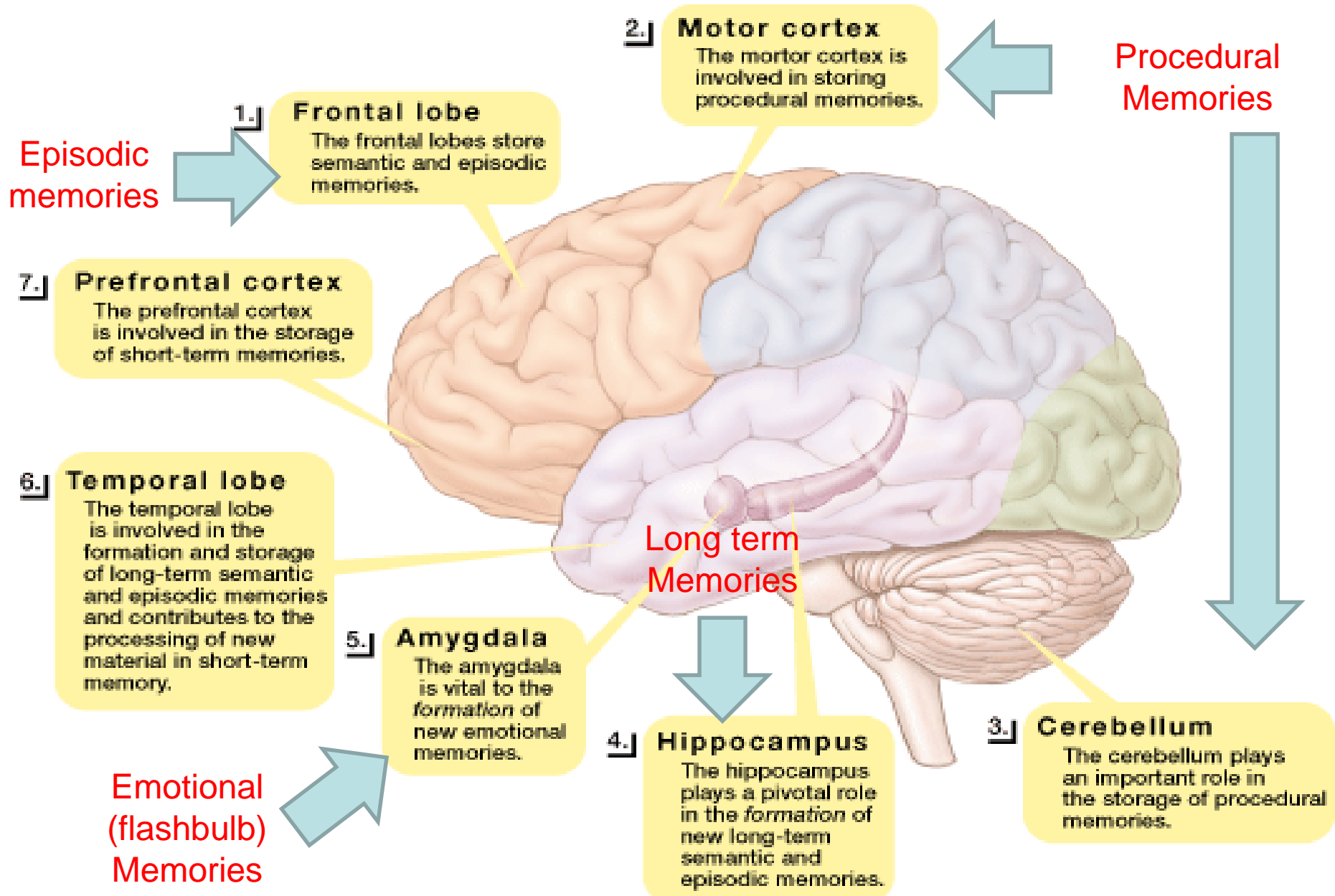
The Yerkes-Dodson Law



# The Biology of Memory: Two Questions For Today

- Where are memories stored?
  - There is no one place
  - Different parts of the brain are specialized for different types of information
- How are memories formed?
  - Changes in synaptic connections among neural cells
  - Called *long-term potentiation*

# Where Are Memories Stored?



# Cognition

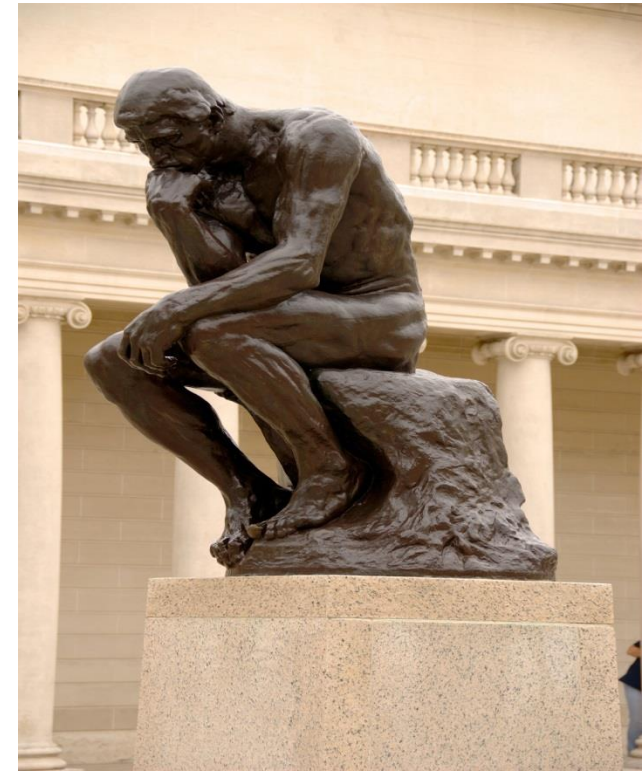
# OA 1

1. What does cognition mean?
2. How does cognitive psychology explain behavior? What topics would it be interested in?



# Cognition

Cognition, or thinking, refers to a process that involves knowing, understanding, remembering, problem solving and communicating.



# Cognitive Psychologists

Cognition involves a number of mental activities. Cognitive psychologists study

1. Concepts
2. Problem solving
3. Decision making
4. Judgment formation

Intuition is NOT enough, we need cognition  
when faced with problems

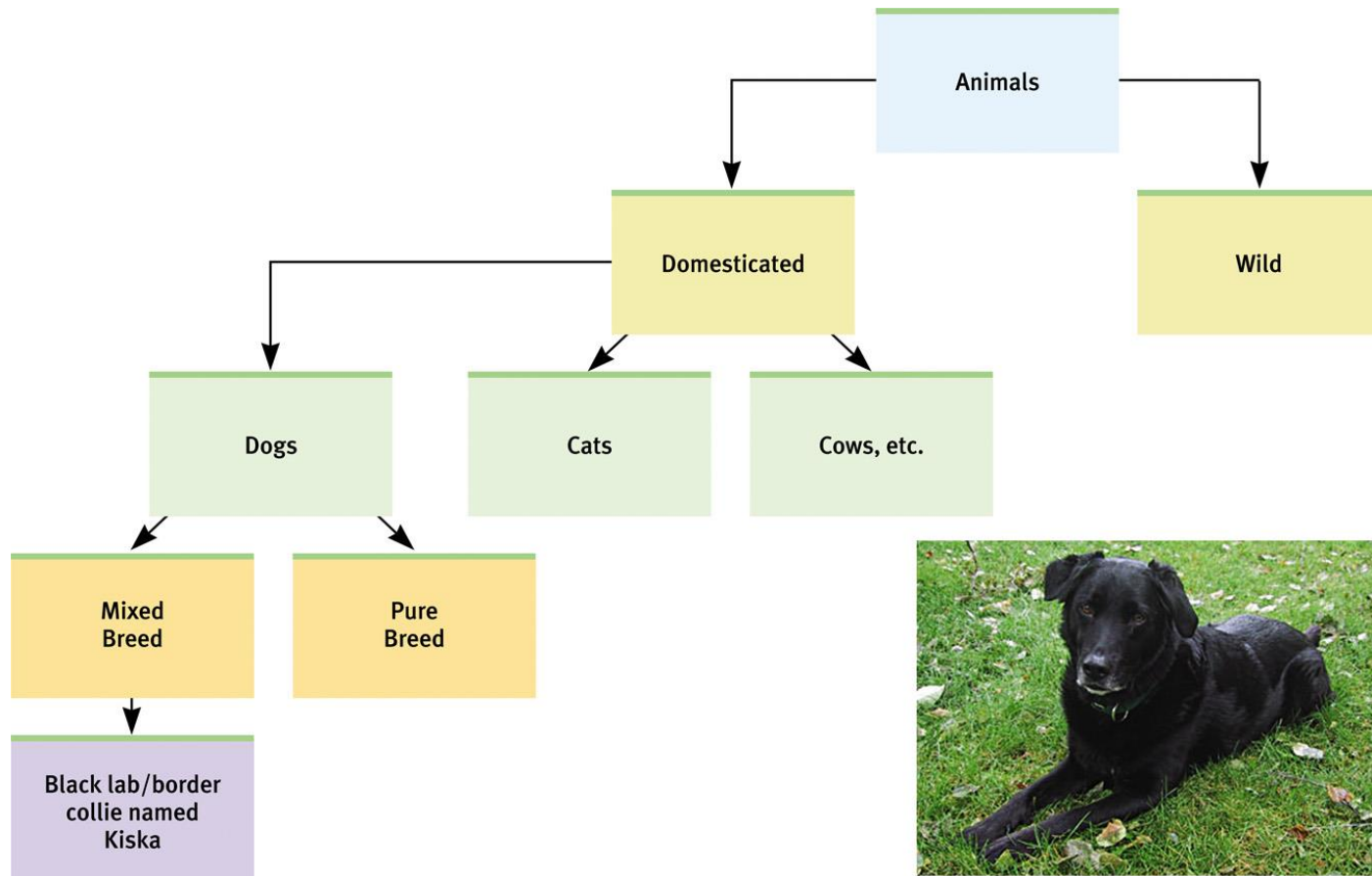
# 1. Concept

The mental grouping of similar objects, events, ideas, or people. There are a variety of chairs but their common features define the concept of a *chair*.



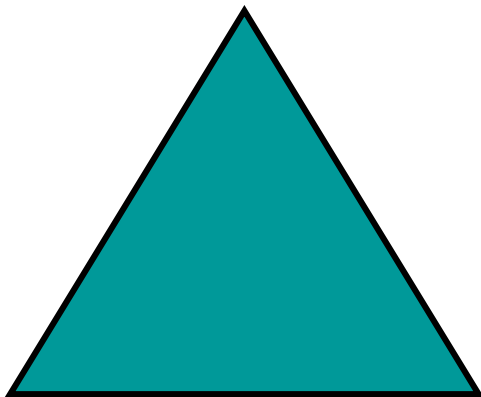
# Category Hierarchies

To simplify things we organize concepts into category **hierarchies**.



# Development of Concepts

- We form some concepts with definitions.  
Example: a triangle has three sides.
- We form concepts with mental images or typical examples (**prototypes**).
  - example, a robin is a prototype of a bird, but a penguin is not.



Triangle (definition)



Bird (mental image)

# When we move away from our prototypes categories get “fuzzy”

- Is a whale a mammal?
- Are penguins and kiwis birds?
- Are tomatoes fruits?
- Are 17 year old people children or adults





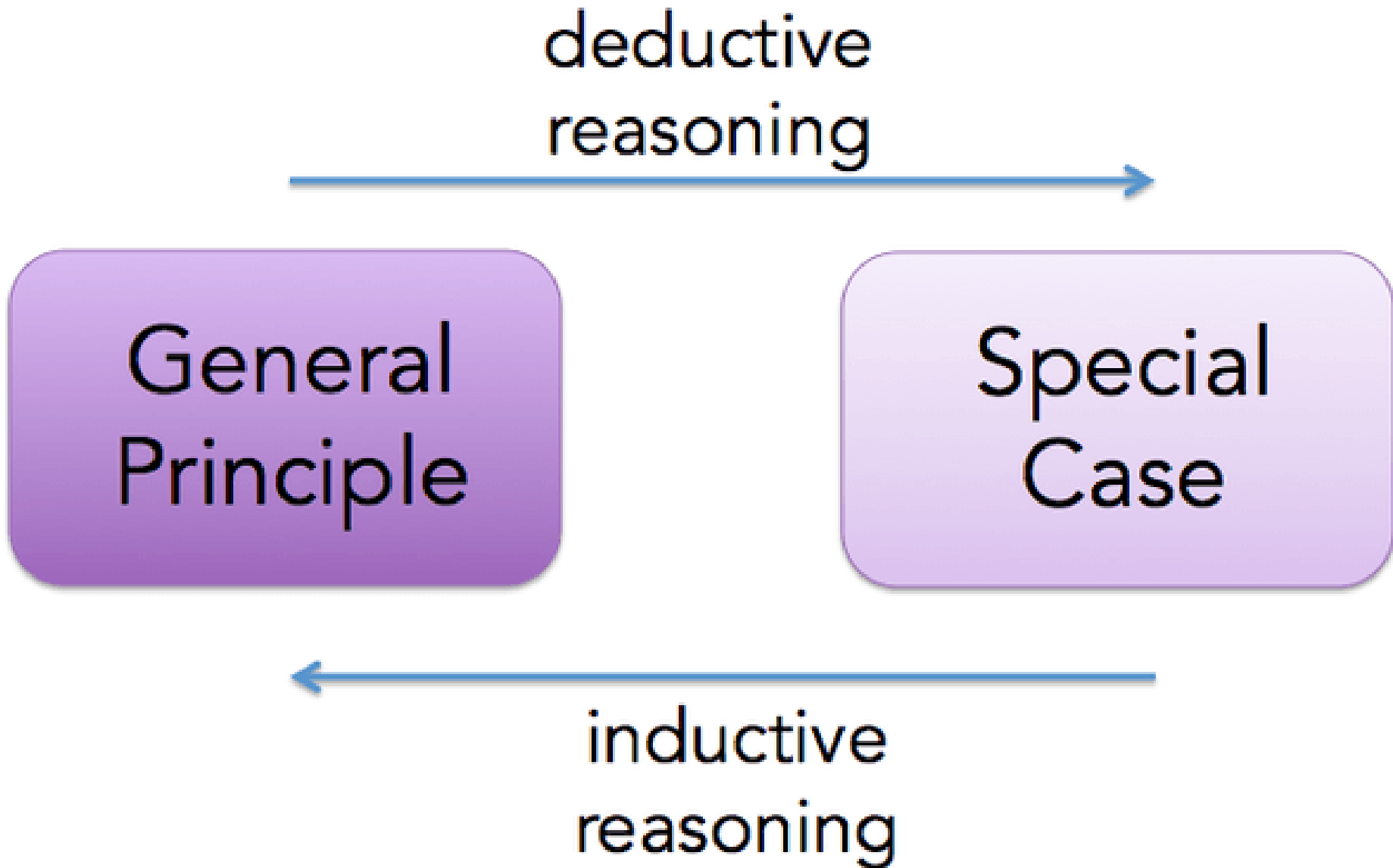
# Is it murder? Or is it patriotism?



## 2. Problem Solving



deductive  
reasoning



```
graph LR; A[General Principle] -- "deductive reasoning" --> B[Special Case]; B -- "inductive reasoning" --> A
```

General  
Principle

Special  
Case

inductive  
reasoning

# DEDUCTION

VS

# INDUCTION

Theory



Hypothesis



Observation



Confirmation



Theory



Hypothesis



Pattern



Observation



## ARISTOTLE



## SHERLOCK



# Problem Solving

- **Insight**
  - Sudden understanding of a problem or potential strategy for solving a problem.
- **Divergent thinking**
  - method used to generate creative ideas by exploring many possible solutions.
  - Brainstorming - a way to get over sets where you use divergent thinking to come up with multiple ideas/possibilities to solve a problem.
- **Convergent thinking**
  - Method that generates one single solution
  - Coming up with one single solution on a multiple choice question

# Problem Solving

- **Trial and error**

- the process of experimenting with various methods of doing something until one finds the most successful.
- Works best with limited number of choices

- **Information retrieval**

- Retrieve from memory information about how such a problem has been solved in the past

# Problem Solving

- **Creativity**
  - The ability to produce ideas that are both novel and valuable
  - Expertise; imagination; venturous personality; intrinsically motivated; divergent thinkers
- **Algorithms**
  - Step-by-step methods that guarantees a solution
  - Methodical, logical rules or procedures that guarantee solving a particular problem.
  - Math problems are an example of the type best solved using an algorithm
  - Chess and Checkers
- **Heuristics**
  - Rules of thumb that may help simplify a problem, but do not guarantee a solution.
  - They are quicker than algorithms

# Algorithms

Algorithms, are very time consuming, exhaust all possibilities before arriving at a solution.  
Computers use algorithms.

**S P L O Y O C H Y G**

If we were to unscramble these letters to form a word using an algorithmic approach, we would face 907,208 possibilities.

# Heuristics

Heuristics make it easier for us to use simple principles to arrive at solutions to problems.

**S P L O Y O C H Y G**

**B B Y O M O C H G Y**

Put a Y at the end, and see if the word  
begins to make sense.

# How would you look for milk using algorithm? Heuristic?





# Representativeness Heuristic

Judging the likelihood of things or objects in terms of how well they seem to represent, or match, a particular prototype.

Rep. Heuristics is based on stereotypes

If you meet a slim, short, man who wears glasses and likes poetry, what do you think his profession would be?

An Ivy league professor or a truck driver?



# Availability Heuristic

- Operates when we base our judgments on how mentally available information is.
- Depends on how fast or recent people can remember an instance, the more they expect it to occur.



# On the Fly!

# OA 2

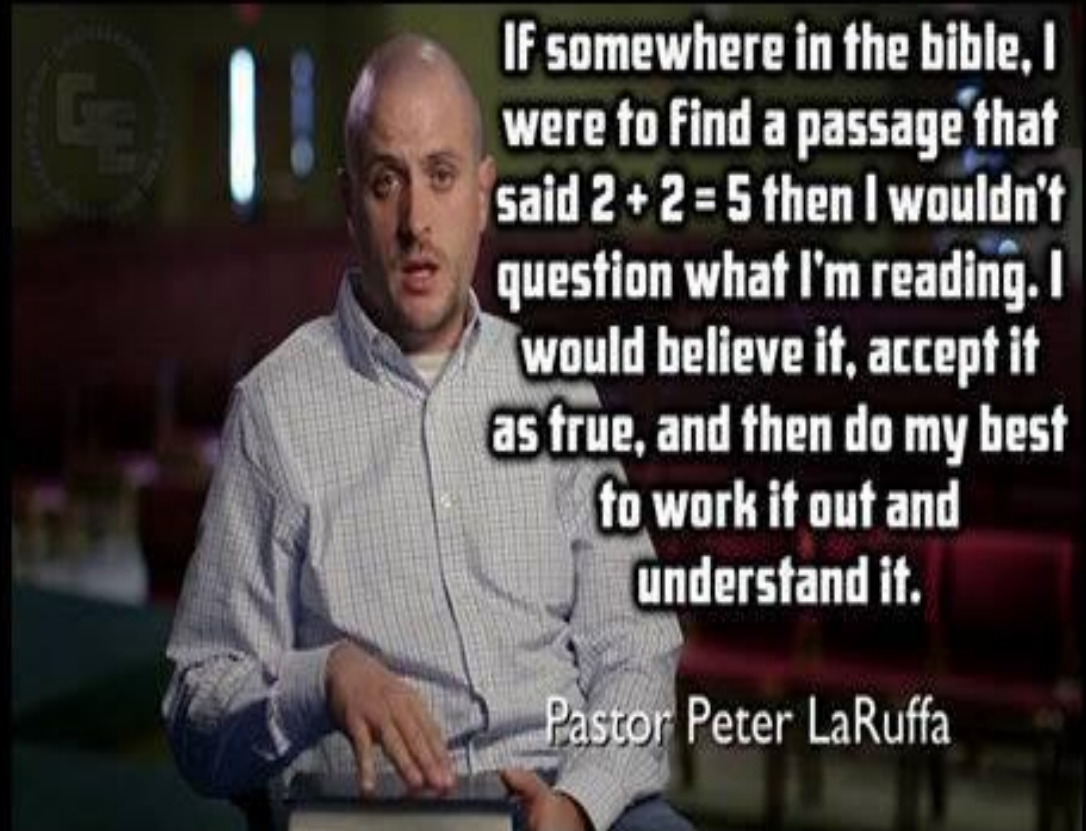
<https://www.youtube.com/watch?v=F-TyPfYMDK8&feature=youtu.be>

1. Describe and explain the experiment
2. In what ways do our beliefs affect our behavior and thought?

# Beliefs



Martyrdom of Ignatius of Antioch



Pator LaRuffa, Creationist

# Bias in the process

- **Confirmation Bias** – while we solve the problem this is our eagerness to look for information that confirms our ideas
- **Belief Bias** – The tendency of one's preexisting beliefs to distort logical reasoning by making invalid conclusions.
  - our prior ideas distort our logic
- **Belief Perseverance** – clinging to our prior idea even after it has been discredited
  - tendency to cling to our beliefs in the face of contrary evidence



# Discussion

- 1) A man who strongly does not believe in global warming will not be swayed by mountain of evidence that suggest that the climate is changing
- 2) A strongly religious person believes that everything happens on earth due to divine interference. Thus, this person believes that natural disasters are caused by god.
- 3) A doctor who strongly believes vitamin C is medicinal only focuses on evidence that support his belief and ignores evidence that suggests that Vitamin C has no medical effect

# Example

1) A man who strongly does not believe in global warming will not be swayed by mountain of evidence that suggest that the climate is changing.

- What is this?
- Why?



# Example

2) A strongly religious person believes that everything happens on earth due to divine interference. Thus, this person believes that natural disasters are caused by god.

- What is this?
- Why?

# examples

3) A doctor who strongly believes vitamin C is medicinal only focuses on evidence that support his belief and ignores evidence that suggests that Vitamin C has no medical effect

- What is this?
- Why?

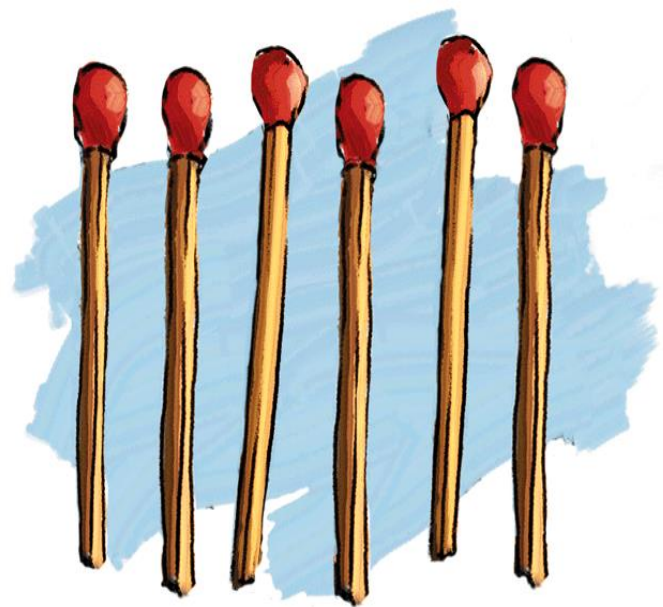
# Heuristic Methods

- **Hill climbing**
  - Move progressively closer to goal without moving backward
- **Subgoals**
  - Break large problem into smaller, more manageable ones, each of which is easier to solve than the whole problem
- **Means-end analysis**
  - Aims to reduce the discrepancy between the current situation and the desired goal – subgoals not immediately in the solution direction are considered
- **Working backward**
  - Work backward from the desired goal to the existing condition

# Fixation

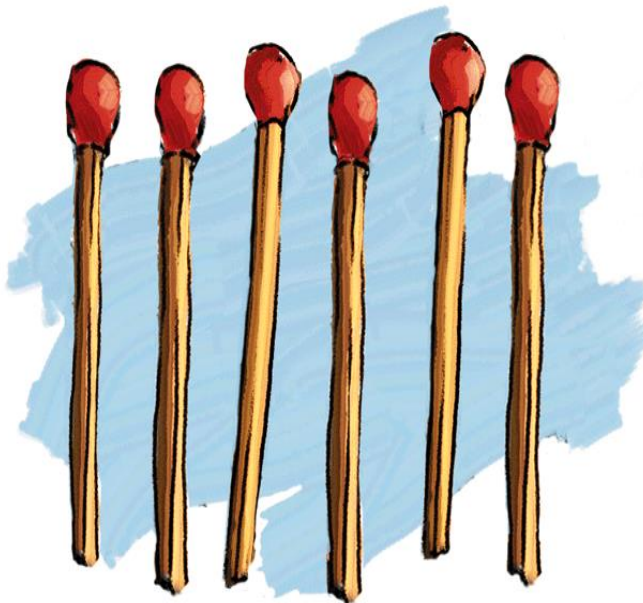
- **Fixation:** An inability to see a problem from a fresh perspective. This impedes problem solving.
- Two examples of fixation are *mental set* and *functional fixedness*.

The Matchstick  
Problem: How would  
you arrange six  
matches to form four  
equilateral triangles?

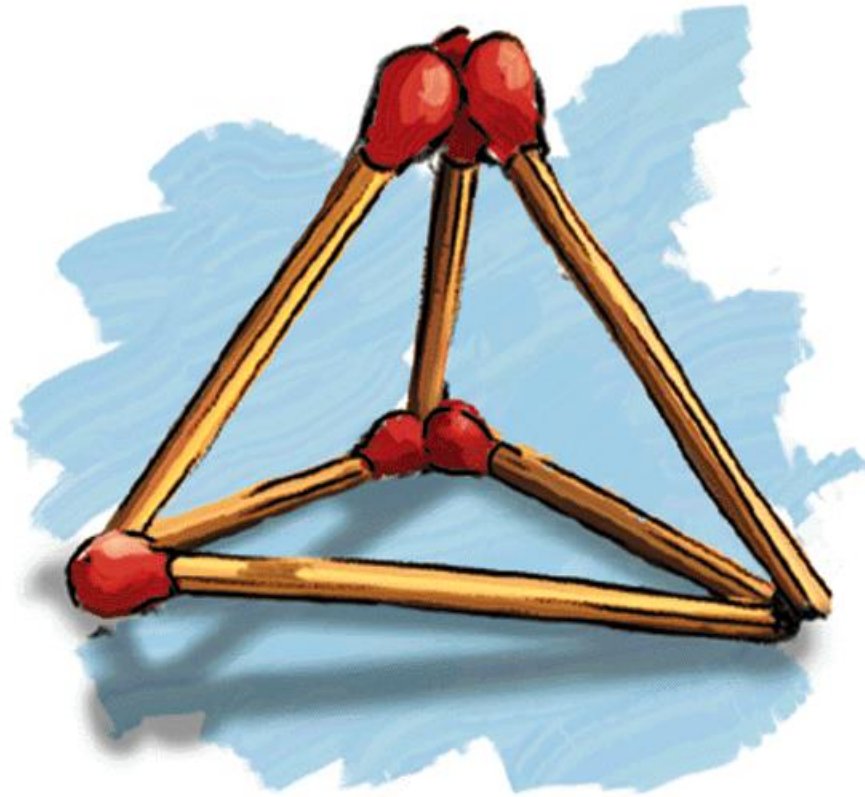


# Functional Fixedness

A tendency to think only of the familiar functions of an object.



# The Matchstick Problem: Solution



From "Problem Solving" by M. Scheerer. Copyright © 1963 by Scientific American, Inc. All Rights Reserved.

# Mental Set

- A tendency to approach a problem in a particular way, especially if that way was successful in the past.



# Overconfidence

**Overconfidence** is a tendency to overestimate the accuracy of our beliefs and judgments.

At a stock market, both the seller and the buyer may be confident about their decisions on a stock.





# Exaggerated Fear

The opposite of having overconfidence is having an **exaggerated fear** about what may happen. Such fears may be unfounded.

The 9/11 attacks led to a 20% decline in air travel due to fear. 800 more people would die if they drove just half those miles



# Framing Decisions

Decisions and judgments may be significantly affected depending upon how an issue is framed.

Examples:

What is the best way to market ground beef?  
as 25% fat or 75% lean?

What is the best way to market flavored drinks?  
Natural flavors or contains no juice

# Decision Making Models

- We must make decisions all the time – but how?
  - **Compensatory Model** – making a decision by allowing attractive attributes to compensate for unattractive ones
    - “The car looks all banged up but gets great gas mileage”
  - **Non-Compensatory Model** – does not allow some attributes to offset others
    - “I don’t care how cheap the car is, it’s got way too much mileage!”

# Reasoning

- Reasoning – drawing conclusions from evidence
- **Deductive reasoning** – Process of drawing logical conclusions from general statements
  - If  $A = B$ ,  $B = C$ , then  $A = C$
- **Inductive reasoning** – process of drawing general inferences from specific observation
  - If Kayla is wearing Taylor Swift shirt we might conclude that she likes Taylor Swift

# Kahoot!



## INTUITION'S PERILS AND POWERS (TEXT CHAPTER NUMBERS FOLLOW)

### Intuition's Dozen Deadly Sins

- *Hindsight bias*—looking back on events, we falsely surmise that we knew it all along. (1)
- *Illusory correlation*—intuitively perceiving a relationship where none exists. (1)
- *Memory construction*—influenced by our present moods and by misinformation, we may form false memories. (8)
- *Representativeness and availability heuristics*—fast and frugal heuristics become quick and dirty when leading us into illogical and incorrect judgments. (9)
- *Overconfidence*—our intuitive assessments of our own knowledge are often more confident than correct. (1, 9)
- *Belief perseverance and confirmation bias*—thanks partly to our preference for confirming information, beliefs are often resilient, even after their foundation is discredited. (1, 9)
- *Framing*—judgments flip-flop, depending on how the same issue or information is posed. (9)
- *Interviewer illusion*—inflated confidence in one's discernment based on interview alone. (11)
- *Mispredicting our own feelings*—we often mispredict the intensity and duration of our emotions. (12)
- *Self-serving bias*—in various ways, we exhibit inflated self-assessments. (13)
- *Fundamental attribution error*—overly attributing others' behavior to their dispositions by discounting unnoticed situational forces. (16)
- *Mispredicting our own behavior*—our intuitive self-predictions often go astray. (16)

### Evidence of Intuition's Powers

- *Blindsight*—brain-damaged persons' "sight unseen" as their bodies react to things and faces not consciously recognized. (2)
- *Right-brain thinking*—split-brain persons displaying knowledge they cannot verbalize. (2)
- *Infants' intuitive learning*—of language and physics. (5)
- *Moral intuition*—quick gut feelings that precede moral reasoning. (5)
- *Divided attention and priming*—unattended information processed by the mind's downstairs radar watchers. (3, 8)
- *Everyday perception*—the instant parallel processing and integration of complex information streams. (6)
- *Automatic processing*—the cognitive autopilot that guides us through most of life. (various)
- *Implicit memory*—learning *how* to do something without knowing *that* one knows. (8)
- *Heuristics*—those fast and frugal mental shortcuts that normally serve us well enough. (9)
- *Intuitive expertise*—phenomena of unconscious learning, expert learning, and physical genius. (9, 10, 13)
- *Creativity*—the sometimes-spontaneous appearance of novel and valuable ideas. (10)
- *Social and emotional intelligence*—the intuitive know-how to comprehend and manage ourselves in social situations and to perceive and express emotions. (10)
- *The wisdom of the body*—when instant responses are needed, the brain's emotional pathways bypass the cortex; hunches sometimes precede rational understanding. (12)
- *Thin slices*—detecting traits from mere seconds of behavior. (13)
- *Dual attitude system*—as we have two ways of knowing (unconscious and conscious) and two ways of remembering (implicit and explicit), we also have gut-level and rational attitude responses. (16)

SEE YOUR ETEXT FOR THIS IN  
LARGER FONT – A GREAT SUMMARY!

# III. Language

313-322

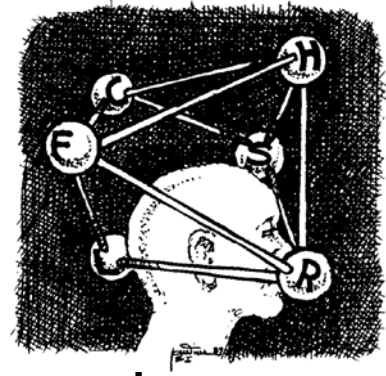
# Building Blocks of Thought

- Images
  - Nonverbal mental representations of sensory experiences
- Language
  - A flexible system of symbols that enables us to communicate our ideas, thoughts, and feelings
  - Nonhumans communicate primarily through signs
  - Human language is *semantic*, or meaningful
  - It is also characterized by *displacement* in that it is not limited to the here-and-now

NOV 1 2005



# Thinking in Images



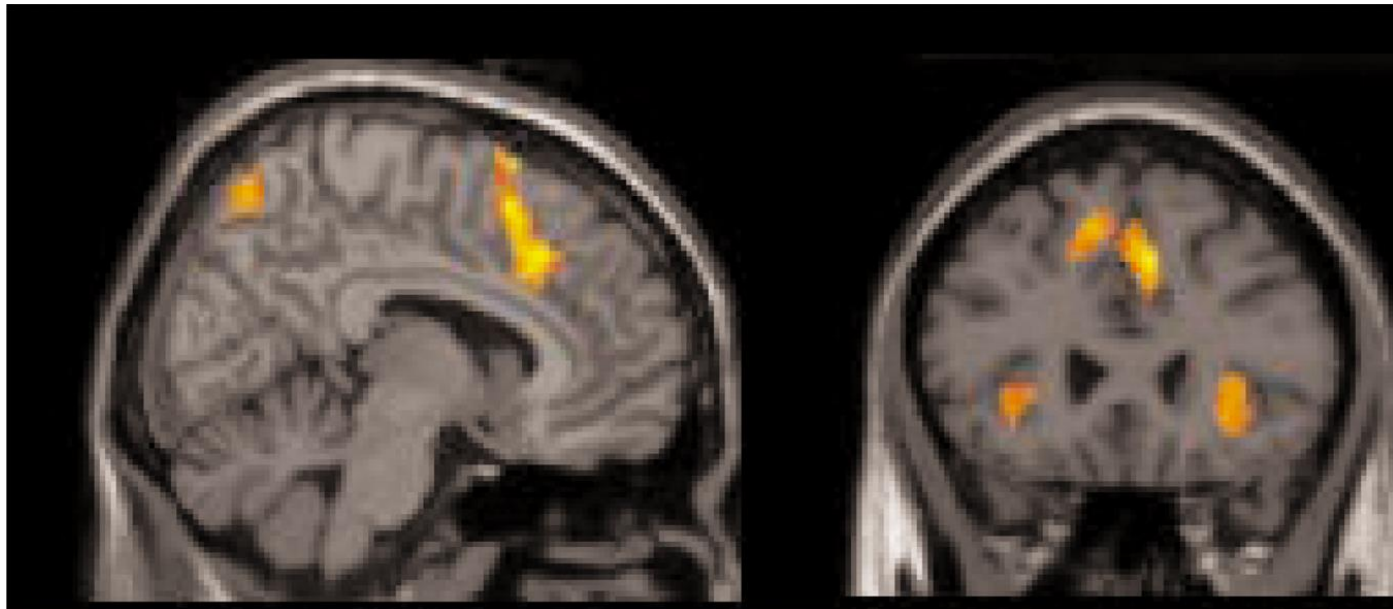
To a large extent thinking is language-based. When alone, we may talk to ourselves. However, we also think in images.

We don't think in words, when:

1. When we open the hot water tap.
2. When we are riding our bicycle.

# Images and Brain

Imagining a physical activity activates the same brain regions as when actually performing the activity.



Jean Duffy Decety, September 2003

# Language

Language, our spoken, written, or gestured work, is the way we communicate meaning to ourselves and others.



Language transmits culture.

# Language Structure

**Phonemes:** The smallest distinct sound unit in a spoken language. For example:

*bat*, has three phonemes  $b \cdot a \cdot t$   
*chat*, has three phonemes  $ch \cdot a \cdot t$

How many meanings can you make by varying the vowel phoneme between B and T?

Generally \_\_\_\_\_ phonemes carry more information.

# Answers

- Bait, bat, beat/beet, bet bit, bite, boat, boot, bought, bout, and but.
- The consonant phonemes. The truth of this statement should be evident from this brief demonstration.

# Language Structure

**Morpheme:** The smallest unit that carries a meaning. It may be a word or part of a word.  
For example:

Milk = *milk*

Pumpkin = *pump . kin*

Unforgettable = *un . for . get . table*

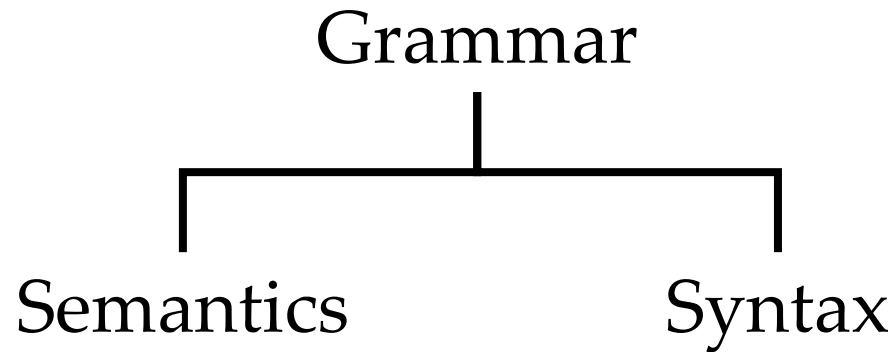


# Structuring Language

Phonemes	Basic sounds (about 40) ... <i>ea, sh.</i>
Morphemes	Smallest meaningful units (100,000) ... <i>un, for.</i>
Words	Meaningful units (290,500) ... <i>meat, pumpkin.</i>
Phrase	Composed of two or more words (326,000) ... <i>meat eater.</i>
Sentence	Composed of many words (infinite) ... <i>She opened the jewelry box.</i>

# Grammar

Grammar is the system of rules in a language that enable us to communicate with and understand others.





# Semantics

Semantics is the set of rules by which we derive meaning from morphemes, words, and sentences. For example:

Semantic rule tells us that adding *-ed* to the word *laugh* means that it happened in the past.

# Syntax

Syntax consists of the rules for combining words into grammatically sensible sentences.

For example:

In English, syntactical rule says that adjectives come before nouns; *white house*. In Spanish, it is reversed; *casa blanca*.

# Structure of Language

- Surface structure
  - How we order the sentence
  - English “She ate an apple”
  - Japanese “She an apple ate”
- Deep structure
  - Underlying meaning of a sentence

# Universal Characteristics of Language

1. Semanticity
2. Arbitrariness
3. Flexibility of symbols
4. Naming
5. Displacement
6. Generativity

# Language Development

Children learn their native languages much before learning to add  $2+2$ .

We learn, on average (after age 1), 3,500 words a year, amassing 60,000 words by the time we graduate from high school.

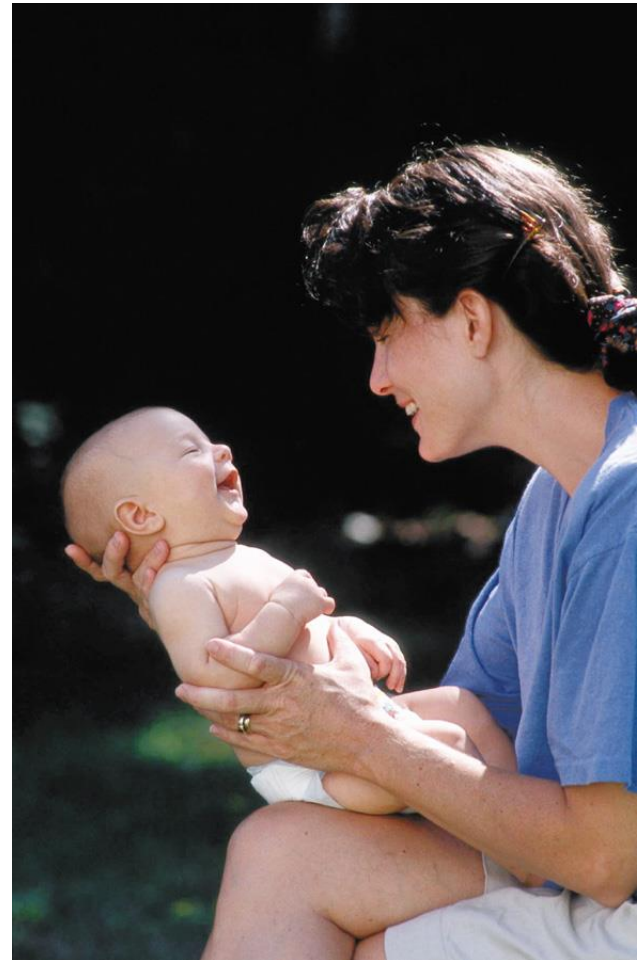


Time Life Pictures/ Getty Images

# When do we learn language?

## Babbling Stage:

Beginning at 4 months, the infant spontaneously utters various sounds, like *ah-goo*. Babbling is not imitation of adult speech.



# When do we learn language?

**One-Word Stage:** Beginning at or around his first birthday, a child starts to speak one word at a time and is able to make family members understand him. The word *doggy* may mean *look at the dog out there*.

# When do we learn language?

**Two-Word Stage:** Before the 2nd year a child starts to speak in two-word sentences. This form of speech is called **telegraphic speech** because the child speaks like a telegram: “Go car,” means *I would like to go for a ride in the car.*



# When do we learn language?

**Longer phrases:** After telegraphic speech, children begin uttering longer phrases (*Mommy get ball*) with syntactical sense, and by early elementary school they are employing humor.

*You never starve in the desert because of all the sand-which-is there.*

# When do we learn language?

## SUMMARY OF LANGUAGE DEVELOPMENT

Month (approximate)	Stage
4	Babbles many speech sounds.
10	Babbling resembles household language.
12	One-word stage.
24	Two-word, telegraphic speech.
24+	Language develops rapidly into complete sentences.

# Theories of Language Development

- Imitation
- Operant Learning
- Inborn Universal Grammar (Critical Period)

# Imitation

- Don't they just listen to what is said around them and then repeat it?
- But, sentences produced by children are very different from adult sentences
  - Cat stand up table
  - A my pencil
  - What the boy hit?
  - Other one pants
- And children who can't speak for physiological reasons learn the language spoken to them.
- When they overcome their speech impairment they immediately use the language for speaking.

# Operant Learning (Skinner)

- Language acquisition is governed by operant learning principles.
- Association of the sight of things with sounds of words
- Imitation of the words/syntax modeled by others
- Reinforcement by the caregiver
- This assumes that children are being constantly reinforced for using good grammar and corrected when they use bad grammar. (Seldom occurs)
- Cute mistakes?

# Inborn Universal Grammar

- Linguist **Noam Chomsky**
- Language is almost entirely inborn
- Language will naturally occur
- **We are hard wired to learn language**
- Children acquire untaught words and grammar at a rate too high to be explained through learning
- Productivity? “I hate you daddy”
- Many of the mistakes children make are from overgeneralizing grammar rules they picked up on
- Universal Grammar
- But children do learn their environment’s language

# Universal Grammar

- All human languages have the same grammatical building blocks, such as nouns and verbs, subjects and objects, negations and questions.
- We all start speaking mostly in nouns
- We all follow language development stages

# Critical period

- **Language Machines** - A one year old's brain is statistically analyzing which syllables most often go together to discern word breaks
- Can we keep it up?
- No, childhood seems to represent a critical period for mastering certain aspects of language
- Once the critical period is over mastering the grammar of another language is very difficult
- When a young brain does not learn language its language-learning capacity never develops.