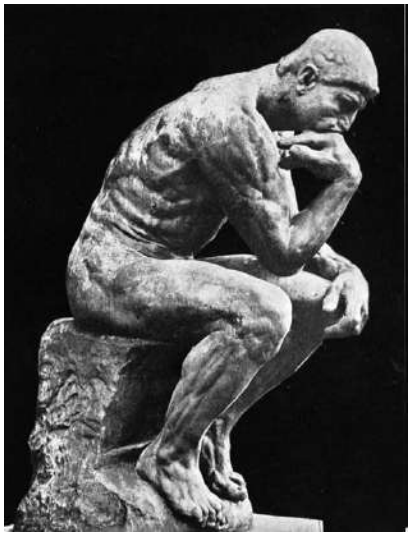
Chapter 9
Thinking & Language



AP Psychology

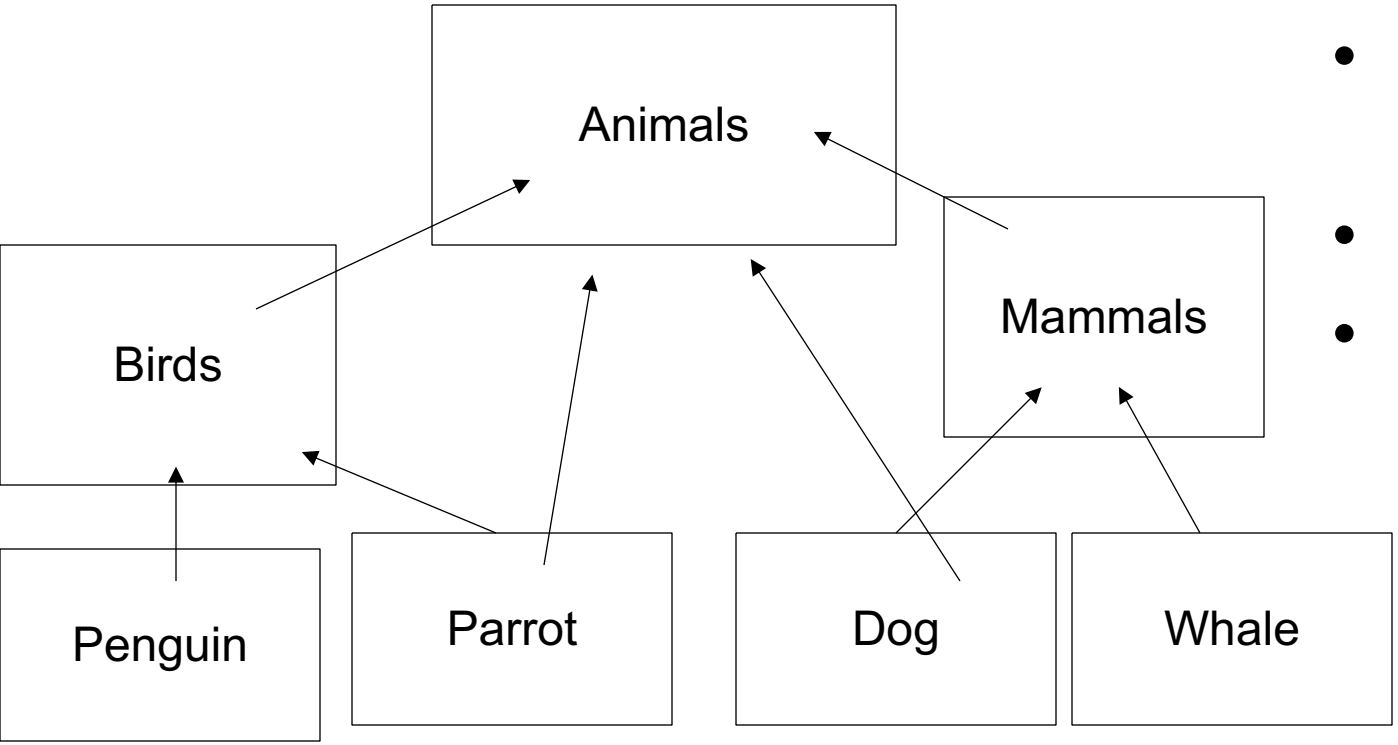
THINKING AND LANGUAGE

- Both Thinking and Language are Cognitive Activities**.**
- **Cognitive Activity** refers to all the mental activities associated with processing, understanding, remembering and communicating
- Cognitive psychologists study the **mental activities**.

THINKING AND LANGUAGE

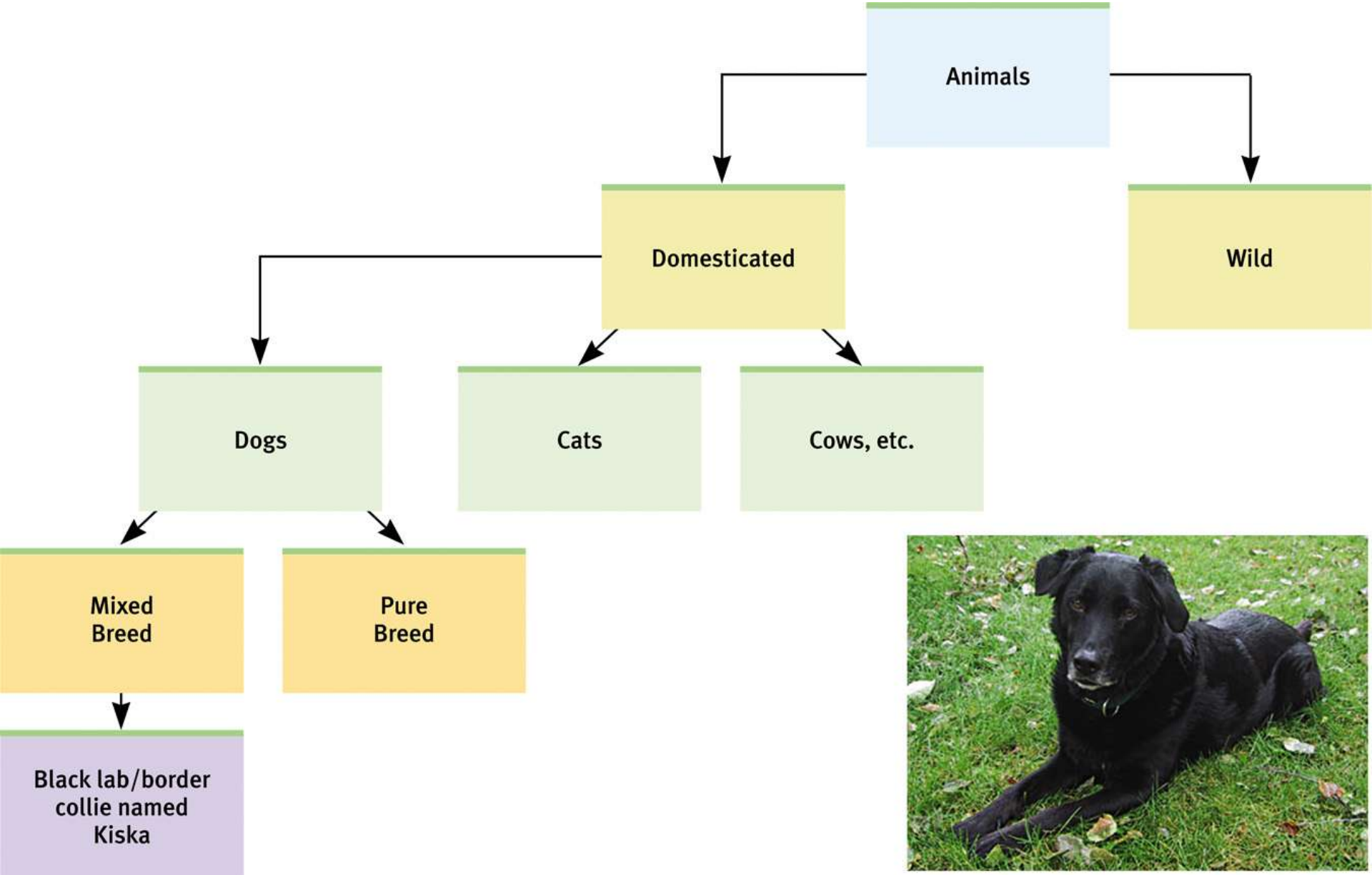
- **Concepts** refers to the mental grouping of similar objects, events and people.
- The organization of concepts into categories is known as **hierarchies.**
- **Prototypes** are the mental image or best example that incorporates all the features we associate with a category
- Once we place an item into a category, our memory later recognizes it as its category prototype.

Example



- What are these two items considered?
- This is an example of a
- **<u>Concept</u>**
- Now Add these “animals”
- How would you organize them?
- That is called
- **Hierarchies**

We develop hierarchies for concepts to organize information in our memory



Example

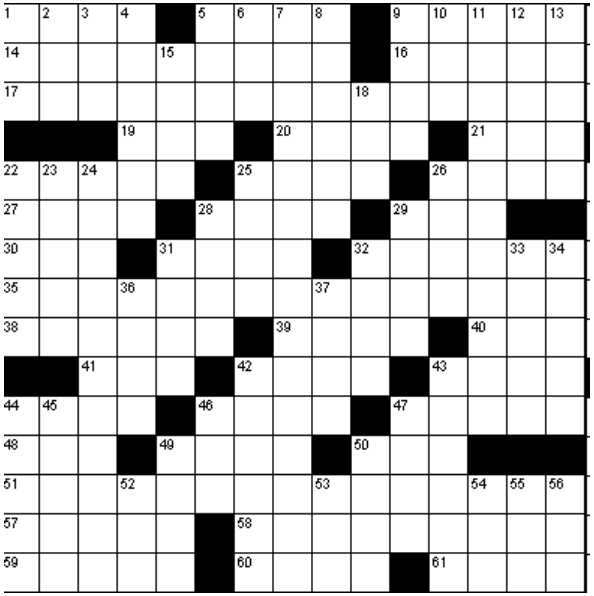
- If I said “shoe”, you thought of what type of shoe?
- I think of a pump
- That is an example of a :
- **Prototype**

THINKING AND LANGUAGE

- **Algorithms** are step-by-step procedures that will guarantee a solution. Usually long.
- **Heuristics** are a speedier, more error prone version of algorithms. By reducing the number of options and then applying trial and error, the result may be found.
- **Insights** are flashes of inspiration.
- **The right temporal lobe** is responsible for such insights. (Edward Bowden, mark Jung- Beeman and John Kounios) Researched the associated neural activity and it's electrical signature.

Example

- You are working with a crossword puzzle.
- You are trying to fill in a word for which you have all but one letter.
- What you have is: CL_FF.
- You would try putting every letter of the alphabet starting with A in that blank middle space until you found the letter that formed a word that fit the clue.
- This is an example of:
- **An Algorithm**

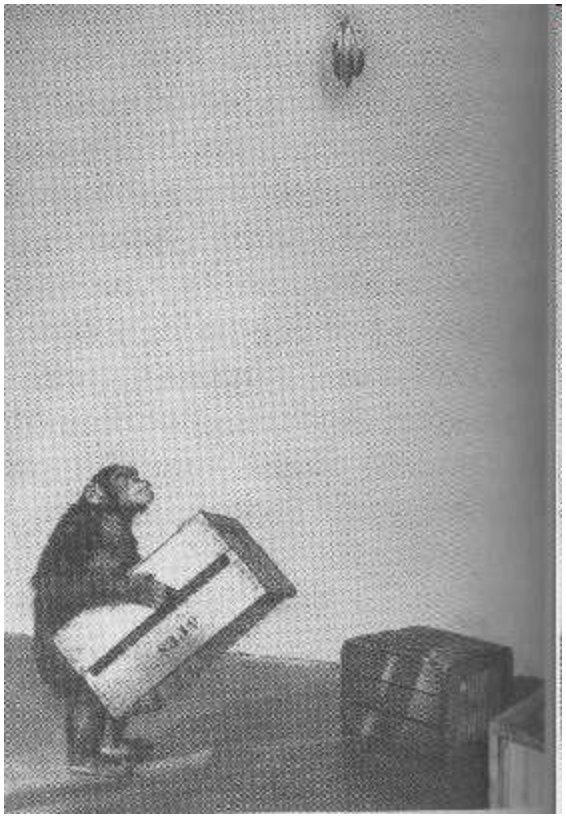


Example

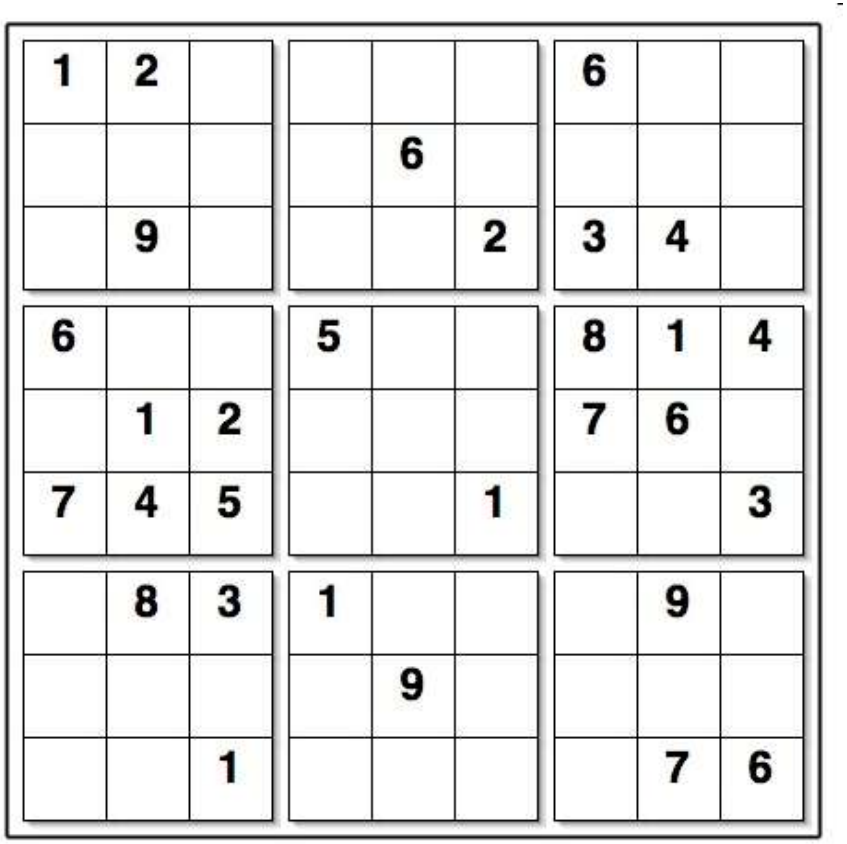
- You are going in a maze
- If you keep on hand on the right wall and walk through the entire maze with one hand on the wall, you will get out of the maze.
- This is an example of a :
- **Heuristic**
- Ex. “i before e except after c”
- **Heuristics are “rules of thumb”**

Example

- Chimpanzees were placed in an experimental cage with several different objects in the cage.
- On the ceiling there are bananas high in the cage so that they were inaccessible to chimps.
- The chimps would holler and jump for the bananas without success, but some of the chimps looked around the cage, saw the various objects, and figured out how to build a scaffold they could climb to reach the bananas.
- This is an example of
- **Insight**



Example



1	2					6		
				6				
	9				2	3	4	
6			5			8	1	4
	1	2				7	6	
7	4	5			1			3
	8	3	1				9	
				9				
		1					7	6

Sudden Insight- Often fun, satisfying, and one of the reasons that people enjoy working on word jumbles and other mental puzzles (causes a pleasing excitement)

THINKING AND LANGUAGE

Obstacles to problem solving

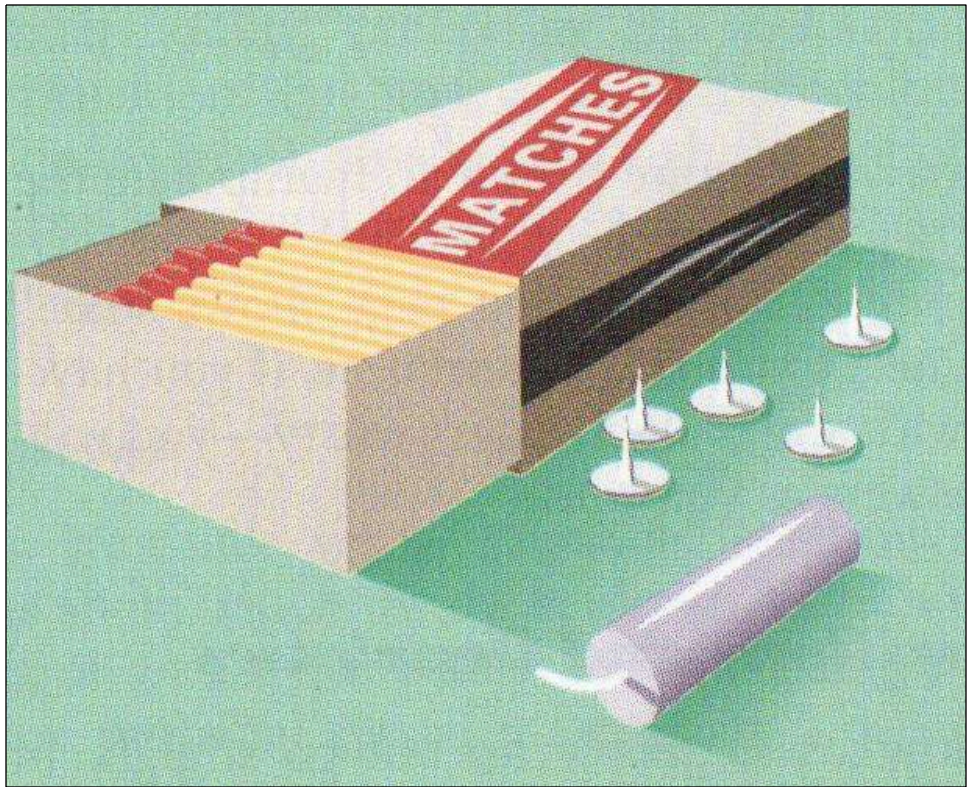
- **Confirmation bias** is the tendency to search for information that confirms one's perceptions
- Peter Wason revealed this principle when he gave university students **wrong formulas** to work with and found that the students tended to research examples to defend these theories.
- He revealed that we tend to find **examples** that credit their statements rather than finding examples that may **refute** it.
- **Fixation** is the inability to see a problem from a new perspective, it impedes our process to problem solve. Influenced by **mental sets** and **functional fixedness** .
- A **mental set** predisposes how we think. It refers to our tendency to approach a problem from a particular way that we have been **successful** in the **past** .
- **Functional fixedness** is the tendency to think of things only in terms of their usual **functions** . **Stereotypes** also limit our thinking.

Example

- **You have a theory that during a full moon there is an increase in admissions to the emergency room where you work.**
- **You will take notice of admissions during a full moon, but be inattentive to the moon when admissions occur during other nights of the month.**
- **A tendency to do this over time unjustifiably strengthens your belief in the relationship between the full moon and accidents and other lunar effects.**
- **This is an example of:**
- **Confirmation Bias**

Example:

Imagine that you are in a room with a candle, a box of matches, and some thumbtacks. Your task is to use these objects to attach the candle to the wall. How do you do it? (Adapted from Duncker, 1945)



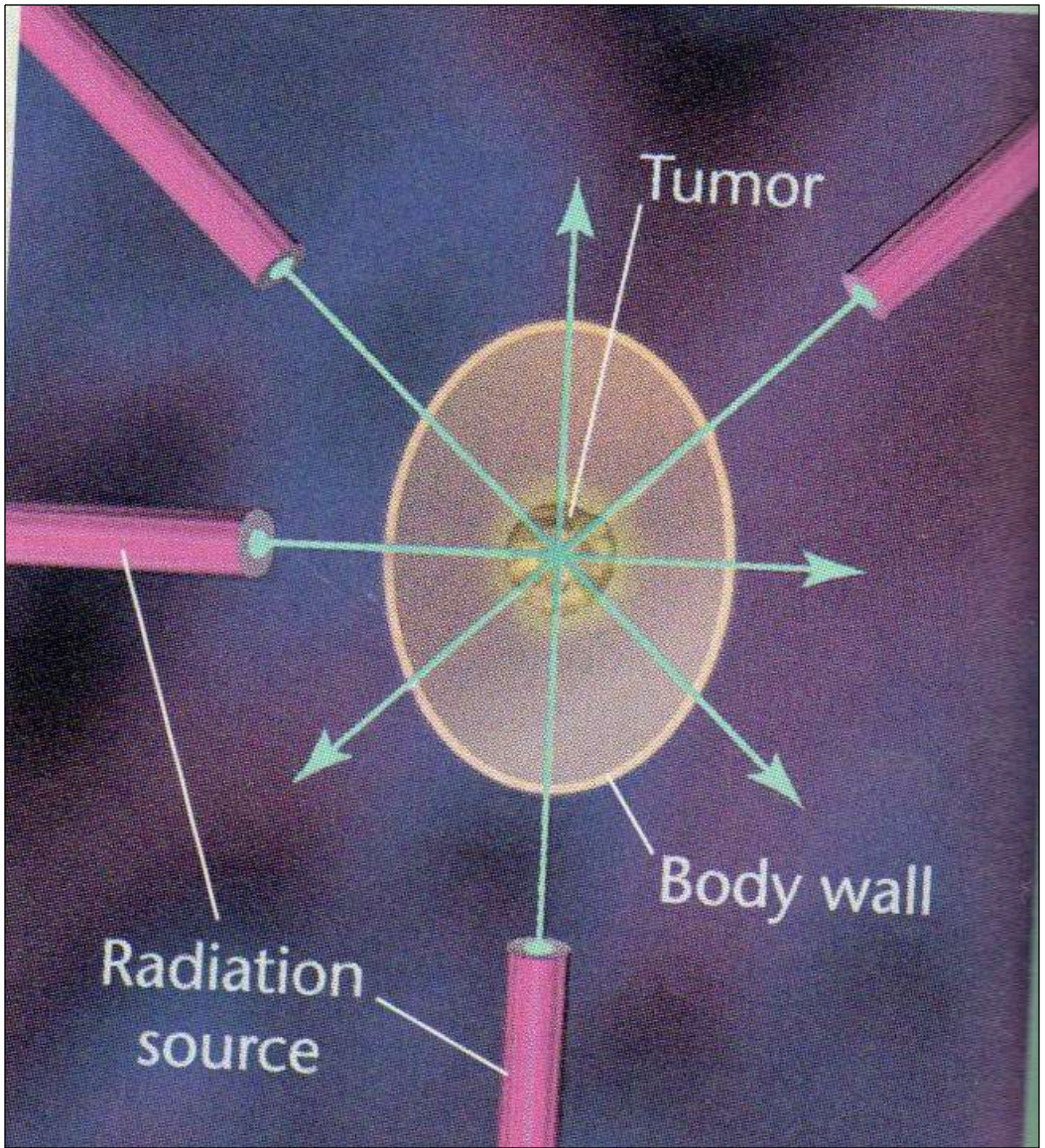
Example:

- The American space agency, NASA wanted to find a way for astronauts to write notes in space.
- Problem? In space ink pens don't always work upside down.
- After much research and many research dollars, NASA invented a pen that could be used in space even if the astronaut was upside down.
- What did the Russians do? They had their cosmonauts use pencils.
- This is an example of:
- **Functional Fixedness**

Example

Imagine that you are a doctor. One of your patients has a stomach tumor that must be destroyed if the patient is to live. Certain rays will destroy the tumor if they are intense enough. To reach the tumor, however, the rays need to pass through the healthy tissue that surrounds it, and at the intensity needed to destroy the tumor, the rays will also destroy the healthy tissue. How can you use the rays to destroy the tumor without damaging the healthy tissue?

Answer



Example

Imagine you are in a room in which two strings are hanging from the ceiling.

Your task is to tie the two strings together, but they are so far apart that you cannot reach both of them at the same time.

The only other object in the room is a pair of safety scissors.

How can you tie the strings together?

Example

- There are six eggs in a basket
- Six people take one of each.
- How is it that one egg can still be left in the basket?
- Answer:
- The sixth person took the basket as well as the last egg still inside.
- This is an example of a
- **Mental Set**

THINKING AND LANGUAGE

Using and Misusing Heuristics

- Amos Tversky and Daniel Kaneman revealed two heuristics of **representativeness** and **availability** .
- **Representativeness** heuristic demands you to use **rapid judgment** , while leaving out certain **relevant** information. By judging the likelihood of things in terms of how well they seem to **represent** , or math prototypes. Overrides the usage of **logic** and **statistics**.
- The **availability** heuristic states that anything that **increases** the ease of our **retrieving** information can increase its **perceived** availability. If it comes more **easily** to our mind, we tend to think that it is **more common** .
- It does not take into other factors such as **how recently** you heard about it, the **distinctiveness** and its **concreteness** .

Example

- You watch the news and read the papers and all they are reporting is some tragic event, such as a plane crash.
- You come to believe that you are likely to die in a plane crash.
- This is an example of:
- **Availability Heuristic**
- Which operates on the notion:
- "if you can think of it, it must be important."

Example

- A person claims to a group of friends that drivers of red cars get more speeding tickets. The group agrees with the statement because a member of the group, "Jim," drives a red car and frequently gets speeding tickets.
- The reality could be that Jim just drives fast and would get a speeding ticket regardless of the color of car that he drove.
- Even if statistics show fewer speeding tickets were given to red cars than to other colors of cars, Jim is an accessible example which makes the statement seem more plausible.
- This is an example of :
- **Availability Heuristic**

THINKING AND LANGUAGE

Overconfidence

- Overconfidence is the tendency to overestimate the accuracy of our knowledge and judgments.
- When people feel 100% confident about their answer, they tend to be wrong 15% of the time.
- Does not have any adaptive value.
- People do however, tend to live more happily, find it easier to make tough decisions and seem more credible.
- Not innate but learned through experience .

Examples of Overconfidence:

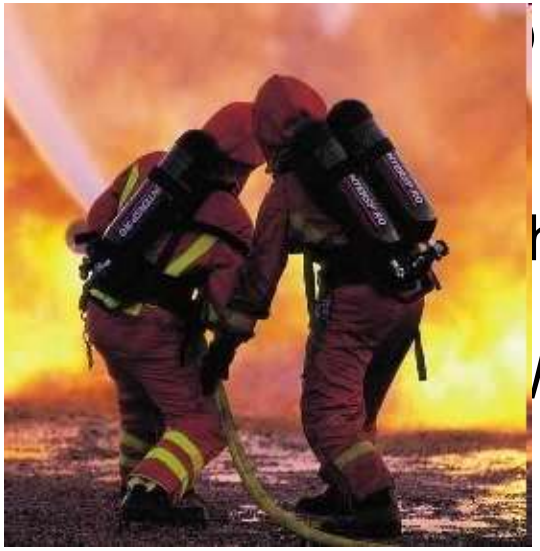
- **Hitler invading Russia**
- **LBJ invading N. Vietnam**
- **Bush marching into Iraq to eliminate WMD**
- **Students estimating the time it will take to complete an assignment**
- **Mrs. Ponder estimating how long it will take to finish the unit and be ready for a test**
- **When given clear and prompt feedback about the accuracy of predictions people learn to assess their accuracy more realistically**

THINKING AND LANGUAGE

The Belief Perseverance Phenomenon

- Belief perseverance is our tendency to hold onto beliefs even when we are presented with **contradicting** evidence.
- Considering evidence supporting the **opposite position** is a remedy for this type of bias.

Two groups of people were asked: Do risk takers or cautious people make better firefighters?



- ne group was told accounts of both a risk taker who was a good firefighter and of a cautious person who was a poor firemen.
- hey came to the conclusion that risk takers are braver and therefore better firemen.
- /hen they later told the people that not only do statistics show that **cautious people make better firefighters**, but that the stories were fabricated for the purposes of the study.
- They still kept their beliefs and would continue to explain why they thought that risk takers would make better firefighters.
- This is the **belief perseverance phenomenon**.

Examples of Belief Perseverance:

- A teacher's belief about a student
- A voter's belief about a candidate
- An investor's belief about a company

* It takes more to change a belief than create it

THINKING AND LANGUAGE

The Perils and Powers of Intuition

- Intuition has an adaptive value.
- Allows us to **react quickly**.
- Not innate, grown through experience.
- Not as valid as **assessing risks**.

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. (9)
- *Representativeness and availability*—fast and frugal heuristics become quick and dirty when leading us into illogical and incorrect judgments. (10)
- *Overconfidence*—our intuitive assessments of our own knowledge are often more confident than correct. (1,10)
- *Belief perseverance and confirmation bias*—thanks partly to our preference for confirming information, beliefs are often resilient, even after their foundation is discredited. (1,10)
- *Framing*—judgments flip-flop, depending on how the same issue or information is posed. (10)
- *Interviewer illusion*—inflated confidence in one's discernment based on interview alone. (12)
- *Mispredicting our own feelings*—we often mispredict the intensity and duration of our emotions. (13)
- *Self-serving bias*—in various ways, we exhibit inflated self-assessments. (15)
- *Fundamental attribution error*—overly attributing others' behavior to their dispositions by discounting unnoticed situational forces. (18)
- *Mispredicting our own behavior*—our intuitive self-predictions often go astray. (18)

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. (4)
- *Moral intuition*—quick gut feelings that precede moral reasoning. (4)
- *Divided attention and priming*—unattended information processed by the mind's downstairs radar watchers. (5)
- *Everyday perception*—the instant parallel processing and integration of complex information streams. (5)
- *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. (9)
- *Heuristics*—those fast and frugal mental shortcuts that normally serve us well enough. (10)
- *Intuitive expertise*—phenomena of nonconscious learning, expert learning, and physical genius. (10, 11, 15)
- *Creativity*—the sometimes-spontaneous appearance of novel and valuable ideas. (11)
- *Social and emotional intelligence*—the intuitive know-how to comprehend and manage ourselves in social situations and to perceive and express emotions. (11)
- *The wisdom of the body*—when instant responses are needed, the brain's emotional pathways bypass the cortex; hunches sometimes precede rational understanding. (13)
- *Thin slices*—detecting traits from mere seconds of behavior. (15)
- *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. (18)

THINKING AND LANGUAGE

Framing Decisions

- Framing is the way we **present** an issue.
- Just like how something is “framed” as in framing of a picture. If the picture is of fruits and the frame looks like an interwoven wooden thread, then the picture looks very natural. If the picture is placed around a frame that is grey and metallic-like, the effect is very different.
- Just like if I “frame” the statement: there is a 70% chance of winning as opposed to 30% chance of losing.

Example

Political:

- **Public Assistance**
  - "Aid to the needy" (for it)
  - "Welfare" (against it)
- This is an Example of:
- **Framing**

More Examples of Framing:

- **Condoms have 95% success rate in stopping HIV, the virus that causes AIDS**
  - **90% of college students rated condoms as effective**
- **Condoms have a 5% failure rate in stopping HIV, the virus that causes AIDS**
  - **40% of college students rated condoms as effective**
- **Ground beef marketed as 20% fat rather than 80% lean**
- **A surgeon bragging about a 2% death rate as opposed to a 98% survival rate**

THINKING AND LANGUAGE

Language

- Our spoken, written or signed words and the ways we **combine** them to **communicate** meaning.

THINKING AND LANGUAGE

Language Structure

- **Phonemes** are the smallest sound units in language.
- **Consonant phonemes** carry more meaning than vowel phonemes
- **Sign Language** is also learned with accents
- **Morphemes** are the smallest units of language that carries meaning. Includes prefixes and suffixes.
- **Grammar**: Rules in a language that allows us to properly understand it.
- **Semantics**: How we get meaning from morphemes, words, and sentences.
- **Syntax:** How to combine words into meaningful sentences.

THINKING AND LANGUAGE

How do we learn language?

- **Receptive language** is the child's ability to **comprehend** speech. Begins to mature before their **productive** language, which is their ability to **produce** words.
- **Productive Language** is a child's ability to produce words. (improves with improvement of receptive language)
  - **Babbling Stage**: (3-4 months after birth) A stage in speech development where the infant utters **sounds** unlike the family language.
  - **One-word** stage: (1-2 years old) A stage in speech development where the infant speaks **single** words
  - **Two-word** stage: (2 years old) Infants speak in two-word phrases that resemble **Telegraphic speech** – speech like a "telegram" I.e. Want candy, me play, no eat…etc

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.

THINKING AND LANGUAGE

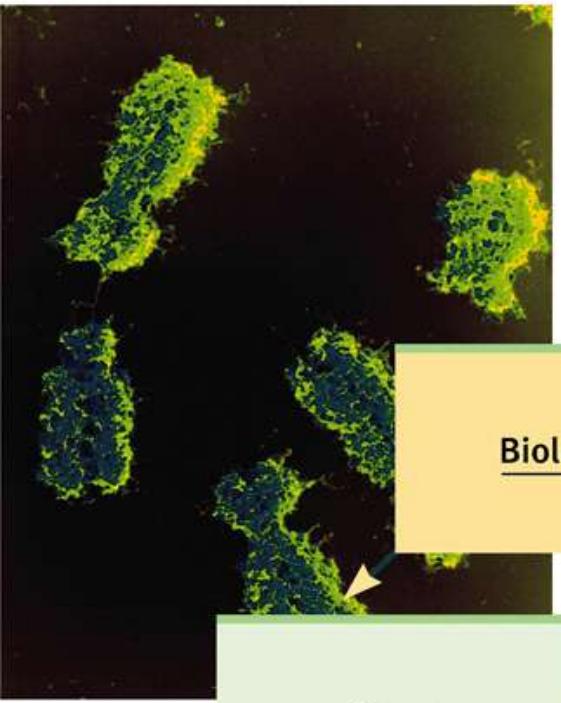
Explaining Language Development

- **Skinner** described acquisition of language thru **association**/ **operant** conditioning.
  - **Overgeneralizing** causes a majority of the mistakes associated with language development in young children.
  - Ex.“I goed to the store”
- **Noam Chomsky** disapproved of Skinner’s description and insisted that **universal grammar** underlies all human language.
  - Claimed that this was a **natural** and inborn process – **language acquisition device.**
  - The **rules** which combine specific phonemes, morphemes, words and sentences are known as **surface structure**.
  - Babies can detect the difference between longer syllables in different sequences suggesting that they do indeed have a **built in** acquisition.
  - A child can learn any language and will spontaneously invent meaningful words to convey their wishes. However, after age **7**, the ability to master a new language greatly **declines**.

THINKING AND LANGUAGE

Language influences thinking

- Linguistic Benjamin Lee Whorf's **Linguistic determinism** states language determines how we think. This is most evident in **polylinguals** (speaking 2 or more languages).
- i.e. someone who speaks English and Chinese will feel differently depending on which language they are using. English has many words describing personal emotions and Chinese has many words describing inter-personal emotions.
- However, **thinking** could occur without **language**. This is evident in pianists and artists where mental images nourish the mind.
- Therefore, thinking and language affect each other in an enduring cycle.
- **Bilingual Speakers** were able to inhibit their attention to **irrelevan**t information. Known as the bilingual advantage.



Biological

Social-cultural
Spoken language heard

provides input to

Genes

Brain mechanisms for understanding and producing language are triggered during a child's critical period for language.

Psychological
Mastery of native language

THINKING AND LANGUAGE

Language influences thinking

- Studies of the effects of the generic pronoun “he” show that subtle **prejudices** can be conveyed by the words we choose to express our everyday thoughts
- Some evidence indicates that vocabulary enrichment, particularly immersion in bilingual education, can enhance thinking
  - Children of signing **deaf parents** become fluent in sign language and outperform other students on measures of academic and intelligence **achievement**

THINKING AND LANGUAGE

Statistical Learning and Critical Periods

- Infants learn **statistical** aspects of human speech
- Saffran exposed 8 mo old infants to a computer voice speaking an unbroken string of nonsense syllables. After two minutes, the infants were able to recognize (by attention) three syllable sequences that appeared repeatedly.
- Babies appear to come with a built in **readiness** to learn grammatical rules (Marcus)
- **Critical period** in childhood seems to be the time that humans can master certain aspects of language.
- (proven through deaf children getting **cochlear** implants at 2 and at 4).
- Language learning **capacity** never fully develops when a young brain does not learn ANY language.

THINKING AND LANGUAGE

The Brain and Language

- Language depends on a chain of events in several brain regions

When we read aloud, the words:

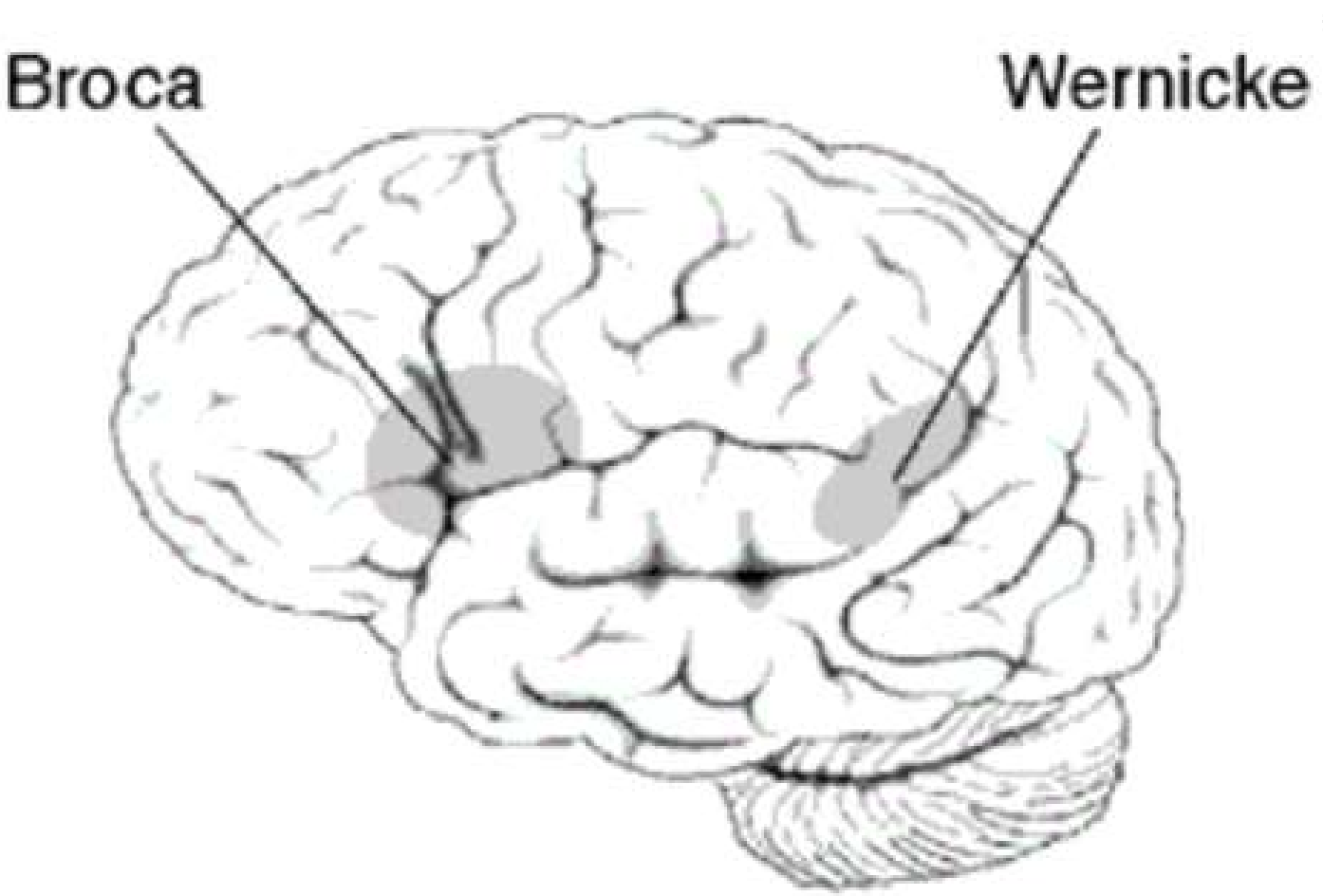
1. Register in the visual area.
2. Relayed to the **angular gyrus**, which transforms the words into auditory code.
3. Received and understood in nearby **Wernicke's area**
4. Sent to ***Broca's area***
5. **Brocas** controls the **motor cortex** as it creates the pronounced word.

THINKING AND LANGUAGE

Damaged Brain and Language:

- Depending on which link in this chain is damaged, a different form of **aphasia (**impaired use of language, usually caused by left hemisphere damage**)** occurs.
  - For example, damage to the angular gyrus leaves the person able to speak and understand but unable to read.
  - Damage to Wernicke's area disrupts understanding.
  - Damage to Broca's area disrupts speaking.

  What we experience as a continuous experience is the visible tip of a subdivided information-processing iceberg, most of which is outside our awareness. More generally, language processing illustrates how the mind's subsystems are localized in particular brain regions, yet the brain acts as a unified whole.


Broca
Wernicke

THINKING AND LANGUAGE

Thinking Images

- Thinking in images is very useful especially for mentally **practicing** upcoming events can actually increase our skills.
- **Visualization** can improve skills and/or performance
- **Procedural Memory** is our unconscious memory system for **motor** and **cognitive** skills and conditioned associations.

What is the relationship between language and thinking?

- Whorf's *Linguistic determinism-* suggests that language determines thought, it is more accurate to say that langue influences thought.
- For example, speakers of different languages may see different numbers of bands in a rainbow. Since rainbows are actually a continuum of color, there are no empirical stripes or bands, and yet people see as many bands as their language possesses primary color words.

THINKING AND LANGUAGE

Do Animals Exhibit Language?

- Animals also communicate, whether by means of **sound** or **behavior** just as bees dictate the location of nectar with an elaborate dance.
- Allen Gardner and Beatrice Gardner, researchers of University of Nevada, successfully taught a chimpanzee to perform **sign language** as means of communication
- Only humans have been found to master the verbal or signed expression of complex rules of **syntax.**
- Both humans and apes shared the abilities of reasoning, self-recognition, empathy, imitation as well as understanding another's **mind**.

Do animals think?

- 5 cognitive skills shared by the great apes and humans
  - **Formation of concepts**
  - **Display insight**
  - **Use and create tools**
  - **Transmit cultural innovations**
  - **Have a theory of mind**

Do animals think?

- Several species of apes have learned to communicate using sign language or special keyboards wired to computers
  - **Developed vocabularies of hundreds of words**
  - **Communicated by stringing words together**
  - **Taught their skills to younger animals**
  - **Cannot grasp complex rules of grammar**