Thinking and Language

Chapter 10

1

Thinking

Thinking, or *cognition,* refers to a process that involves knowing, understanding, remembering, and communicating.

2

Cognitive Psychologists

Thinking involves a number of mental activities, which are listed below. Cognitive psychologists study these in great detail.

- Concepts (concept formation)
- Problem solving
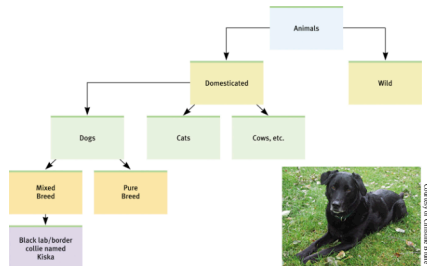- Decision making
- Judgment formation

3

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*.

4

Category Hierarchies

We organize concepts into category hierarchies.

Animals

Domesticated — Wild

Dogs — Cats — Cows, etc.

Mixed Breed — Pure Breed

Black lab/border collie named Kiska

Courtesy of Christine Brune

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Development of Concepts

We form some concepts with definitions. For example, a triangle has three sides. Mostly, we form concepts with mental images or typical examples (prototypes). For example, a robin is a prototype of a bird, but a penguin is not.
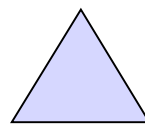
Triangle (definition)

Bird (mental image)

Daniel J. Cox/ Getty Images

J.M.Storey/odd/The Picture Cube

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Categories

Once we place an item in a category, our memory shifts toward the category prototype.

90% CA 80% CA 70% CA 60% CA 50%/50% 60% AS 70% AS 80% AS 90% AS

A computer generated face that was 70 percent Caucasian led people to classify it as Caucasian.

7

Problem Solving

There are two ways to solve problems:

Algorithms: Methodical, logical rules or procedures that guarantee solving a particular problem.

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Algorithms

Algorithms, which 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.

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Heuristics

Heuristics are simple, thinking strategies that allow us to make judgments and solve problems efficiently. Heuristics are less time consuming, but more error-prone than *algorithms*.

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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.

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Insight

Insight involves a sudden novel realization of a solution to a problem. Humans and animals have insight.
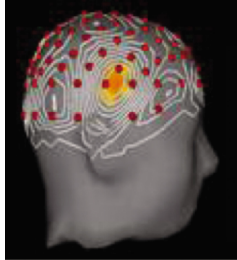

Grande using boxes to obtain food

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Insight

Brain imaging and EEG studies suggest that when an insight strikes (the "Aha" experience), it activates the right temporal cortex (Jung-Beeman, 2004). The time between not knowing the solution and realizing it is 0.3 seconds.

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Obstacles in Solving Problems

Confirmation Bias: A tendency to search for information that confirms a personal bias.

$$2 - 4 - 6$$

Rule: Any ascending series of numbers. 1 – 2 – 3 would comply. Ss had difficulty figuring out the rule due to a confirmation bias (Wason, 1960).

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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?
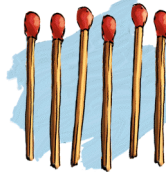
Candle-Mounting Problem

Using these materials, how would you mount the candle on a bulletin board?

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The Matchstick Problem: Solution
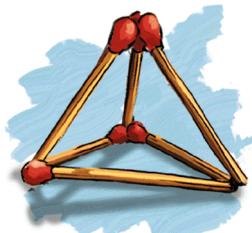
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Candle-Mounting Problem: Solution

Bulletin board

Thumbtacks pushed through empty matchbox
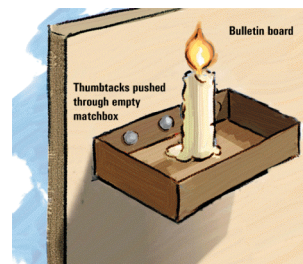
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Mental Set

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

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Functional Fixedness

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

Problem: Tie the two ropes together.
Use a screw driver, cotton balls and a matchbox.

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Functional Fixedness

Use the screwdriver as a weight, and tie it to the end of one rope. Swing it toward the other rope to tie the knot.

The inability to think of the screwdriver as a weight is functional fixedness.

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Using and Misusing Heuristics

Two kinds of heuristics, representative heuristics and availability heuristics, have been identified by cognitive psychologists.

Amos Tversky   Daniel Kahneman

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Representativeness Heuristic

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

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?

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Availability Heuristic

Why does our availability heuristic lead us astray? Whatever increases the ease of retrieving information increases its perceived availability.

How is retrieval facilitated?
- How recently we have heard about the event.
- How distinct it is.
- How correct it is.

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Making Decision & Forming Judgments

Each day we make hundreds of judgments and decisions based on our intuition, seldom using systematic reasoning.

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Overconfidence

Intuitive heuristics, confirmation of beliefs, and the inclination to explain failures increase our 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.

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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 decline in air travel due to fear.

AP Wide World Photos

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Framing Decisions

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

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

28

Belief Bias

The tendency of one's preexisting beliefs to distort logical reasoning by making invalid conclusions.

God is love.
Love is blind
Ray Charles is blind.
Ray Charles is God.
Anonymous graffiti

29

Belief Perseverance

Belief perseverance is the tendency to cling to our beliefs in the face of contrary evidence.

If you see that a country is hostile, you are likely to interpret their ambiguous actions as a sign of hostility (Jervis, 1985).

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Perils & Powers of Intuition

Intuition may be perilous if unchecked, but may also be extremely efficient and adaptive.

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

Intuition's Dozen Deadly Sins	Evidence of Intuition's Powers
• *Hindsight bias*—looking back on events, we falsely surmise that we knew it all along. (1)	• *Blindsight*—brain-damaged persons' "sight unseen" as their bodies react to things and faces not consciously recognized. (2)
• *Illusory correlation*—intuitively perceiving a relationship where none exists. (1)	• *Right-brain thinking*—split-brain persons displaying knowledge they cannot verbalize. (2)
• *Memory construction*—influenced by our present moods and by misinformation, we may form false memories. (9)	• *Infants' intuitive learning*—of language and physics. (4)
• *Representativeness and availability*—fast and frugal heuristics become quick and dirty when leading us into illogical and incorrect judgments. (10)	• *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)
• *Overconfidence*—our intuitive assessments of our own knowledge are often more confident than correct. (1,10)	• *Everyday perception*—the instant parallel processing and integration of complex information streams. (5)
• *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)	• *Automatic processing*—the cognitive autopilot that guides us through most of life (various).

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Perils & Powers of Intuition

- *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)

- *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)

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Language

Language, our spoken, written, or gestured work, is the way we communicate meaning to ourselves and others (includes nonverbal, paraverbal, and verbal)

Language transmits culture.

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Language Structure

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

bat, has three phonemes *b · a · t*

chat, has three phonemes *ch · a · t*

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Language Structure

Morpheme: The smallest meaningful unit. It may be a word or part of a word. For example:

Milk = *milk*
Pumpkin = *pump . kin*
Unforgettable = *un · for · get · table*

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## Structuring Language

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

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Grammar

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

Grammar
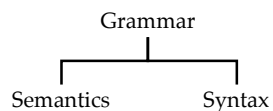
Semantics   Syntax

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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.

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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*.

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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.

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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.

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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*.

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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.*

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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.

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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.

45

Explaining Language Development

1. Operant Learning: Skinner (1957, 1985) believed that language development may be explained on the basis of learning principles such as association, imitation, and reinforcement.

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Explaining Language Development

2. Inborn Universal Grammar: Chomsky (1959, 1987) opposed Skinner's ideas and suggested that the rate of language acquisition is so fast that it cannot be explained through learning principles, and thus most of it is inborn.

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Explaining Language Development

3. Statistical Learning and Critical Periods: Well before our first birthday, our brains are discerning word breaks by statistically analyzing which syllables in *hap-py-ba-by* go together. These statistical analyses are learned during critical periods of child development.
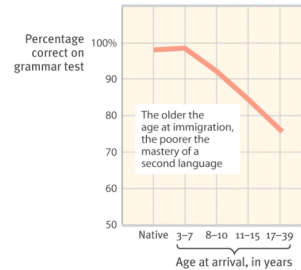
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Genes, Brain, & Language

Genes design the mechanisms for a language, and experience modifies the brain.
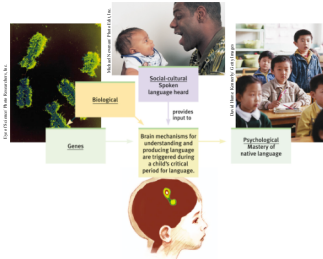
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Language & Age

Learning new languages gets harder with age.

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Language & Thinking

Language and thinking intricately intertwine.

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Language Influences Thinking

Linguistic Determinism: Whorf (1956) suggested that language determines the way we think. For example, he noted that the Hopi people do not have the past tense for verbs. Therefore, the Hopi cannot think readily about the past.

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Language Influences Thinking

When a language provides words for objects or events, we can think about these objects more clearly and remember them. It is easier to think about two colors with two different names (A) than colors with the same name (B) (Özgen, 2004).
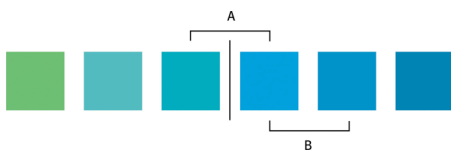
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Word Power

Increasing word power pays its dividends. It pays for speakers and deaf individuals who learn sign language.

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Linguistic Determinism Questioned

Although people from Papua New Guinea do not use our words for colors and shapes, they still perceive them as we do (Rosch, 1974).

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Thinking in Images

To a large extent thinking is language-based. When alone, we may talk to ourselves. However, we also think in images.
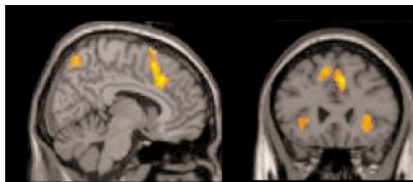
We don't think in words, when:

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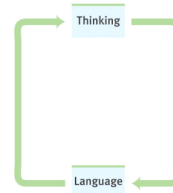
2. When we are riding our bicycle.

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Images and Brain

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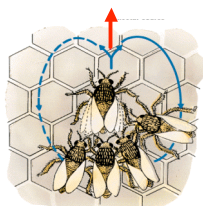

Jean Duffy Decety, September 2003

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Language and Thinking

Traffic runs both ways between language and thinking.

Thinking

Language

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Animals & Language

Do animals have a language?

Honey bees communicate by dancing. The dance moves clearly indicate the direction of the nectar. 59
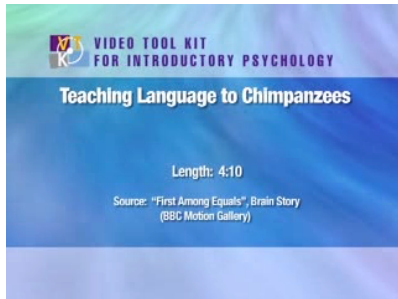
Do Animals Think?

Common cognitive skills in humans and apes include the following:

1. Concept formation.
2. Insight
3. Problem Solving
4. Culture
5. Mind?

William Munoz

African grey parrot assorts red blocks from green balls.

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VIDEO TOOL KIT FOR INTRODUCTORY PSYCHOLOGY

Teaching Language to Chimpanzees

Length: 4:10

Source: "First Among Equals", Brain Story
(BBC Motion Gallery)

61

Insight

Chimpanzees show insightful behavior when solving problems.

Sultan uses sticks to get food.

62

Ali G Interview with Noam Chomsky

http://www.youtube.com/watch?v=fOIM1_xOSro

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Problem Solving

Apes are famous, much like us, for solving problems.

Chimpanzee fishing for ants.

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Animal Culture

Animals display customs and culture that are learned and transmitted over generations.

Dolphins using sponges as forging tools.

Chimpanzee mother using and teaching a young how to use a stone hammer.

65

Mental States

Can animals infer mental states in themselves and others?

To some extent. Chimps and orangutans (and dolphins) used mirrors to inspect themselves when a researcher put paint spots on their faces or bodies.

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Do Animals Exhibit Language?

There is no doubt that animals communicate.

Vervet monkeys, whales and even honey bees communicate with members of their species and other species.
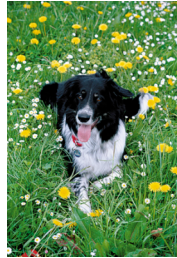
Rico (collie) has a 200-word vocabulary

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The Case of Apes

Chimps do not have a vocal apparatus for human-like speech (Hayes & Hayes,1951). Therefore, Gardner and Gardner (1969) used American Sign Language (ASL) to train Washoe, a chimp, who learned 182 signs by the age of 32.

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Gestured Communication

Animals, like humans, exhibit communication through gestures. It is possible that vocal speech developed from gestures during the course of evolution.

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Sign Language

American Sign Language (ASL) is instrumental in teaching chimpanzees a form of communication.

When asked, this chimpanzee uses a sign to say it is a baby.

70

Computer Assisted Language

Others have shown that *bonobo pygmy chimpanzees* can develop even greater vocabularies and perhaps semantic nuances in learning a language (Savage-Rumbaugh, 1991). *Kanzi and Panbanish* developed vocabulary for hundreds of words and phrases.

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Criticism

1. Apes acquire their limited vocabularies with a great deal of difficulty, unlike children who develop vocabularies at amazing rates.
2. Chimpanzees can make signs to receive a reward, just as a pigeon who pecks at the key receives a reward. However, pigeons have not learned a language.
3. Chimpanzees use signs meaningfully but lack syntax.
4. Presented with ambiguous information, people tend to see what they want to see.

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Conclusions

If we say that animals can use meaningful sequences of signs to communicate a capability for language, our understanding would be naive... Steven Pinker (1995) concludes, "chimps do not develop language."

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