Language, Thought, and Intelligence

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The Complex Structure of Human Language

Language is a system for communicating with others using signals that are combined according to rules of grammar and convey meaning.

Grammar is a set of rules that specify how the units of language can be combined to produce meaningful messages.
Phonemes are the smallest units of sound that are recognizable as speech rather than as random noise.

Phonological rules indicate how phonemes can be combined.
- Vary from language to language.
- Violation of these rules is described as speaking with an accent.
Phonemes are combined to make morphemes, the smallest meaningful units of language.

Morphological rules indicate how morphemes can be combined.

Syntactical rules indicate how words can be combined to form phrases and sentences.
- Every sentence must have a noun and a verb.
Deep structure is the meaning of a sentence and surface structure is the wording of a sentence.

-The boy kissed the girl.
-The girl was kissed by the boy.
Humans learn language remarkably fast.

<table>
<thead>
<tr>
<th>Approximate Age</th>
<th>Language Performance</th>
</tr>
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<tbody>
<tr>
<td>Birth</td>
<td>Cries</td>
</tr>
<tr>
<td>12 Weeks</td>
<td>Coos, gurgles</td>
</tr>
<tr>
<td>16 Weeks</td>
<td>Differentiates sounds and responds to human sounds</td>
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<tr>
<td>20 Weeks</td>
<td>Makes vowel and consonant sounds</td>
</tr>
<tr>
<td>6 Months</td>
<td>Babbles single syllable (ma, mu, da, di)</td>
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<tr>
<td>8 Months</td>
<td>Reduplicates babbles (mama, didi), intonates</td>
</tr>
<tr>
<td>12 Months</td>
<td>Understands some words as symbols</td>
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<tr>
<td>18 Months</td>
<td>Still babbles, utters 2-50 words, not many joined</td>
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<tr>
<td>24 Months</td>
<td>Shows vocabulary of 50+ words (specially nouns), uses two-word phrases</td>
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<tr>
<td>30 Months</td>
<td>Shows fastest vocabulary increase – daily additions</td>
</tr>
<tr>
<td>36 Months</td>
<td>Shows 1,000-word vocabulary, 80% of which is intelligible to strangers</td>
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</tbody>
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The ages in this table are approximations. Parents need not assume that their children will have language problems if they are somewhat behind. Source: Adapted from Lenneberg (1967)
At birth, infants can distinguish all the sounds that occur in all human languages.

Although infants can distinguish speech sounds, they can’t produce them reliably.

Babbling is an important part of the language learning process.
Fast mapping the “mapping” of a word onto an underlying concept after only a single exposure

Telegraphic speech is devoid of function morphemes and consists mostly of content words.
Some of the key milestones of language development depend on characteristics of language learning rather than general limitations of cognitive development.
Video “The Linguistic Genius of Babies”

http://www.youtube.com/watch?v=G2XBIkHW954

Ted Talk on The Linguistic Genius of Babies
Concepts and Categories

**concept** a mental representation that groups or categorizes shared features of related objects, events, or other stimuli

abstract representation that serves to designate certain objects to certain categories

e.g.: “Bird” - small, winged, beaked creature
Family Resemblance Theory

developed by Eleanor Rosch

features that appear to be characteristic of category members but may not be possessed by every member

e.g.: family facial structures (beards)
Prototype Theory

the “best” or “most typical member” of the category

posses most or all of the characteristics

e.g.: Prototype of “bird” category is wren due to containing the most characteristics of the category
Exemplar Theory

making category judgements by comparing a new instance with stored memories for other instances of the category

e.g.: Out of the corner of your eye you see a 4 legged animal, may assume it’s a wolf, but it reminds you of a German shepherd

categorised as dog due to striking resemblance to stored memories of instances with dogs
visual cortex focuses on prototypes (holistic approach) vs.
prefrontal cortex and basal ganglia focusing on learning exemplars (analysis and decision making)

**Category-specific deficit** inability to recognize objects belonging to a specific category *although* being able to recognize objects outside the category

more common with damage to left-hemisphere
damage to different areas of the brain

front left temporal lobe: difficulty identifying humans
lower left temporal lobe: difficulty identifying animals

Brain regions are “prewired” to respond to some categories more than others
Theories of Language Development

Behaviorist Explanation

● B. F. Skinner’s operant conditioning
● Infants vocalize, and repeat reinforced vocalizations and stop unreinforced ones
● Does not account for children creating their own sentences or phrases
● Does not account that parents spend little time correcting children’s grammar
Theories of Language Development

Nativist Theory

- innate biological capacity for language
- only possible at a young age
- genetic dysphasia may be evidence against
- only explains how language develops, not why
Theories of Language Development

VIDEO: https://sakai.claremont.edu/access/content/group/CX_mtg_74816/Chapter%207%20Notes/Media%20Clips/22.MPG
Theories of Language Development

Interactionist Explanation

- social interaction crucial for language development
- parents speak in a way designed to make language acquisition easy for children
Broca’s area is involved in producing grammatical and understandable speech while Wernicke’s area is involved with understanding language. Aphasia is damage to either of these areas resulting in difficulty producing or comprehending language.
Rational Choice Theory: We make decisions by determining how likely something is to happen, judging the value of the outcome, and then multiplying the two (Edwards, 1955)
Frequency Format Hypothesis: our minds evolved to notice how frequently things occur, not how likely they are to occur.

Availability Bias: The tendency to mistakenly judge items that are more readily available in memory as having occurred more frequently.

Conjunction Fallacy: An error that occurs when people think that two events are more likely to occur together than either individual event.

Representativeness Heuristic: A mental shortcut that involves making a probability judgment by comparing an object or event to a prototype of the object or event.
Framing Effects: Phenomena that occur when people give different answers to the same problem depending on how the problem is phrased (or framed)

Sunk Cost Fallacy: A framing effect in which people make decisions about a current situation based on what they have previously invested in the situation

Prospect Theory: The proposal that people choose to take risks when evaluating potential losses and avoid risks when evaluating potential gains
Risky decision making depends critically on the contributions of the prefrontal cortex.
Comprehension Questions for Decision Making

1. People give different answers to the same problem depending on how the problem is phrased because of:
   a. the availability bias    c. the representativeness heuristic
   b. the conjunction fallacy  d. framing effects

2. The view that people choose to take on risk when evaluating potential losses and avoid risks when evaluating potential gains describes:
   a. expected utility    c. prospect theory
   b. the frequency format hypothesis  d. the sunk-cost fallacy
Intelligence: The ability to direct one’s thinking, adapt to one’s circumstances, and learn from one’s experiences.
1920’s Henry Goddard administered Intelligence tests to assess who was “feeble minded.” However, they were originally developed to help underprivileged kids succeed in school.

Binet and Simon developed the ratio IQ - a statistic obtained by dividing a person's mental age by their physical age and then multiplying the quotient by 100.

Deviation IQ - a statistic obtained by dividing a person's test score with the average score of people in the same age group and multiplying the quotient by 100.
Intelligence Testing

Stanford-Binet and the WAIS test seeing similarities and differences, recalling general knowledge, working with numbers etc.

Can predict, academic performance, number of years of education as well as occupational status and income
Charles Spearman measured how well students could detect small differences in color, pitch, and weight and correlated them to their grades

- Positive Correlation
- The highest score on one measure was not the same on every measure

Two Factor Theory: Every task requires a combination of general ability (g) and skills that are specific to the task (s)
Fluid Intelligence: The ability to see abstract relationships and draw logical inferences

Crystallized Intelligence: The ability to retain and use knowledge that was acquired through experience

Emotional Intelligence: The ability to reason about emotions and to use emotions to enhance reasoning
Where Does Intelligence Come From?

Genetic Influences on Intelligence

- Fraternal twins
- Identical twins

shared environment - environmental factors that are experienced by all relevant members of a household

nonshared environment - environmental factors that are not experienced by all relevant members of a household
Americans often think “genetic” is a synonym for “unchangeable”

Is intelligence unchangeable?

- Relative intelligence
- Absolute intelligence
- Flynn effect

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**Environmental Influences on Intelligence**

*Chart showing absolute intelligence changes over time.*

*Source: Kaufman (2001).*
Environmental Influences on Intelligence

● Economics
  ○ socioeconomic status
● Education
● Improving Intelligence
  ○ Ritalin, Adderal, Modafinil
Are Some Groups More Intelligent Than Others?

Standford-Binet intelligence test in the early 1900s

Lewis Terman poses the question

“Are the inferior races really inferior, or are they merely unfortunate in their lack of opportunity to learn?”
His answer

“Our dullness seems to be racial, or at least inherent in the family stocks from which they come.”

His idea for action:

“children of this group should be segregated into separate classes because they cannot master abstractions but they can often be made into efficient workers”