What is language?
- Creative or generative
- Structured
- Referential
- Species-Specific

Units of Language
- Phonemes
- Morphemes
- Semantics
- Syntax
- Pragmatics

Language Development: The Components of Language

- Sounds are combined to form words.
- Sentences are formed to compose stories, conversations, and other narratives.
- Words are combined to form sentences.
**Language Milestones**

<table>
<thead>
<tr>
<th>Phoneme perception</th>
<th>Understand words</th>
<th>1st word</th>
<th>50 words Combining words</th>
<th>300 words</th>
<th>&gt;2000 words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer mom’s voice</td>
<td>2</td>
<td>50</td>
<td>300</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Precursors to language**

**Before birth**
- Respond to auditory stimulation in 2nd month before birth.
- Prefer familiar sound patterns (Cat in the Hat)

**First months**
- Newborns less sensitive than adults (need louder sound)
- 2-3 months: better at high frequencies (15-25 dB).

**Sound localization**
- 4 months: deliberately search for sounds: Before 6 months: large location differences need to detect a change (12-20 degrees).

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**What is the problem space with respect to speech?**

Speech sounds are highly variable:
- Different speakers
- Different rates
- Different genders
- Accents
- Different intonation patterns

Speech stream is continuous: the “segmentation problem”
- When people write, there are clear gaps between words
- When people speak, these gaps are less obvious or nonexistent

**What are some of the child’s strategies?**

1. Sensitivity to
   - Includes sensitivity to spoken language characteristic: rhythm, tempo, cadence, melody, intonational patterns
     - Discriminate French and Russian

2. Sensitivity to the
   - 1 month: hear many more sounds than adults
   - Sensitivity modified in 1st year:
     - Ignore phonemic distinctions that are no longer important.
The Process of Language Acquisition: Speech Perception

- Categorical perception of speech sounds
  - Possessed by adults and infants
  - Involves perception of speech sounds as belonging to discrete categories
- Studying the perception of VOT
  - Recordings of two phonemes (/b/ and /p/) occurring along VOT continuum presented
  - Adult and infant categorizations of new and old speech sounds measured

Categorical Perception of Speech by Adults

When adults listen to a tape of artificial speech sounds that gradually change from one sound to another, such as /ba/ to /pa/ or vice versa, they suddenly switch from perceiving one sound to perceiving the other.

Developmental Changes in Speech Perception

- Infants’ ability to discriminate between speech sounds not in their native language declines between 6 and 12 months of age.
- Six-month-olds from English-speaking families readily discriminate between syllables in Hindi (blue bars) and Nhlakapmx (green bars), but 10- to 12-month-olds do not.
- Perceptual narrowing was not limited to speech.

Word Detection

- How quickly could you pick out a word from a stream of speech like the one shown here?
Prelinguistic Communication

Crying: First communication:
- desire for food, comfort, stimulation, distress.
2-3 weeks: unique vocal signature – parents recognize it

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Adult responses to crying
Strong response – arousal & discomfort.
Parent learns aim: intensity of cry + context.

Cooing
Starts at 1-2 months

Babbling
Start around 6 months

Silent Babbling
- Babies who are exposed to the sign language of their deaf parents engage in “silent babbling”
- A subset of their hand movements differ from those of infants exposed to spoken language in that their slower rhythm corresponds to the rhythmic patterning of adult sign

What’s so amazing about word learning?

1 year: 1 word
2 years:
3 years:
4 years:
5 years:
18 years:
Milestones in the Acquisition of Semantics:
Comprehension: 8-10 months
Production: 10-12

Why?
Must look at words understood, not just produced.

Methodology
Train infants on the names of novel objects for 3 months.
Test children's comprehension & production weekly.

First words
Often important people:
Objects that move or can be acted on:
Familiar actions:
Outcomes of actions:

Rate of Acquisition
From 12 months: infants add 1-3 words a month (50 words)
Between 18 and 24 months:
the language spurt or naming explosion.
Rate of Acquisition

From 12 months: infants add 1-3 words a month (50 words)

Between 18 and 24 months:

the language spurt or naming explosion.

Why so quick to add words? What changes?
1. Concept acquisition?
2. Fast mapping?

Fast Mapping

Note: Girls develop language before boys. Why?

Critical Period

- To learn language, children must also be exposed to other people using language—spoken or signed

Sometime between age 5 and puberty, language acquisition becomes much more difficult
- Difficulties feral children (such as Genie) have in acquiring language in adolescence
- Comparisons of the effects of brain damage suffered at different ages on language
- Language capabilities of bilingual adults who acquired their second language at different ages
Bilingual Children
• More than half of the world’s children are exposed to more than one language
• Children who are acquiring two languages do not seem to confuse them
  • They initially lag but course and rate are similar
• Bilingual children outperform monolingual children on a variety of cognitive tests
  • The advantages of acquiring two languages outweigh disadvantages

Hemispheric Differences in Language Processing
• Adults who learned a second language at 1 to 3 years of age show the normal pattern of greater left-hemisphere activity in a test of grammatical knowledge (darker colors indicate greater activation)
• Those who learned the language later show increased right-hemisphere activity

Test of the Critical-Period Hypothesis
• Performance on a test of English grammar by adults originally from Korea and China was directly related to the age at which they came to the United States and were exposed to English
• The scores of adults who emigrated before the age of 7 are indistinguishable from those of native English speakers

What kinds of words and how?
Children learn object words (nouns) before action words (verbs).

Why? Objects tend to be distinct, bounded wholes.

Thus, children need only match label to object.
**Overextension and Underextension of word meaning**

**Underextension:** using words to refer to a smaller set of objects, actions and events.

For example: “doggie” refers only to personal pet

**Overextension:** the use of specific words to refer to a broader set of objects.

For example: “cat”

<table>
<thead>
<tr>
<th>Word</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>ball</td>
<td>ball, balloon, marble, apple, egg, spherical water tank (Rescorla, 1980)</td>
</tr>
<tr>
<td>cat</td>
<td>cat, cat’s usual location on top of TV when absent (Rescorla, 1980)</td>
</tr>
<tr>
<td>moon</td>
<td>moon, half-moon-shaped lemon slice, circular chrome dial on dishwasher, half a Cheerio, hangnail (Bowman, 1978)</td>
</tr>
<tr>
<td>snow</td>
<td>snow, white flannel bed pad, white puddle of milk on floor (Bowman, 1978)</td>
</tr>
<tr>
<td>baby</td>
<td>own reflection in mirror, framed photograph of self, framed photographs of others (Huff, 2001)</td>
</tr>
</tbody>
</table>

**Question:** can point to a “cat”, “bear” and “dog”. Why?

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Language continued...

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Strategies of Word Learning: The Problem of Induction (Quine)
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Constraints guiding children’s inferences about word meanings:

Whole Object Assumption:
• Word refers to entire object rather than features, parts, or substance.

Taxonomic Assumption:
• Names or words label kinds of things (e.g., dogs, cars, animals, vehicles).

More constraints on word-learning

Mutual Exclusivity:
• Things have only one label/name.
  Children accept only one name for things.

Syntactic Bootstrapping

Use of grammar to infer word meaning.

Children notice where words fall in a sentence. When children in Naigles’s (1990) study heard an adult describe this scene as “The duck is kradding the rabbit,” they used the syntactic structure of the sentence to infer that kradding is what the duck was doing to the rabbit.

Extending nouns
Nouns typically refer to a whole category of objects.

What objects should be named with the same label?
• Texture?
• Color?
• Shape?
Methodology

Wug

Get me another wug.

Whole Object Assumption: Revisited

- Word refers to entire object rather than features, parts, or substance.

Milestones in the Acquisition of Syntax

Grammar requires more than one word:

- Holophrases: single word used for an entire phrase or sentence.
  For example, “ghetti?”

<table>
<thead>
<tr>
<th>Exemplar</th>
<th>Shape change</th>
<th>Texture change</th>
<th>Size change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.50</td>
<td>.76</td>
<td>.82</td>
</tr>
<tr>
<td></td>
<td>.53</td>
<td>.48</td>
<td>.80</td>
</tr>
</tbody>
</table>
Milestones in the Acquisition of Syntax

Grammar requires more than one word:

- **Holophrases**: single word used for an entire phrase or sentence.
  
  For example, “ghetti?”

1½ - 2½ years: first sentence, normally just two words:

- **Telegraphic Speech**: contains only essentials.
  
  For example, “go kitty” or “Mommy drink”.

Development of Grammatical Morphemes

- 2½ years: Children create adult-like sentences

  Use grammatical morphemes: markers that alter sentence meaning

  For example, “John’s dog”, or “he is eating”

  These morphemes are acquired in a strict order:

<table>
<thead>
<tr>
<th>“-ing” verb ending</th>
<th>“He is singing”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preposition “on”</td>
<td>“On horsie”</td>
</tr>
<tr>
<td>Noun plural “-s”</td>
<td>“Cats”</td>
</tr>
<tr>
<td>Verb Irregular past tense</td>
<td>“He ran”, “It broke”</td>
</tr>
</tbody>
</table>

Length of Utterance

- This graph shows the relation between age and the mean length of utterance for the three children—Adam, Eve, and Sarah—studied by Roger Brown. (Brown, 1973)

  - What else do you see?

Regular and irregular verbs

Overregularization:

Children learn irregular verb forms (“I went”, “I ran”)

But then they start to make errors for these verbs (“I goed”, “I runned”)

Why do children make these errors?

Irregular forms are usually important frequently used words
The Role of Family and School Context in Early Language Development: Individual Differences

- Socioeconomic status of parents is key determinant in the language children hear.
  - After 4 years, there is a vast difference in accumulated experience with words among children from upper middle class, working-class, and families on welfare. (Hart and Risley, 1994)
  - For a variety of reasons, parents’ SES affects the way they talk to their children.
  - Individual differences have a substantial influence on the way their children talk.

Milestones in the Acquisition of Pragmatics:

1st year: Joint attention with caregiver to the environment
- Turn-taking in games and vocalizations with adults:

2nd year: Better understanding of vocal turn-taking
- Stand close and/or talk loudly.
- When talking to toddlers, they know to be in proximity of the object of discussion.

Learn the turnabout: Comment on other’s utterance, add something to encourage another response.

The Process of Language Acquisition: Conversational Skills

- The extent to which children talk about the past increases dramatically over the preschool period.
  - Three-year-olds include brief references to past events, 5-year-olds produce narratives—descriptions of past events that have the basic structure of a story.
  - Parents scaffold their young children’s narratives by asking for elaboration.

Acquisition: Meaning from Context

- Pragmatic cues
  - Children use pragmatic cues—aspects of the social context used for word learning.
  - These include the adult’s focus of attention and intentionality.
Having announced her intention to find a "gazzer," this adult appears displeased when looking in one bucket, but happy when looking in another. The child will infer that the object that elicited the smile is a "gazzer."

First signs of etiquette in children's speech

3 years: sensitive to illocutionary intent

They know speaker intent, irrespective of linguistic form (e.g., "I need a pencil").

Awareness of audience:

4-year-olds talk differently to a 2-year-old than to an adult.

Current Theoretical Issues in Language Development: Biological perspective

- Are language milestones controlled by maturation?
  - Over time, language becomes lateralized:
    - Wernicke's and Broca's area
  - Critical period
    - Genie
Language and the Brain

- Language processing involves a substantial degree of functional localization in the brain
  - The left hemisphere shows some specialization for language in infancy, although the degree of hemispheric specialization for language increases with age
  - Individuals with brain damage resulting in aphasia provide evidence of specialization for language within the left hemisphere
    - Damage to Broca’s area, near the motor cortex, is associated with difficulties in producing speech
    - Damage to Wernicke’s area, which is near the auditory cortex, is linked to difficulties with meaning

Current Theoretical Issues in Language Development: Learning Theory

- Product of the environment
- Learned through domain-general mechanisms
  - Association (Smith)
  - Conditioning (Skinner)
  - Fast mapping: used in language is used in other domains
  - Imitation
  - Abstract modeling

Current Theoretical Issues in Language Development: Nativist Views

- According to language theorist Noam Chomsky, all these children rely on the same innate linguistic structures in acquiring their various languages.

Current Theoretical Issues in Language Development: Chomsky and the Nativist Views

- Chomsky countered Skinner by pointing out why language cannot be learned through processes of reinforcement and punishment.
  - Generativity
  - Recognition of grammatical and non-grammatical sentences and other language structures that have not been taught
Current Theoretical Issues in Language Development

- **Chomsky and the Nativist views**
  - Universal grammar hypothesis: using language requires a universal grammar that is innate and common to all languages.
  - Cognitive abilities that support language development are highly specific to language.

- **Current Theoretical Issues in Language Development: Nativist Views**
  - **Evidence for this view**
    - Universal and species-specific nature of language
    - Observations of invented sign language among groups of deaf children that imposes grammatical structure onto simple signs
  - **Criticism**
    - View focuses almost exclusively on syntax and ignoring the communicative role of language.

Current Theoretical Issues in Language Development: Ongoing Debates

- **Current theories all acknowledge some of Chomsky’s crucial observations.**
  - Any language theory must explain why all human languages share so many characteristics.
  - Theories must explain the ability to generalize.

- **Theories differ in ways explanations are presented.**
  - To what degree do explanations lie within the child (nature) versus with the environment (nurture)?
  - Did the cognitive and neural mechanisms underlying language learning evolve solely to support language learning (domain-specific) or learning many different kinds of things (domain-general)?

- **Did the cognitive and neural mechanisms underlying language learning evolve solely to support language learning (domain-specific) or learning many different kinds of things (domain-general)?**
  - The modularity hypothesis supports Chomsky’s view and proposes that the human brain contains a self-contained language module.
  - Others suggest that language learning mechanisms are general; fast mapping used in language is used in other domains.
Cognition and Language

- Down's Syndrome
  - Restricted vocabulary
  - Simplistic grammar
- William's Syndrome
  - Cognitive deficits
  - Fluent conversationalists