CHAPTER NINE

The Linguistic Approach: Language and Cognitive Science
Linguistics

- The study of language.
- A variety of theoretical approaches and methodologies.
- Topics include grammatical rules, animal language, development, and computer speech recognition.
Language Properties

- **Communicative.** Production, transmission, and comprehension of information.
- **Arbitrary.** Use of symbols.
- **Structured.** A grammar specifies rules of symbol combination.
- **Generative.** Large number of possible meanings.
- **Dynamic.** Changes over time.
Language Properties

- **Phonemes.** Smallest unit of speech without meaning. Example: “ah” in “father.”

- **Morphemes.** Units of speech with meaning. Words or word parts. Example: “s” in “apples” makes plural.
Language is governed by a number of rules. Collectively, these rules are called its grammar:

1. **Phonology.** Rules governing sounds.
2. **Morphology.** Rules governing word structure.
3. **Syntax.** Rules for arranging words in sentences.
4. **Semantics.** Rules for understanding meaning.
Primate Language Use

- Animals communicate, but do they have language?
- Washoe the chimp and Koko the gorilla were both taught to use ASL.
- Sarah the chimp was taught to use plastic tokens.
- Kanzi the chimp was instructed in word-lexigrams.
Evaluating Primate Language Use

- Primates demonstrate some arbitrariness and displacement.
- They fail to show complex syntactical abilities.
- They have limited generative capability.
- They don’t teach language to other members of their own species.
Humans pass through several stages while learning language:

1. *Cooing stage.* Begin to utter a wide range of sounds.
2. *Babbling stage.* Utter a smaller set of phonemic sounds.
3. *One-word stage.* Speak out words and morphemes.
4. *Two-word stage.* Production of two-word sentences.
Language Deprivation

- Is experience necessary to develop language?
- Humans and other animals have a *critical period*, a time in development during which language or some other cognitive skill is normally acquired.
- If linguistic experience is missing in the critical period, language ability is impaired.
- Case studies: Victor the “wild child” and Genie.
The hierarchical relationships between parts of a sentence are known as its phrase structure.
Transformational Grammar

A sentence can be rearranged to express new meanings (Chomsky, 1957). Example:

“Jessie drank a cup of coffee”

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“Did Jessie drink a cup of coffee?”

The rules that allow us to do this are known as a transformational grammar.
Aphasias

- Language deficits are known as *aphasias*.
- In *Broca’s aphasia* patients have problems producing speech. They have damage to *Broca’s area* on the lower left frontal lobe.
- In *Wernicke’s aphasia* patients have problems comprehending speech. They have damage to *Wernicke’s area* on the posterior portion of the left hemisphere.
Natural Language Processing

- *Natural languages* have evolved in and are used by humans.

- Four stages of natural language processing (Cawsey, 1998):
  2. Syntactic analysis.
  4. Pragmatic analysis.
Steps in an automated speech recognition process:

1. Recorded spoken language is converted to a *speech spectrogram* showing frequency changes over time.
2. Phonemes are extracted from the speech stream.
3. The phonemes are assembled to form words.
Syntactic Analysis

- Individual words in the order they occurred serve as input.
- These are submitted to a phrase-structure analysis to understand how the words are grammatically related.
- The result is the recovery of sentence structure.
Prior phonemic analysis can produce the meaning of some words.

Knowing the type of word (noun, verb, adjective) from syntactic analysis further disambiguates and helps to recover word meanings.

So does the overall meaning of the sentence.
Pragmatic Analysis

- **Pragmatics** are the social rules of language use.
- The five types of speech (Searle, 1979):
  1. **Assertives.** Assertion of a belief.
  2. **Directives.** Instructions.
  3. **Commissives.** Commit speaker to an action.
  4. **Expressives.** Describe psychological states.
  5. **Declaratives.** The utterance is an action.
Interdisciplinary Crossroads: The Linguistic Relativity Hypothesis

- **Strong version:** Thought and language are so similar it may be impossible to express the thoughts of one language in another.
- **Weak version:** Language influences the way a person thinks.
- Evidence fails to provide strong evidence one way or the other.
- We can conclude that language influences but does not necessarily determine how we think.