Chapter VII: LANGUAGE

1. What Is Language?

There are almost 7,000 languages spoken in the world today (Lewis, 2009). It is to be expected that there are many more languages that linguists do not yet know about. What exactly constitutes a language, and are there some things that all languages have in common?

1.1. Properties of Language

Languages can be strikingly different, but they all have some commonalities. No matter what language you speak, language is (Brown, 1965; Clark & Clark, 1977):

1. Communicative: Language permits us to communicate with one or more people who share our language.

2. Arbitrarily symbolic: Language creates an arbitrary relationship between a symbol and what it represents: an idea, a thing, a process, a relationship, or a description.

3. Regularly structured: Language has a structure; only particularly patterned arrangements of symbols have meaning, and different arrangements yield different meanings.

4. Structured at multiple levels: The structure of language can be analyzed at more than one level (e.g., in sounds, meaning units, words, and phrases).

5. Generative, productive: Within the limits of a linguistic structure, language users can produce novel utterances. The possibilities for creating new utterances are virtually limitless.

6. Dynamic: Languages constantly evolve.

2. The Basic Components of Words

Language can be broken down into many smaller units. The smallest unit of speech sound is the phone, which is simply a single vocal sound. A phoneme is the smallest unit of speech sound that can be used to distinguish one utterance in a given language from another. At the next level of the hierarchy after the phoneme is the morpheme—the smallest unit of meaning within a particular language. The word recharge contains two morphemes, "re-" and "charge," where "re" indicates a repeated action (Roca, 2003b).

English courses may have introduced you to two forms of morphemes—root words and affixes. Root words are the portions of words that contain the majority of meaning. These roots cannot be broken down into smaller meaningful units. They are the items that have entries in the dictionary (Motter et al., 2002). Examples of roots are the words "fix" and "active." We add the second form of morphemes, affixes, to these root words. Affixes include prefixes, which precede the root word, and suffixes, which follow the root word.

Linguists analyze the structure of morphemes and of words in general in a way that goes beyond the analysis of roots and affixes. **Content morphemes** are the words that convey the bulk of the meaning of a language. **Function morphemes** add detail and nuance to the meaning of the content morphemes or help the content morphemes fit the grammatical context. Examples are the suffix -ist, the prefix de-, the conjunction and, or the article *the*.

The lexicon is the entire set of morphemes in a given language or in a given person's linguistic repertoire. By combining morphemes, most adult English

speakers have a vocabulary of hundreds of thousands of words. For example, by attaching just a few morphemes to the root content morpheme study, we have student, studious, studied, studying, and studies. Vocabulary is built up slowly.

3. The Basic Components of Sentences

A sentence comprises at least two parts. The first is a noun phrase, which contains at least one noun (often the subject of the sentence) and includes all the relevant descriptors of the noun (like "big" or "fast"). The second is a verb phrase (predicate), which contains at least one verb and whatever the verb acts on, if anything. Linguists consider the study of syntax to be fundamental to understanding the structure of language.

When we read and speak, it is important not only to comprehend words and sentences but also to figure out the meaning of whole conversations or larger written pieces. Semantics is the study of meaning in a language. A semanticist would be concerned with how words and sentences express meaning. Discourse encompasses language use at the level beyond the sentence, such as in conversation, paragraphs, stories, chapters, and entire works of literature.

4. Language Comprehension

Many processes are involved when we try to understand what somebody says. First of all, we need to perceive and recognize the words that are being said. Then we need to assign meaning to those words. In addition, we have to make sense of sentences we hear. These processes will be discussed in the next sections.

4.1. Understanding the Meaning of Words, Sentences, and Larger Text Units

4.1.1. Understanding Words

We are able to perceive speech with amazing rapidity. On the one hand, we can perceive as many as fifty phonemes per second in a language in which we are fluent (Foulke & Sticht, 1969). When confronted with non-speech sounds, on the other hand, we can perceive less than one phone per second (Warren et al., 1969). What makes

Words perception even more complicated is that often we pronounce more than one sound at the same time. This is called **coarticulation**. One or more phonemes begin while other phonemes still are being produced.

This overlapping of speech sounds may seem to create additional problems for perceiving speech, but coarticulation is viewed as necessary for the effective transmission of speech information.

The process of trying to separate the continuous sound stream into distinct words is called **speech segmentation**. Thus, speech perception is viewed as different from other perceptual abilities because of both the linguistic nature of the information and the particular way in which information must be encoded for effective transmission.

5. The View of Speech Perception as Ordinary

One approach to speech perception suggests that when we perceive speech, we use the same processes as when we perceive other sounds. They suggest that there are different stages of neural processing: In one stage, speech sounds are analyzed into their components. In another stage, these components are analyzed for patterns and matched to a prototype or template. There are several theories about this issue among them:

- **The phonetic refinement theory.** It says that we start with an analysis of auditory sensations and shift to higher-level processing. We identify words on the basis of successively paring down the possibilities for matches between each of the phonemes and the words we already know from memory (Pisoni et al., 1985)
- **The TRACE model:** According to this model, speech perception begins with three levels of feature detection: the level of acoustic features, the level of phonemes, and the level of words. TRACE model works in a similar fashion of spreading activation. Phonemic information changes activation patterns in the network while information about words or their meaning can influence the analysis as well by prediction of which words are likely to appear next. Therefore, lower levels affect higher levels and vice versa (McClelland & Elman, 1986)

One attribute these theories have in common is that they all require decision making processes above and beyond feature detection or template matching.

- **The phonemic-restoration effect:** Because the speech we perceive may differ from the speech sounds that actually reach our ears. The reason is that cognitive and contextual factors influence our perception of the sensed signal. Thus, we integrate what we know with what we hear when we perceive speech (Kashino, 2006; Samuel, 1981)

6. The View of Speech Perception as Special

Some researchers suggest that speech-perception processes differ from the processes we use when we hear other sounds. We will explore this view further in the next sections by reviewing research on categorical perception and the motor theory of speech perception (Liberman et al., 1957)

6.1. Categorical Perception

One phenomenon in speech perception that led to the notion of specialization was the finding of categorical perception—discontinuous categories of speech sounds. That is, although the speech sounds we actually hear comprise a continuum of variation in sound waves, we experience speech sounds categorically. This phenomenon can be seen in the perception of the consonant–vowel combinations **ba, da**, and **ga**. A speech signal would look different for each of these syllables. Some patterns in the speech signal lead to the perception of ba.

Others lead to the perception of da. And still others lead to perception of ga. Additionally, the sound patterns for each syllable may differ as a result of other factors like pitch. The ba that you said yesterday differs from the ba you say today. But it is not perceived as different: It is perceived as belonging to the same category as the ba you said a few days ago or will say tomorrow. However, a non-speech sound such as a **tone** would be perceived as different.

Here, continuous differences in pitch (how high or low the tone is) are heard as continuous and distinct.

6.2. The Motor Theory of Speech Perception

According to the motor theory, we use the movements of the speaker's vocal tract to perceive what he says. Observing that a speaker rounds his lips or presses his lips together provides the listener with phonetic information. Thus, the listener uses specialized processes involved in producing speech to perceive speech. In fact, there is substantial overlap between the parts of the cortex that are involved in speech production and speech perception.

7. Understanding Meaning: Semantics

In semantics, **denotation** is the strict dictionary definition of a word. **Connotation** is a word's emotional overtones, presuppositions, and other non explicit meanings. Taken together, denotation and connotation form the meaning of a word. Because connotations may vary between people, there can be variation in the meaning formed.

How do we understand word meanings in the first place? Recall from previous chapters that we encode meanings into memory through concepts. These include ideas, to which we may attach various characteristics and with which we may connect various other ideas, such as through propositions (Rey, 2003). They also include images and perhaps motor patterns for implementing particular procedures. Here, we are concerned only with concepts, particularly in terms of words as arbitrary symbols for concepts.

8. Understanding Sentences: Syntax

Syntax is the systematic way in which words can be combined and sequenced to make meaningful phrases and sentences (Carroll, 1986). Whereas studies of speech perception chiefly investigate the phonetic structure of language, syntax focuses on the study of the grammar of phrases and sentences. In other words, it considers the regularity of structure.

In the following, the properties and impact of syntax will be explored in more detail. Phenomena such as syntactical priming and two main approaches to analyzing sentences: phrase-structure grammar and transformational grammar will also be highlighted.

8.1. Syntactical Priming

Just as we show semantic priming of word meanings in memory (that is, we react faster to words that are related in meaning to a prior presented word), we show syntactical priming of sentence structures. In other words, we spontaneously tend to use syntactical structures and read faster sentences that parallel the structures of sentences we have just heard. For example, a speaker will be more likely to use a passive construction (e.g.,"The student was praised by the professor") after hearing a passive construction. He or she will do so even when the topics of the sentences differ.

The preceding examples seem to indicate that we humans have some mental mechanism for classifying words according to syntactical categories. This classification mechanism is separate from the meanings for the words (Bock, 1990). When we compose sentences, we seem to analyze and divide them into functional components.

This process is called **parsing**. We assign appropriate syntactical categories (often called "parts of speech," e.g., noun, verb, article) to each component of the sentence. We then use the syntax rules for the language to construct grammatical sequences of the parsed components.

8.2. Phrase-structure grammar

Early in the 20th century, linguists who studied syntax largely focused on how sentences could be analyzed in terms of sequences of phrases, such as noun phrases and verb phrases, which were mentioned previously. They also focused on how phrases could be parsed into various syntactical categories, such as nouns, verbs, and adjectives. Such analyses look at **the phrase-structure grammar**—they analyze the structure of phrases as they are used.

Let's have a closer look at the sentence:

"The girl looked at the boy with the telescope."

First of all, the sentence can be divided into the noun phrase (NP) "The girl" followed by a verb phrase (VP) "looked at the boy with the telescope." The noun phrase can be further divided into a determiner ("the") and a noun ("girl"). Likewise, the verb phrase can be further subdivided. However, the analysis of

how to divide the verb phrase depends on what meaning the speaker had in mind. You may have noticed that the sentence can have two meanings:

(a) The girl looked with a telescope at the boy, or
(b) The girl looked at a boy who had a telescope.

In case (a), the verb phrase contains a verb (V; "looked"), and two prepositional phrases (PP; "at the boy" and "with the telescope"). In case (b), the verb phrase would again contain the verb "looked," but there is just one prepositional phrase ("looked at the boy with the telescope").

8.3. A New Approach to Syntax: Transformational Grammar

In transformational grammar, deep structure refers to an underlying syntactical structure that links various phrase structures through various transformation rules. In contrast, surface structure refers to any of the various phrase structures that may result from such transformations. Chomsky meant only to show that differing phrase structures may have a relationship that is not immediately apparent by using phrase-structure grammar alone. For example, the sentences,

"Susie greedily ate the crocodile," and "The crocodile was eaten greedily by Susie" have a relationship that cannot be seen just by looking at the phrase-structure grammar.

For detection of the underlying relationship between two phrase structures, transformation rules must be applied.

9. Understanding discourse

Discourse involves units of language larger than individual sentences—in conversations, lectures, stories, essays, and even textbooks (Di Eugenio, 2003). Just as grammatical sentences are structured according to systematic syntactical rules, passages of discourse are structured systematically.

Obviously, we can understand discourse only through analysis of words. But sometimes we understand words through discourse. For one example, sometimes in a conversation or watching a movie, we miss a word. The context of the discourse helps us figure out what the word was likely to be. As a second

example, sometimes a word can have several meanings, such as “well.” We use discourse to help us figure out which meaning is intended. As a third example, sometimes we realize, through discourse, that a word is intended to mean something different from its actual meaning, as in “Yeah, right!” Here, “right” is likely to be intended to mean “not really right at all.” So discourse helps us understand individual words, just as the individual words help us understand discourse.

10. Brain Structures Involved in Language

10.1. The Brain and Word Recognition

Studies have found that the middle part of the superior temporal sulcus (STS) responds more strongly to speech sounds than to non-speech sounds. The response takes place in both sides of the STS, although it is usually stronger in the left hemisphere (Binder, 2009)

10.2. The Brain and Semantic Processing

There are five brain regions that are involved in the storage and retrieval of meaning (Binder, 2009):

1) The ventral temporal lobes, including middle and inferior temporal, anterior fusiform, and anterior parahippocampal gyri;
2) The angular gyrus;
3) The anterior aspect (pars orbitalis) of the inferior frontal gyrus;
4) The dorsal prefrontal cortex; and
5) The posterior cingulate gyrus.

The activation of these areas takes place mostly in the left hemisphere, although there is some activation in the right hemisphere. It is suspected, however, that the right hemisphere does not play a significant role in word recognition

10.3. The Brain and Language Acquisition

In general, the left hemisphere seems to be better at processing well-practiced routines. The right hemisphere is better at dealing with novel stimuli. A possibly related finding is that individuals who have learned language later in life show more right-hemisphere involvement (Neville, 1995). Research findings suggest that one cannot precisely map linguistic or other kinds of functioning to

hemispheres in a way that works for all people. Rather, the mappings differ somewhat from one person to another (Zurif, 1995)

11. Speech problems

11.1. Aphasia

Aphasia is an impairment of language functioning caused by damage to the brain. There are several types of aphasias.

11.1.1. Wernicke's Aphasia

Wernicke's aphasia is caused by damage to Wernicke's area of the brain. It is characterized by notable impairment in the understanding of spoken words and sentences. It also typically involves the production of sentences that have the basic structure of the language spoken but that make no sense. They are sentences that are empty of meaning. There are two cases: In the first case, the words make sense, but not in the context they are presented. In the second case, the words themselves are neologisms, or newly created words. Treatment for patients with this type of aphasia frequently involves supporting and encouraging non-language communication.

11.1.2. Broca's Aphasia

Broca's aphasia is caused by damage to Broca's area of the brain. It is characterized by the production of agrammatical speech at the same time that verbal comprehension ability is largely preserved. It thus differs from Wernicke's aphasia in two key respects. First is that speech is agrammatical rather than grammatical (as in Wernicke's). Second is that verbal comprehension is largely preserved.

11.1.3. Global Aphasia

Global aphasia is the combination of highly impaired comprehension and production of speech. It is caused by lesions to both Broca's and Wernicke's areas.

11.1.4. Anomic Aphasia

Anomic aphasia involves difficulties in naming objects or in retrieving words. The patient may look at an object and simply be unable to retrieve the word that corresponds to the object.

11.2. Autism

Autism is a developmental disorder characterized by abnormalities in social behavior, language, and cognition. It is biological in its origins, and researchers have already identified some of the genes associated with it (Wall et al., 2009). Children with autism show abnormalities in many areas of the brain. It is five times more common in males than in females. Children with autism usually are identified by around 14 months of age, when they fail to show expected normal patterns of interactions with others. Children with autism display repetitive movements and stereotyped patterns of interests and activities. Often they repeat the same motion, over and over again, with no obvious purpose to the movement. When they interact with someone, they are more likely to view their lips than their eyes. About half of children with autism fail to develop functional speech. People with autism also may have problems with the semantic encoding of language.