What is language?

- A system of symbols used to communicate ideas among two or more individuals.
- Must be learnable by children, spoken and understood by adults, and capable of expressing ideas that people normally communicate in a social and cultural context.
Origins of Language

Written records of language date back 5,000 years, but language probably dates back 150,000-200,000 (when the larynx dropped to its unusual position allowing speech).

Gestures may have developed in tandem rather than as the precursor of speech.

Large brains—or reorganized brains—may have been crucial; or they may have emerged together in a positive feedback loop created by social interaction in large groups.
Semantics

Semantics is the study of meaning, that is, how people mentally represent the meaning of words and sentences.

A morpheme is the minimal unit of speech used to code a specific meaning. (e.g., pill and kill are morephemes; so are –s and –ed.

Morphemes taken together comprise a mental lexicon, the dictionary of long-term memory.
Figure 10.1. Meaningful units of language.
Syntax

Grammatical rules that specify how words and other morphemes are arranged so as to yield acceptable sentences.

Implicit knowledge provides linguistic intuitions of ungrammatical strings and equivalency of meaning of different grammatical constructions.
Box 10.1

SYNTAX AND SEMANTICS: A DEMONSTRATION

Which of these sentences are grammatical? Which are meaningful?

The psychologist slept fitfully, dreaming new ideas.
Fitfully the slept new, ideas dreaming psychologist.
The new ideas slept fitfully, dreaming a psychologist.
Figure 10.2. The grammatical structure of a sentence influences the perception of a click embedded in the first syllable of the word "company."
Pragmatics

The manner in which speakers communicate their intentions depends on the social context.

Direct speech acts (e.g., command: “Open the window!”) may be socially awkward. Indirect speech acts assume the guise of a different speech act to achieve the same result (e.g., inform: “It is really hot in here.”)
Pragmatics

- The cooperative principle guides conversations so that speakers utter appropriate statements. We speak audibly, use language understood by the listener, and follow the rules.

- Listeners draw appropriate inferences called conversational implicatures. For example, if I say “I am out of gas” you might say “There’s a gas station around the corner.”
Contrasts to Animal Communication

- Only language uses symbols to represent objects. Words are detached from their referents unlike the calls of a bird or chimpanzee. Displacement in space and time is thus possible with language.

- Productivity is ability to create novel sentences that can be understood by other speakers of the language. Although chimps can learn ASL and sign novel expressions, there is a vast difference in productivity.
Universal Grammar

Genetically determined knowledge of language allows rapid acquisition, in theory. At issue is whether a general learning process is sufficient.

A Language Acquisition Device (LAD) requires parameter setting from exposure to examples but restricts range (e.g., SOV, SVO, VSO, VOS in a pinch but not OVS or OSV).
Broca’s aphasia is an inability to speak fluently without effort and correct grammar. Speech is halting and agrammatic.

Wernicke’s aphasia is a comprehension dysfunction. Speech is fluent and effortless but also semantically vacuous.
Figure 10.7. Broca’s area and Wernicke’s area in the left hemisphere.
Neural Systems

90% of the population is left-hemisphere dominant. Right-handedness and left localization of Broca’s and Wernicke’s are universal, at least in males. Females show more bilateral language representation.

Left-handed individuals may present with left, mixed, or in some cases right language representation.

The language zone extends far beyond Broca’s and Wernicke’s areas in neocortical and subcortical regions.
Figure 10.8. The language zone in the left hemisphere.

Figure 10.9. Subcortical regions are also involved in language.

SOURCE: Adapted from Goodglass (1993).
Thought and Language

Identity hypothesis equates thought with subvocal speech.
Modularity regards language as independent of general cognitive resources.
Alternatively, language might be dependent on such general resources.
Linguistic relativity asserts thought is dependent on the form of language.
Figure 10.10. Possible relations between thought and language.
Thought and Language

- Only the identity hypothesis can be rejected unequivocally (curare paralyzes speech musculature but thought remains from neocortical activity).

- Supporting modularity, linguistic savants and Williams Syndrome show speech can be preserved despite mental retardation. However, general intellectual impairment from accidents or disease typically causes aphasia.
Thought and Language

- Color names differ across cultures but perception of the color spectrum as revealed by color typicality effects is universal.

- However, polysemy in English creates ambiguity in comprehension. Euphemisms can cloud thought.

Language A can be translated to Language B but often there is a cognitive cost involved. Thus, a weak version of linguistic relativity finds support.
Thought and Language

Object permanence (sensori-motor thought) precedes first words at around 12 months.

Gestural abilities (e.g., pointing, pretending, imitating) predict the transition from babbling to first words.
Figure 10.3. A two-layer connectionist model of past tense learning in English.
Representations of Language

- A single, statistical or frequency process can account for overgeneralization errors (vocabulary discontinuity). But a hidden layer is needed unless the input is well-tailored.
- Some verbs show strong u-shaped curves and others weak curves. How can a single process produce both?
Figure 10.4. Percentages correct in generating regular and irregular verbs as a function of training.

Representations of Language

The representation of past tense can be achieved by a symbolic or a connectionist architecture.

Connectionism posits similarity and associations of phonological representations of base verb forms with past tense phonologies.

The symbolic model posits learning a rule (base verb + -ed) and memorizing exceptions (e.g. went, not goed).
<table>
<thead>
<tr>
<th>Condition</th>
<th>Test Prime</th>
<th>Control Prime</th>
<th>Target Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular past</td>
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<td>locked</td>
<td>jump</td>
</tr>
<tr>
<td>Irregular past</td>
<td>found</td>
<td>shows</td>
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<td>Semantic</td>
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<td>hay</td>
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</tr>
<tr>
<td>Phonological</td>
<td>gravy</td>
<td>sherry</td>
<td>grave</td>
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</tbody>
</table>

Figure 10.5. Priming in a lexical decision task: A study of the representation of the past tense in the mental lexicon.
Agrammatic speech in aphasia reveals a selective loss of past tense morphology. Priming effects are normal for irregular verbs but not regular. If a single network handles both, how can this be?

Habituation in 7 month olds indicates rule learning (ABA, e.g., ga ti ga) not tied to feature similarity. Novel phonology also produced dishabituation (ABB, e.g. wo fe fe).
Figure 10.6. Priming effects in normal controls and three patients with acquired aphasia. SOURCE: Marslen-Wilson and Tyler (1997).