SENTENCE PROCESSING CHAPTER 9 (HARLEY) & CHAPTER 7 (ALTMANN)

SENTENCE PROCESSING

- ► Sentences convey information regarding "who-did-what-to-whom."
- ► <u>Sentence Processing</u>: how listeners rapidly decipher the structure of sentences and gain access to the meaning of the sentence as a whole.

3 FACTORS THAT AFFECT SENTENCE PROCESSING

STRUCTURAL PROPERTIES OF SENTENCES

➤ One reason why we can process speech so rapidly is our ability to make use of the		
in natural language.		
Structure of Language =		
■ English convention:		
Generative Nature of Language:		
Thechange and depend on where they appear in a sentence (English). Structure/Conventions of Language		

- ► <u>Configurational Languages</u>:
 - Example of the importance of word order:
 - ▶ Politicians think that the public don't know.
 - ▶ The public know that politicians don't think.

► <u>Inflectional Languages</u>

• Example from German: see p. 88 in Altmann

Real-World Knowledge Can Supply Constraints That Operate As Part Of The Structure Of Language

>	Regularities	in the	language	make	statistical	prediction	possible.

•	The average college-educate	d adult has a speak	ing vocabulary of
		words.	

- The 50 most commonly used words in English make up about ______ of all words we speak, and about ______ of all those we write.
- Thus some words are *more predictable* than other even without context.

SYNTACTIC STRUCTURE OF A SENTENCE

- ▶ In order to understand a sentence, the listener or reader must determine its syntactic structure.
- **▶** Parsing –
- **►** Tree Diagram
 - $S \rightarrow NP + VP$
 - NP → Adjective + Adjective + Noun
 - $VP \rightarrow Verb + Adverb$

DEEP STRUCTURE VS. SURFACE STRUCTURE

- **►** Surface Structure =
- **▶ Deep Structure** =
- ▶ 2 sentences can have very different surface structure, but the same deep structure.

•	2 sentences can have similar/identical surface structure but very different deep structure.
•	Some sentences contain, where different hypotheses about the intended structure of a sentence could give rise to different meanings.
	 Flying planes can be dangerous. They are eating apples. Visiting relatives can be a nuisance. The lamb is too hot to eat. They are boiling potatoes.
•	This distinction between deep and surface structure suggest that sentence processing
	CLAUSAL PROCESSING
•	One way the perceptual system can reduce the processing load is to break up incoming sentences into their constituent clauses.
	I was going to take a train to New York, but I decided it would be too heavy.
•	Processing this sentence for meaning requires at least 3 operations:
>	Research has demonstrated that the more clauses a sentence contains, the longer the

processing time needed to integrate each new clause into an increasingly rich coherent

structure.

SENTENCE PROCESSING AND SYNTACTIC AMBIGUITY

Most of the Time Ambiguity Is Not Noticed - Why?

• We have	that reduce this ambiguity.
•	are preferred.
	entence thought it ungrammatical because it missed an ce' and 'thought' they would be wrong."
•	: Sentences should be studied in the
in which they normally app	pear.
► "The burglar blew open	n the safe with the new lock and made off with the loot."

▶ Prosody:

- Distinction between written and spoken language.
- Example of using stress to convey meaning:
 - ► You're wrong Sam didn't buy MARY a pizza [he bought it for someone else]
 - ► You're wrong Sam didn't BUY Mary a pizza [he made her one]
 - ► You're wrong SAM didn't buy Mary a pizza [someone else did]
- Does stress disambiguate the alternative meanings, or add alternative meanings?

Why are Ambiguous Sentences Used to Study Sentence Processing?

TWO MODELS OF SENTENCE PROCESSING

► <u>Autonomous/Modularity Model Of Language Processing</u> :
► Interactive Model of Language Processing:
► Bottom-up Processing:
► <u>Top-down Processing</u> :
Top down/bottom un interactions
► <u>Top-down/bottom-up interaction</u> :
► On-line interactive models:
GARDEN PATH SENTENCES
► The old man the boats
► Garden Path Sentence (GPS)
► There are 2 major theories that try to explain how people process such sentences.
► The debate is over whetheror
factors lead us up the GP.

GARDEN PATH MODEL OF SENTENCE PROCESSING

► This is a 2-stage Autonomous Model:
► <u>First stage</u> :
■ Second stage:
▶ 2 Important Principles of the GP Model:
 late closure principle
 minimal attachment principle:
► <u>Late Closure Principle</u> focuses on the way in which listeners might determine they are at the end of a major clause boundary.
▶ Because Jay always jogs a mile,
▶ Because Jay always jogs a mile, this seems like a short distance to him.
► Because Jay always jogs, a mile seems like a short distance to him.

GARDEN PATH MODEL

>	The alternative to late closure would be to keep our options open and consider all kinds of different interpretations.
>	The problem with the open-options alternative is that is places a
	than trying to retain one option at a time.
	CONSTRAINT-BASED MODEL
>	This model states that more than one syntactic analysis of a word sequence may be generated during comprehension.
>	It also contends that both information constrain sentence processing and lead us down the GP.
	The old man the boats.
>	Although we are only consciously aware of the of
	The old man, the alternative of the
	has also been activated, but at a level below conscious awareness.
•	When we reach the end of the sentence and discover that we must have made a parsing error, we resolve this confusion by activating to a conscious level the alternative interpretation.
	GARDEN PATH MODELS VS. CONSTRAINT BASED MODEL

- ► **Eve Movement Studies**: have been used to try to discover which of these theories is correct.
 - There are different patterns of eye fixations for GPSs relative to nonGPs.
 - Studies indicate that GPSs disrupt reading.
 - Read the Harley text and determine which model this research supports.

GARDEN PATH MODELS VS. CONSTRAINT BASED MODEL: READING TIME STUDIES

- ► Some studies suggest that readers construct multiple interpretations in ambiguous regions of as they read the sentences.
- ► These studies also show that such factors as semantic context can override minimal attachment and late closure principle.

Trueswell, Tanenhaus, and Garnsey (1994)

	by the lawyer was useless. principle of the garden path model,
	entences no differently they have
	·
➤ Trueswell et al. found that r	reading times were faster for the
This is because the	constrains
interpretation of the	•
Clifton & Ferreira (1987) de	emonstrated that the problem of GPS is not eliminated by
additional	, and parsing seems to unfold on the
basis of	without interacting with other knowledge.
SENTE	NCE PROCESSING & PROSODY
Speakers can and usually d	lo by usins

such ______ as stress, intonation, and pauses.

IS SYNTAX PROCESSED SEPARATELY FROM MEANING?

► <u>CLICK STUDIES</u>: Insert a click into a recorded sentence and then ask listeners to indicate where it appears.

Garrett, Bever, & Fodor (1966)

- ▶ Ss heard the sentence with a prerecorded click sound occurring at either 1, 2, or 3.
- ▶ "In order to catch [1] his train, [2] George drove [3] furiously to the station."
- ► Results:
- ▶ Why did the subjective impression of where the click occurred migrate toward the major syntactic boundary of the sentence?
 - Perceptual isolation of linguistic clause is the first step in sentence processing, and formal syntactic structure alone was sufficient to tell the listener where the clause boundary had occurred.

► Criticisms

- The claim that semantics and prosody are not important.
- ► Reber & Anderson (1970): Ss were falsely told that sentences contained clicks subliminal clicks.
- ▶ **Prosody** is often used to mark phrase boundaries and end of sentences.
- ► Wingfield & Klein (1971): Formal clause boundary and the prosodic markings for a clause boundary were in direct conflict.

CONFLICTING RESULTS

•	Proponents of the GP model argue that the effects that are claimed to support the constraint-based model arise because:
•	Proponents of the Constraint-Based Model argue that research favoring the GP model use techniques that
	MEANING: THE GOAL OF SENTENCE PROCESSING
•	We discard the surface structure to retain only the meaning of a sentence.
•	Sachs (1967): had Ss listen to paragraph length stories that contained a critical test sentence.
	• Results: