Factors in Visual Word Recognition
Frequency and orthographic neighborhood effects.

The Role of Context in Visual Word Recognition
Top-down information from sentence (semantic) context.

Three Models of Visual Word Recognition:
The Logogen Model
The Autonomous Search Model
A Connectionist Model (Seidenberg & McClelland, 1989)

Dyslexia and Word Recognition
Phonological Dyslexia: high-frequency > low-frequency.
Surface Dyslexia: regular > irregular.
The Immediacy of Interpretation

Sentences are interpreted as completely as possible as each word is processed.

Each word in a sentence is immediately integrated syntactically and semantically with previous words → incremental interpretation.

Evidence for the immediacy of interpretation:

Garden-Path Sentences (syntactic ambiguity)
The Immediacy of Interpretation

A. The policeman told about the accident left quickly. (GP)

B. The policeman that was told about the accident left quickly. (÷ GP)

C. The policeman was told about the accident and left quickly.
Two Approaches to Sentence Processing

Modular Approach:
- Initial lexical access and initial syntactic parsing are autonomous.
- No initial effect of semantic context.
- Information only flows bottom-up.

Interactive Approach:
- Interactive lexical access and syntactic parsing.
- Prior semantic context affects lexical access and syntactic parsing.
- Information flows both bottom-up and top-down.
The Modular Approach

Lexical Access → Syntactic Parsing → Semantic Processing

Input (words) → (interpretation) Output
The Interactive Approach

Input (words)

Lexical Access → Syntactic Parsing → Semantic Processing

(interpretation)
Output

Input (words)
Methods for Studying Sentence Processing

**Off-line Methods:**
- Sentence paraphrasing.
- Complexity/grammaticality ratings.

**On-line Methods:**
- Word-by-word reading times.
- Word-by-word grammaticality judgments.
- Lexical decision → semantic priming.
  - Listening to sentences - words presented on a screen.
- Eye movements during reading/listening.
- ERP brain-wave recordings during reading/listening.
- fMRI brain activations during reading/listening.
Lexical Ambiguity in Sentence Processing (I)

The Problem of Polysemy:

- Many words have more than one meaning.
- Creates lexical ambiguities.

Lexical access is affected by two factors:

- Meaning Dominance: The relative frequency of each meaning of an ambiguous word.
  - bank_{finance} (dominant) > bank_{river} (subordinate)

- Equibias: Meanings have the same frequency.
  - pitcher_{baseball} vs. pitcher_{container for liquids}
Lexical Ambiguity in Sentence Processing (II)

Strength of Context:

How strongly a context implies a particular meaning.

“She liked the Yankees pitcher.” \(\rightarrow\) pitcher_{baseball}

Weak context: No particular word implied.

“She liked the pitcher.”
Two Types of Lexical Access

- **Selective Access**: Only one meaning accessed.
  - Context $\rightarrow$ dominant meaning.
    - Jack opened a savings account at the bank.

- **Multiple Meanings**: All meanings are accessed.
  - Weak context $\rightarrow$ no particular meaning.
    - Jack waited by the bank.

- Top-down information from prior context affects lexical access, but bottom-up information has priority.
Complexity Effects in Sentence Processing

Complex sentences take longer to process.

- The cat that the dog that the mouse bit chased ran away.
- The mouse bit the dog that chased the cat that ran away.

The complexity of a sentence affects how its “goodness” is rated.

Grammatical sentences are rated better than ungrammatical sentences.
Complexity Effects and Grammaticality (I)

1. The apartment that the maid who the service had sent over was cleaning every week was well decorated.

2. The apartment that the maid who the service had sent over was well decorated.

is grammatical, is not.
Complexity Effects and Grammaticality (II)

Gibson & Thomas (1999) used an off-line grammaticality judgment task to look complexity effects on grammaticality.

Rating results:

Ungrammatical sentences (2) were rated no worse than their grammatical counterparts (1).
A Connectionist Model of Recursive Sentence Processing

next word

Lexical items → Hidden

Lexical Items → Context

current word previous internal state

Christiansen & MacDonald (2009)
Grammar for Generation of Training Sentences

S → NP VP "."
NP → PossP N
NP → N rel
NP → N PP
NP → N "and" NP
NP → N
VP → V(c) "that" S
VP → V(t) NP
VP → V(o) (NP)
VP → V(i)
rel → "who" VP
rel → "who" NP V(tlo)
PP → prep locN (PP)
PossP → (PossP) N Poss
Christiansen & MacDonald (2009) suggest that the Gibson & Thomas (1999) results are dependent on using an off-line task.

Prediction: 1 (g) should be rated worse than 2 (ug).
On-Line Grammaticality Judgment Experiment

Materials
- Same as in Gibson & Thomas (1999)

Method
- Word-by-word center presentation (self-paced).
- At each point in a sentence, subjects judged whether what they have seen so far was grammatical or not.
- Following presentation of each sentence, subjects rated the sentence on a 7-point scale.
  - 7 = bad English.

Subjects
- 36 native speakers of English.
Stop Making Sense Task

Following presentation of each sentence, subjects rated the sentence on a 7-point scale (7= bad English).
SRN Predictions

Mean GPE Sentence Scores

$p < .0001$

2 VPs

3 VPs

Human Ratings

\[ p < .0001 \]

Mean Rating
(7 = Bad)

2 VPs

3 VPs

Network Predictions and Human Ratings

Next Class
Sentence Processing (II):
Syntactic Ambiguity Resolution

Chapter 7 (pp. 213-222)

- Garden path sentences
- Modular accounts
- Interactive accounts

Rapid information integration in sentence processing.