How Humans and Machines Parse Garden-Path Sentences

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Outline

• Introduction

• Definition & Examples

• People

• Computers
Introduction

• Human language is amazing
  • Basic Needs: “There’s food over there.”
  • Deeper Ideas: “Give me liberty or give me death.”

• We understand language effortlessly

• Computers using our language is helpful
Definition & Examples

• Example:
  • The horse raced past the barn fell.
Definition & Examples

• Example:
  • The horse raced past the barn fell.

• 1\textsuperscript{st} Pass:
  • The horse raced past the barn fell.
Definition & Examples

• Example:
  • The horse raced past the barn fell.

• 1\textsuperscript{st} Pass:
  • The horse raced past the barn fell.

• 2\textsuperscript{nd} Pass:
  • The horse (which was raced past the barn) fell.
Definition & Examples

The horse raced past the barn fell.

- **Garden-Path Sentence**
  - “To lead someone up the garden path.”
  - “To cause someone to think or proceed wrongly.”
Definition & Examples

• Ambiguity
  • Grammar
    • The horse raced past the barn fell.
  • Semantic
    • Bill saw the girl with binoculars.

• Different languages have different ambiguities.

Source: Ferreira
People

a. Because Bill drinks wine . . .
b. Because Bill drinks wine beer is never kept in the house
c. Because Bill drinks wine is never kept in the house.

Source: Ferreira
### People

Source: Frazier

<table>
<thead>
<tr>
<th>Sentence type</th>
<th>Region of the sentence</th>
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<tbody>
<tr>
<td></td>
<td>Before ambiguity</td>
<td>Ambiguity</td>
<td>Disambiguation</td>
<td></td>
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<tr>
<td>Early closure—long</td>
<td>1st pass</td>
<td>44</td>
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<td>2nd pass</td>
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<tr>
<td>Early closure—short</td>
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<td>2nd pass</td>
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<td>Late closure—long</td>
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</table>

- a. Because Bill drinks *wine* . . .
- b. Because Bill drinks *wine* beer is never kept in the house
- c. Because Bill drinks *wine* is never kept in the house.
People

Source: Osterhout

![Graphical representation of brainwave data](image)

**Mean P600 Amplitude in Microvolts (500-800 ms) in Experiment 1**

<table>
<thead>
<tr>
<th>Electrode site</th>
<th>O1</th>
<th>WL</th>
<th>PTL</th>
<th>ATL</th>
<th>F7</th>
<th>O2</th>
<th>WR</th>
<th>PTR</th>
<th>ATR</th>
<th>F8</th>
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<td>2.40</td>
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</table>

*Note.* O1 = left occipital; WL = Wernicke’s left area; PTL = posterior temporal left; ATL = anterior temporal left; F7 = left frontal region; O2 = right occipital; WR = Wernicke’s right area; PTR = posterior temporal right; ATR = anterior temporal right; F8 = right frontal region; FZ = frontal midline site; CZ = central midline site; PZ = parietal midline site.
Computers
Computers

• The opposite number about 5000.

Source: Du
References

Questions?

- The horse raced past the barn fell.
- Because Bill drinks wine is never kept in the house.
- The old man the boat.
- The complex houses married and single soldiers and their families.