

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.
- 1st Pass:
 - The horse raced past the barn fell.

Definition & Examples

- Example:
 - The horse raced past the barn fell.
- 1st Pass:
 - The horse raced past the barn fell.
- 2nd 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

- 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.

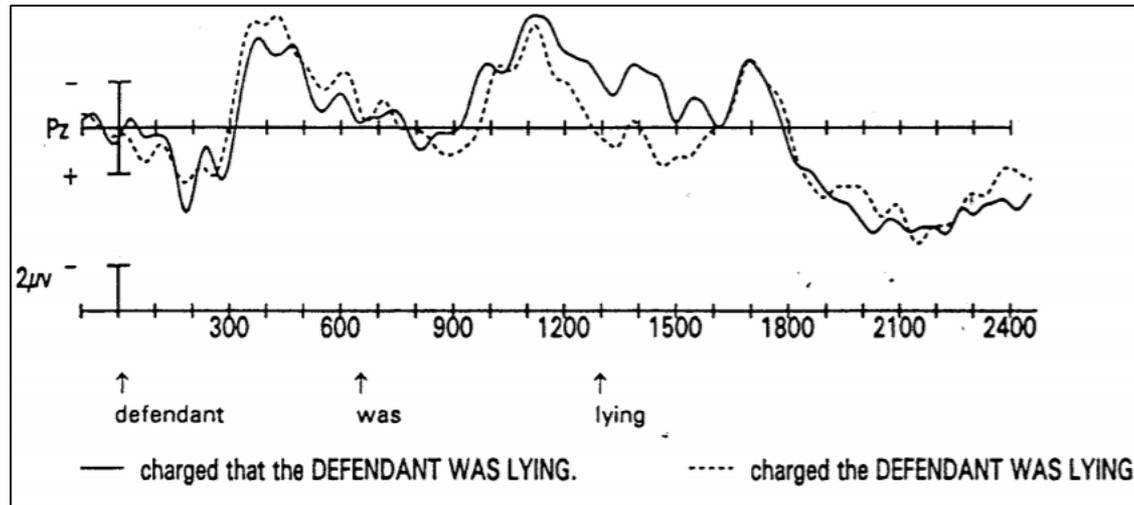
Mean Reading Time per Letter in the Different Regions of the Sentence for the Different Versions of the Closure Sentences on the First and Second Pass

Sentence type	Region of the sentence		
	Before ambiguity	Ambiguity	Disambiguation
Early closure – long			
1st pass	44	40	54
2nd pass	<u>21</u>	<u>32</u>	<u>48</u>
Total	65	72	102
Early closure – short			
1st pass	43	37	41
2nd pass	<u>18</u>	<u>37</u>	<u>41</u>
Total	61	74	82
Late closure – long			
1st pass	43	35	40
2nd pass	<u>12</u>	<u>15</u>	<u>23</u>
Total	55	50	63
Late closure – short			
1st pass	40	42	47
2nd pass	<u>16</u>	<u>27</u>	<u>22</u>
Total	56	69	69

Source: Frazier

People

Source: Osterhout



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

Sentence	Electrode site												
	O1	WL	PTL	ATL	F7	O2	WR	PTR	ATR	F8	Fz	Cz	Pz
Reduced	-0.19	0.73	0.39	0.53	0.31	-0.43	-0.77	-0.34	0.11	0.22	0.15	0.01	-0.34
Unreduced	-0.46	-1.51	-0.83	-0.22	-0.03	-0.47	-1.93	-1.54	-0.29	-0.46	-1.40	-1.46	-2.74
Difference	0.27	2.24	1.22	0.75	0.34	0.04	1.16	1.20	0.40	0.66	1.55	1.47	2.40

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

- (The((CTGY. DET)))
 (Opposite((CTGY. ADJ)))
 (Number((CTGY.LINKV)(PAST.NUMBERED)(PASTP.NUMBERED)))
 (Number((CTGY. LINKV)(TENSE. PRES))
 (Number((CTGY. N) (NUM. SING)))
 (About((CTGY.ADV)))
 (5000((CTGY. NUM)))
 The opposite number about 5000
- Det opposite number about 5000 (6)
 - Det Adj number about 5000 (10)
 - Det Adj N about 5000 (7)
 - NP about 5000 (3)
 - NP Adv 5000 (8)
 - NP Adv Num (11)
 - NP NumP (4)
 - FAIL and backtrack to another path:
 - Det Adj number about 5000 (10)
 - NP number about 5000 (2)
 - NP LinkV about 5000 (9)
 - NP LinkV Adv 5000 (8)
 - NP LinkV Adv Num (11)
 - NP LinkV NumP (4)
 - NP VP (5)
 - S (1)
 - SUCCESS

References

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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.