Sentence Processing I

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Sentence Processing I

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Bottom-up versus top-down models

Evidones for

processing

Garden path sentence

Ambiguity

EXERCISE

How do we explain parsing

biases?

Evidence for cop-down

What factors can be classified as "top down"

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Figure 5: Context influences perception



The. . .

(1)

Bottom up = analysis based on word classes

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Bottom up = analysis based on word classes

(1)The...woman lost her purse Bottom-up models

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Bottom up = analysis based on word classes

(1)The...woman lost her purse

Top down = analysis based on lexical/contextual factors / plausibility

(2)She's just popped out to the...

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p-down models

Bottom-up models

Bottom up = analysis based on word classes

(1) The...woman lost her purse

Top down = analysis based on lexical/contextual factors / plausibility

(2) She's just popped out to the...shops

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Bottom up = analysis based on word classes

(1)The...woman lost her purse

plausibility

- (2)She's just popped out to the...shops
- (3)The disgruntled accountant decided to hand in his...

Top down = analysis based on lexical/contextual factors /

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Bottom up = analysis based on word classes

(1)The...woman lost her purse

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(2)She's just popped out to the...shops

(3)The disgruntled accountant decided to hand in his... notice

Top down = analysis based on lexical/contextual factors /

(1)

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Bottom up = analysis based on word classes

The... woman lost her purse

plausibility

(2)She's just popped out to the...shops

(3)The disgruntled accountant decided to hand in his... notice

Top down = analysis based on lexical/contextual factors /

(4) I'm going to give. . .

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Bottom up = analysis based on word classes

(1)The... woman lost her purse

plausibility

(2)She's just popped out to the...shops

(3)The disgruntled accountant decided to hand in his... notice

Top down = analysis based on lexical/contextual factors /

(4)I'm going to give...it some thought

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(5) Since Jay always jogs a mile and a half seems a short way to him

- (5) Since Jay always jogs a mile and a half seems a short way to him
- (6) [CLAUSE Since Jay always jogs a mile and a half]

 Od. of 'jogs'

- (5) Since Jay always jogs a mile and a half seems a short way to him
- (6) [CLAUSE Since Jay always jogs a mile and a half]

 Od. of 'jogs'
- (7) [Since Jay always jogs] [CLAUSE a mile and a half seems a short way to him]

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The garden path model

Temporary mis-analysis of the structure of a sentence.

We are relatively slow to recover.

Easy to generate and near universal.

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(8)

The criminal confessed his sins harmed many people

```
(9) [ CLAUSE The criminal confessed his sins ]

Od. of 'confessed'

(10) [ The criminal confessed [ CLAUSE his sins harmed many people ] ]

S of 'harmed'
```

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Garden paths allow us to see the inbuilt biases of the parser (parse = analyse a sentence and tag each word according to its word class)

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Garden paths arise due to syntactic ambiguity

Can be **local** (ambiguity resolved before the end of the sentence), or **global** (ambiguity remains even after we have read/hear entire sentence)

global?

(11)

(12)

(13)

(14)

(15)

(16)

Sentence

Newcastle Crown Court.

They're cooking apples.

the police department

were told to record their expenses

day make her a world class athlete

Where is the ambiguity in these sentences? Is it local or

The vampires loaned money at low interest rates

XXX pleaded guilty to running the brothel at

A bicycle was reported stolen by an old lady

The young athlete realised her potential might one

classified as "top down"

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The following are some tips to protect women from

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(17) The vampires (that were) loaned money at low interest rates were told to record their expenses

(18)

XXX pleaded guilty to running the brothel at Newcastle Crown court

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one day make her a world class athlete]

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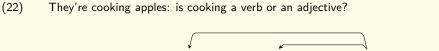
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[CLAUSE The athlete realised her potential] (19)

(20)The athlete realised [CLAUSE her potential might

A bicycle was reported stolen by an old lady (21)

EXERCISE



The following are some tips to protect women from the police department

(23)

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A drive towards **simplicity**?

Innate behaviour of the parser? (Frazier & Fodor, 1978, 'The Sausage Machine')

Processing constraints?

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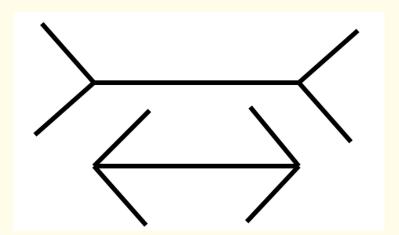
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Modularity (Jerry Fodor, 1983)

Neural regions dedicated to a particular task

The syntactic parser is dedicated to analysing sentences





Behaviour of a module is impervious to external information Is behaviour of parser impervious to top-down information?

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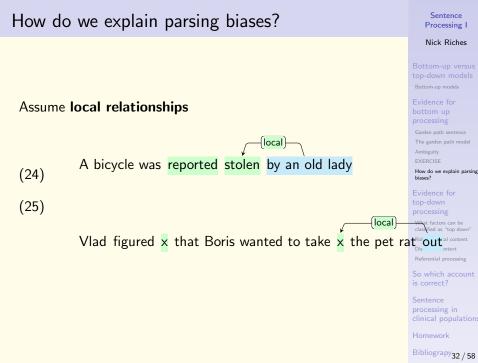
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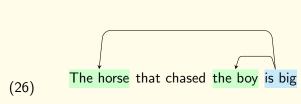
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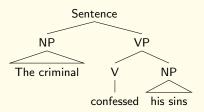
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Assume simple structures (e.g. few nodes and branches)



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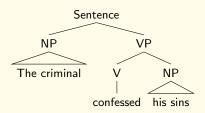
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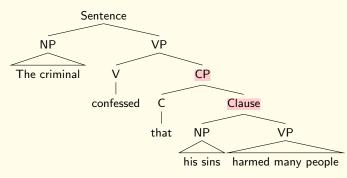
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Assume simple structures (e.g. few nodes and branches)





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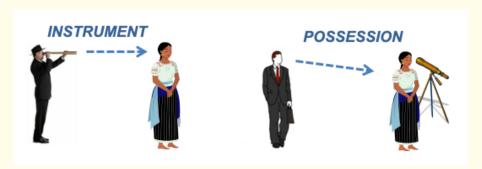
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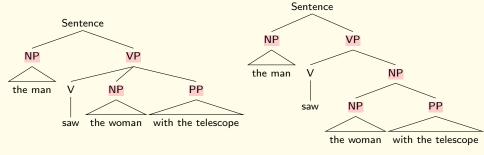
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Alternative: Biases reflect **statistical patterns** in the input

(27)Vampires (who were) loaned money at low interest rates...

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When referring to top-down processing we are typically referring to

- Lexical factors
- Contextual factors

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Words clearly bias structural interpretation:

- 1. The man hit the woman with the _____
- 2. The boy tempted the mouse with the _____
- 3. The protestor splattered the policeman with _____
- 4. The boy likes the girl with _____
- 5. The young athlete **realised/thought** her potential might one day make her a world class athlete

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Trueswell et al. (1983) - measured reading via a self-paced reading paradigm.

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(28)

The student forgot $\begin{cases} the solution \\ the solution was in the book \end{cases}$

I hope { I will remember next time } (29)

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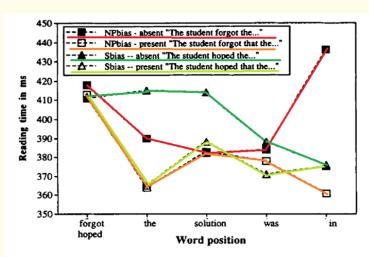


Figure 2. Word-by-word self-paced reading times (in ms). (NP = noun phrase; S = sentence.)

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1. Participants used the verb to predict the structure of the sentence.

2. Participants used subordinator *that* to disambiguate structure.

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Discourse context

Can you understand this sentence?

(30) The horse raced past the barn fell

Now let's put it in context...

Lord Chumley-Worthington wanted to map out a race course around his estate. He therefore wanted to find out if the ground was more slippery next to the barn or next to the pond. So he instructed his servants to race two horses along these different routes. The horse raced past the barn fell, while the horse raced past the pond managed to stay on its feet. He therefore concluded that the ground next to the barn was more slippery.

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According to theories of referential processing, set-restriction is a costly process.

- 1. The vampires loaned money at low interest rates were told to record their expenses
- 2. The man saw the woman with the binoculars



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Garden paths are easy to generate under laboratory conditions

However, top down effects have been repeatedly demonstrated.

- 1. Both bottom-up and top-down factors operate almost immediately, and may co-occur.
- 2. Bottom-up processing slightly precedes top-down processing.

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There is some evidence that language-impaired children may prioritise top-down factors, e.g. animacy.

- (31) The rock that the boy dropped was heavy
- (32) The boy that the rock crushed was blond

Evans, J., & MacWhinney, B. (1999). Sentence processing strategies in children with expressive and expressive-receptive specific language impairments. International Journal of Language and Communication Disorders, 34(2), 117-134.

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"No head injury is too trivial to ignore"

Does it make sense to you? Can you paraphrase is? Is there

Read the following sentence

anything weird about it?

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Trueswell, J. C., Tanenhaus, M. K., & Kello, C. (1993). Verb-specific constraints in sentence processing: Separating effects of lexical preference from garden-paths. JOURNAL OF EXPERIMENTAL PSYCHOLOGY LEARNING MEMORY AND COGNITION, 19, 528-528.

Evans, J., & MacWhinney, B. (1999). Sentence processing strategies in children with expressive and expressive-receptive specific language impairments. International Journal of Language and Communication Disorders, 34(2), 117-134.