Sentence Processing I

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Bottom-up versus top-down models

Evidence for bottom up

Garden path sentence

The garden path model
Ambiguity

How do we explain parsing biases?

biases? Evidence for

processing

What factors can be classified as "top down"

Role of lexical content Discourse context

Referential proc

So which account is correct?

Sentence processing in clinical population

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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

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(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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plausibility

(2)

Top down = analysis based on lexical/contextual factors /

(1)

The... woman lost her purse

She's just popped out to the...shops

Bottom up = analysis based on word classes

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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

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 /

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(1)

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Bottom up = analysis based on word classes

The...woman lost her purse

plausibility

Top down = analysis based on lexical/contextual factors /

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

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

(4) I'm going to give. . . Bottom-up models

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Bottom up = analysis based on word classes

(1)The... woman lost her purse

plausibility

Top down = analysis based on lexical/contextual factors /

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

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

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

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The garden path model

```
(5) [ CLAUSE Since Jay always jogs a mile and a half ]

Od. of 'jogs'
```

(6) [CLAUSE Since Jay always jogs] [CLAUSE a mile and a half seems a long way to him] S of 'seems'

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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.

(7)

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The garden path model

The criminal confessed his sins harmed many people

The garden path model

```
(8) [ CLAUSE The criminal confessed his sins ]
Od. of 'confessed'
```

```
(9) [ 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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Arises where there are two possible analyses.

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

global?

(10)

(11)

(12)

(13)

(14)

(15)

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

Newcastle Crown Court.

the police department

were told to record their expenses

day make her a world class athlete

The vampires loaned money at low interest rates

The young athlete realised her potential might one

XXX pleaded guilty to running the brothel at

A bicycle was reported stolen by an old lady

They're cooking apples.

The following are some tips to protect women from

processing in

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EXERCISE

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

(17)

XXX pleaded guilty to running the brothel at Newcastle Crown court

EXERCISE

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- [CLAUSE The athlete realised her potential] (18)
- (19)The athlete realised [CLAUSE her potential might one day make her a world class athlete]
- A bicycle was reported stolen by an old lady (20)

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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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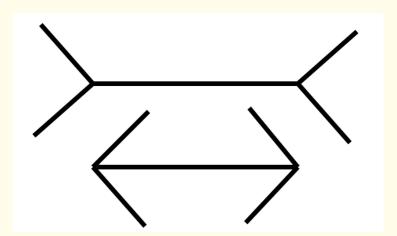
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Modularity (Jerry Fodor, 1983)

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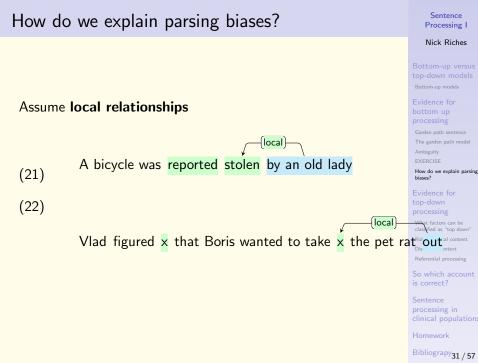
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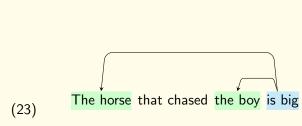
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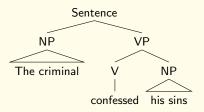
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Assume simple structures (e.g. few nodes and branches)



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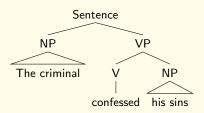
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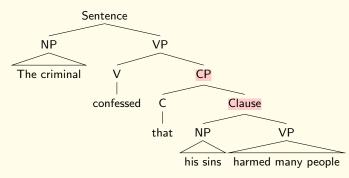
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Assume simple structures (e.g. few nodes and branches)





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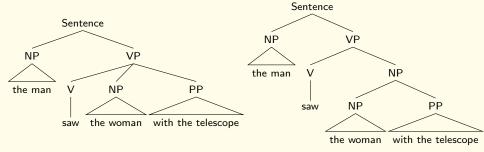
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Alternative: Biases reflect **statistical patterns** in the input

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

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Sentence

When referring to top-down processing we are typically

Lexical factors

referring to

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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reading paradigm.

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

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I forgot { Janet's birthday } that it was Janet's birthday } (25)

I hope { I will remember next time } (26)

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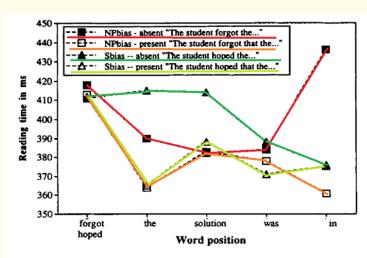


Figure 2. Word-by-word self-paced reading times (in ms). (NP = noun phrase; S = sentence.)

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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?

(27) 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 conluded 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 are operative at once.
- 2. Bottom-up processing slightly precedes top-down processing.

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prioritise top-down factors, e.g. animacy.

There is some evidence that language-impaired children may

(28)The rock that the boy dropped was heavy

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Read the following sentence

"No head injury is too trivial to ignore"

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

anything weird about it?

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