Sentence Processing I

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Bottom-up versus top-down models

Bottom-up models

Evidence for bottom up processing

Garden path sentence

The garden path model

Ambiguity

How do we explain parsing biases?

Evidence for top-down processing

What factors can be classified as "top down"

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Bottom-up models

Figure 5: Context influences perception

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Bottom-up models

Bottom up = analysis based on word classes

(1) The. . .

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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. . .

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

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

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Since

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Jay

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always

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jogs

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seems

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to

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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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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'

The garden path model

(7) The criminal confessed his sins harmed many people

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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’

The garden path model

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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Ambiguity

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)

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Ambiguity

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

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

(11) XXX pleaded guilty to running the brothel at Newcastle Crown Court.

(12) The young athlete realised her potential might one day make her a world class athlete

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

(14) They're cooking apples.

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

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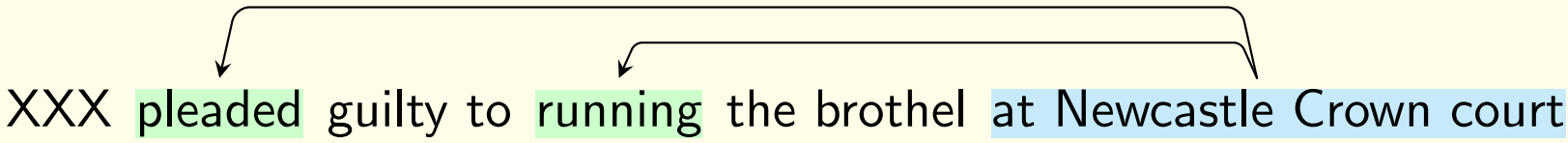
Ambiguity

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

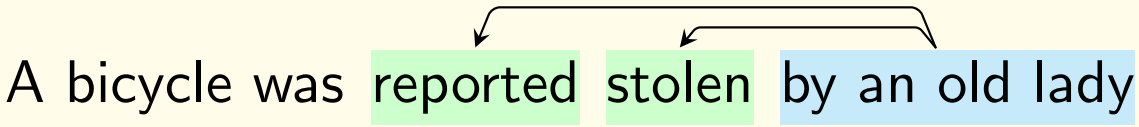
(17)



Ambiguity

(18) [CLAUSE The athlete realised her potential]

(19) The athlete realised [CLAUSE her potential might one day make her a world class athlete]

(20) 

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How do we explain parsing biases?

A drive towards **simplicity**?

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

Processing constraints?

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How do we explain parsing biases?

Modularity (Jerry Fodor, 1983)

Neural regions dedicated to a particular task The syntactic

parser is dedicated to analysing sentences

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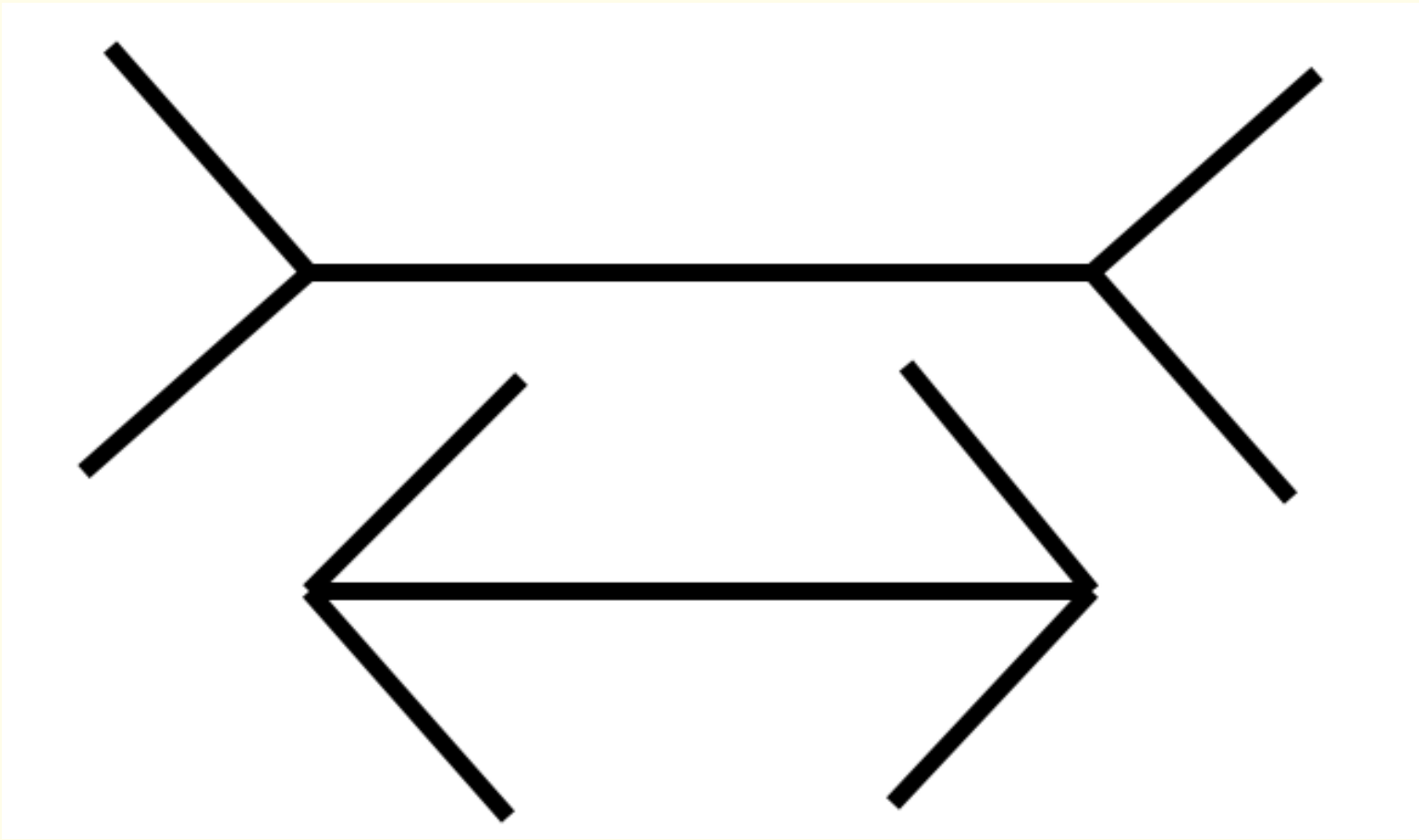

Behaviour of a module is impervious to external information

Is behaviour of parser impervious to top-down information?

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Assume **local relationships**

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

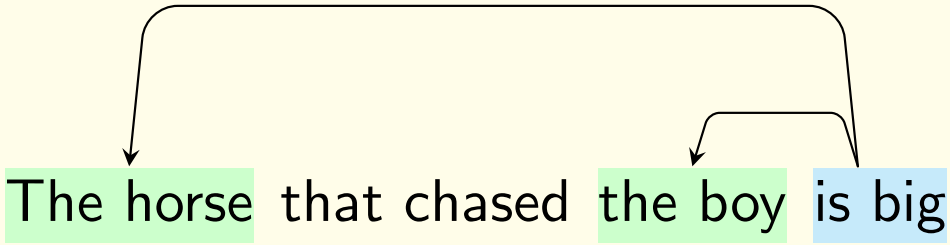
local

(22) Vlad figured x that Boris wanted to take x the pet rat out

local

How do we explain parsing biases?

(23)



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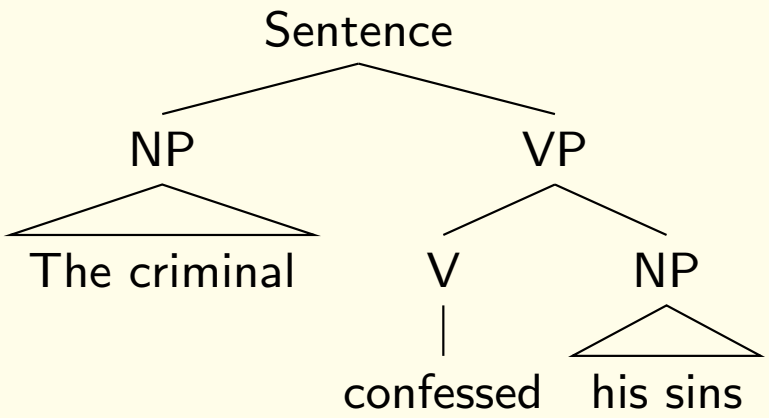
How do we explain parsing biases?

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



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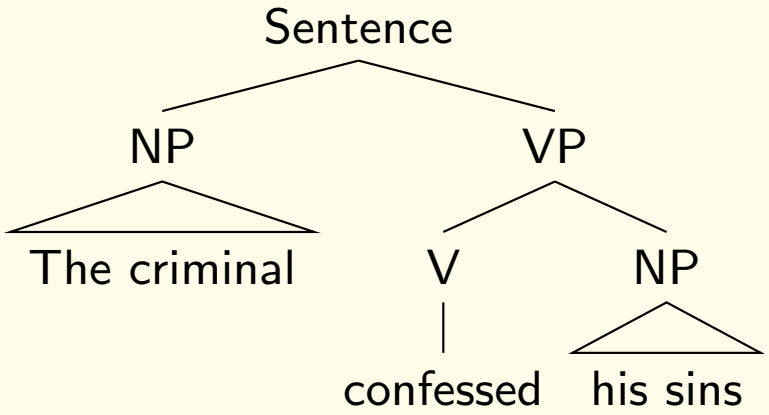

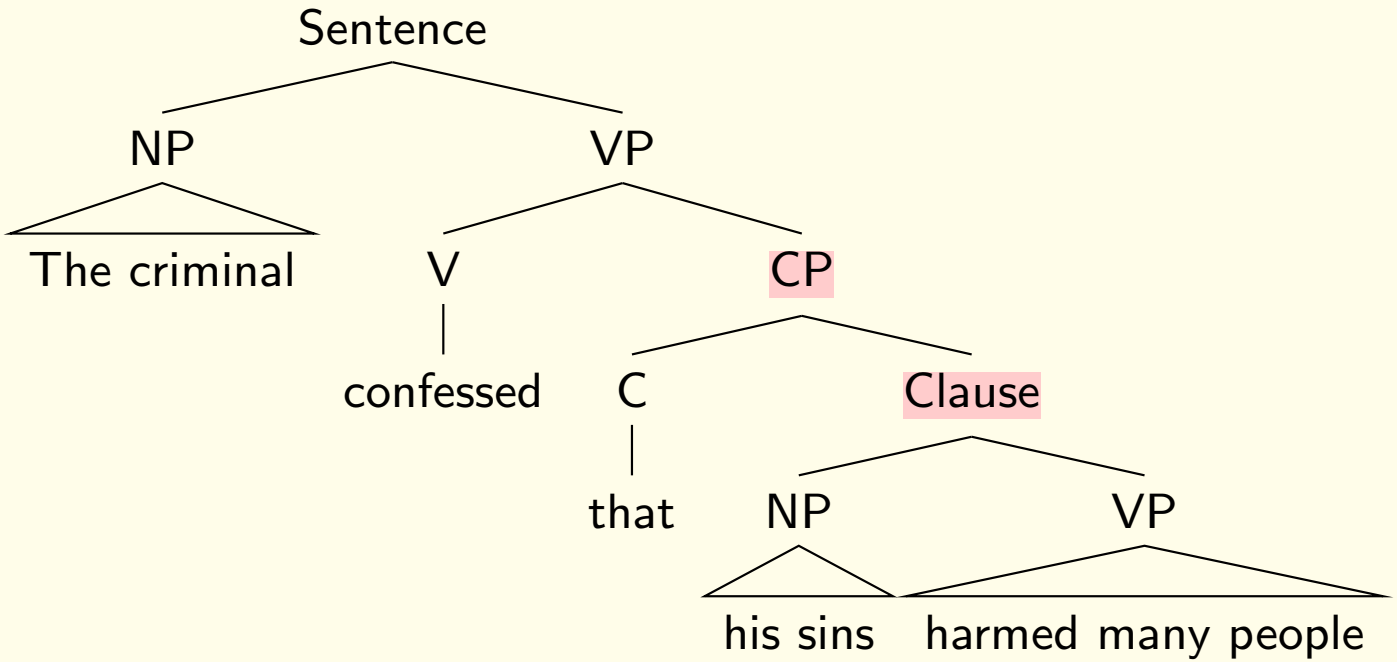

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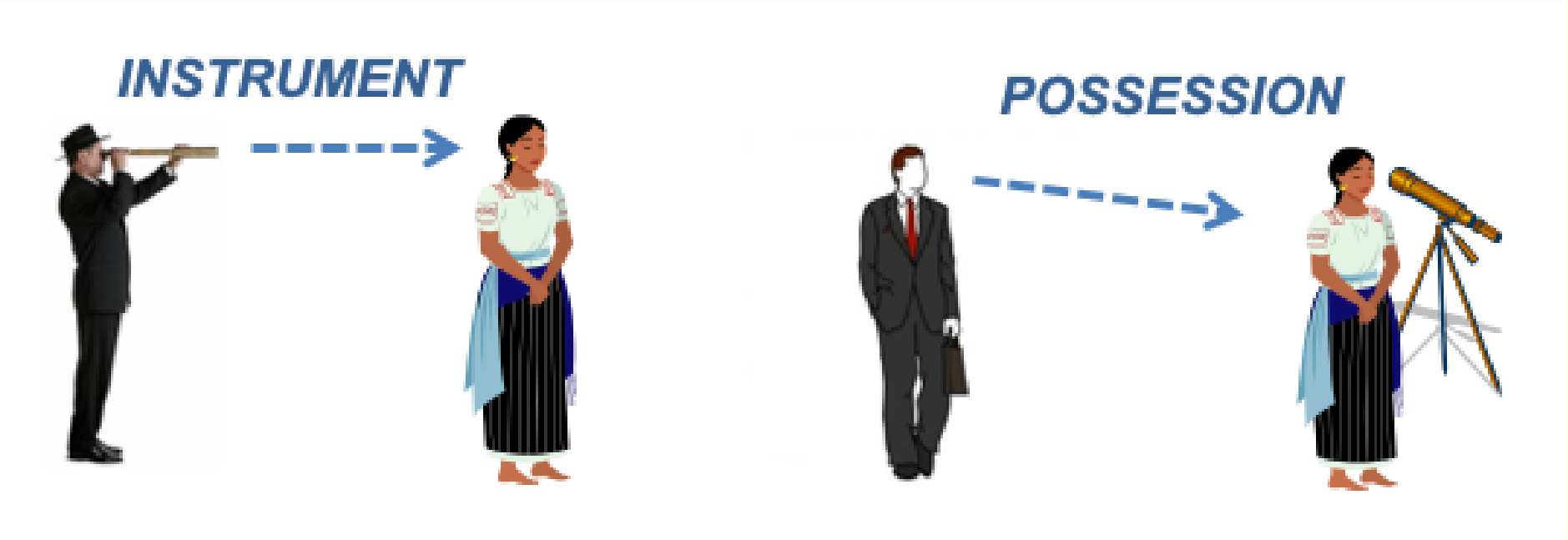

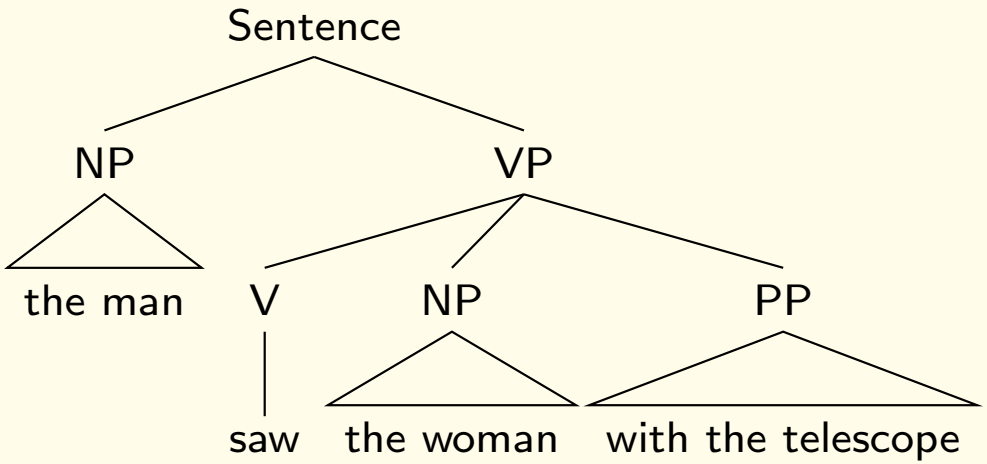

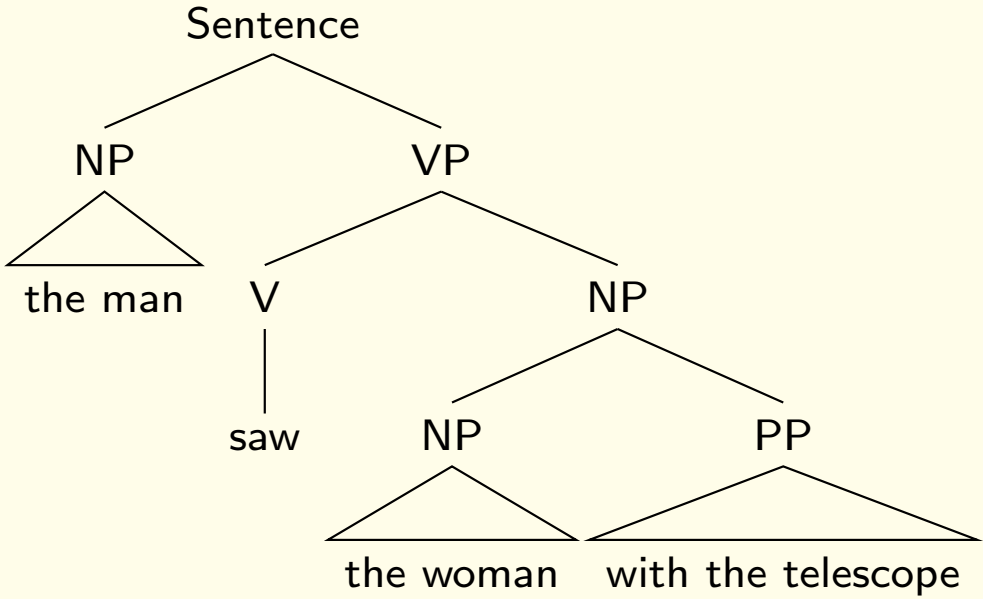

How do we explain parsing biases?

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

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

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What factors can be classified as "top down"

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

1. Lexical factors
2. Contextual factors

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Role of lexical content

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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Role of lexical content

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

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(25) I forgot $\left\{ \begin{array}{c} \textit{Janet's birthday} \\ \textit{that it was Janet's birthday} \end{array} \right\}$

(26) I hope $\left\{ \textit{I will remember next time} \right\}$

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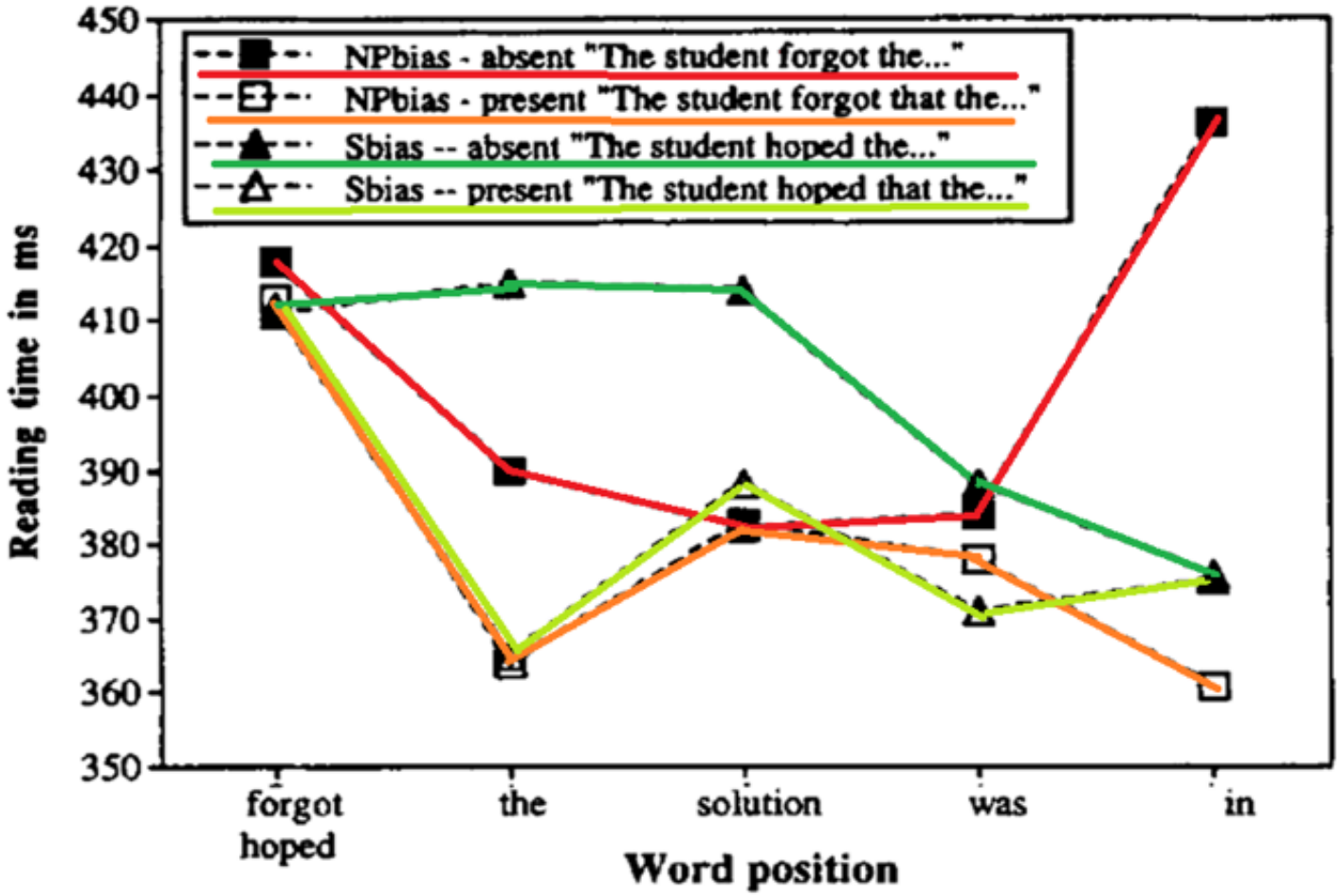

Figure 2. Word-by-word self-paced reading times (in ms). (NP = noun phrase; S = sentence.)

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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

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Discourse context

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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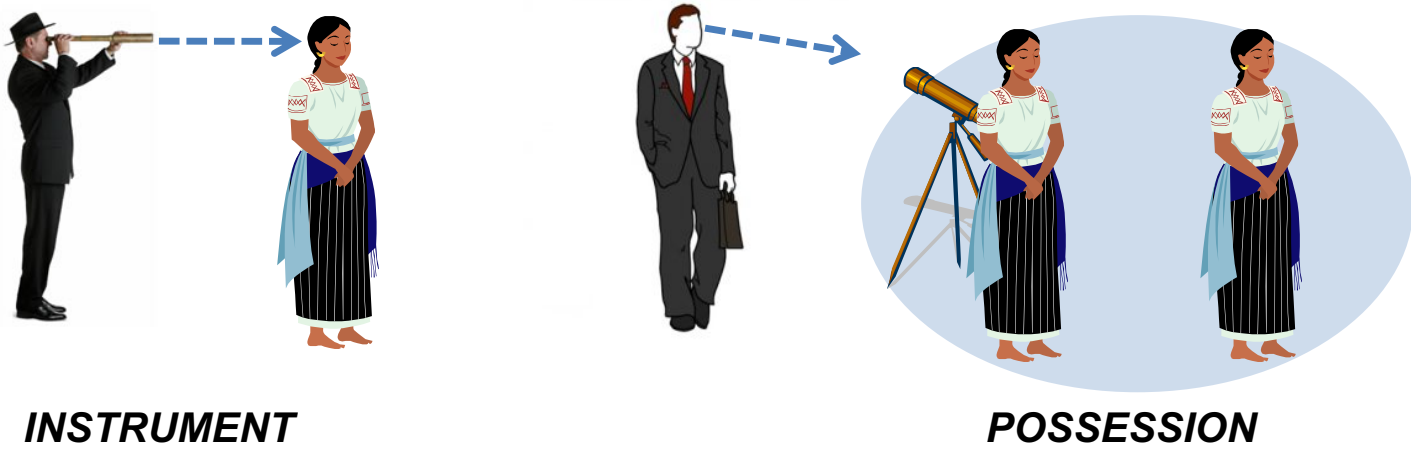
Referential processing

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

(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 anythin weird about it?

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