

Evidence from priming for hierarchical representation in syntactic structure

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Empirical basis of grammars

- Grammars are theories of the mental representation of linguistic phenomena
- How to empirically verify these theories?
- Traditional method:
acceptability judgments



Outline

- Problems with acceptability judgments
- New technique - syntactic priming
- Case studies
 - Passives
 - NP structure
- Conclusions

Problems with acceptability judgments



- Difficult to isolate the effects of grammaticality from other factors (Schutze 1996; Fanselow and Frisch 2004)
- Sentences that are hard to process are also less acceptable:
 - Garden paths, multiple center-embedding, etc.
- Violations of the same grammatical constraint can vary in acceptability

German dislocated NPs (Fanselow and Frisch 2004)

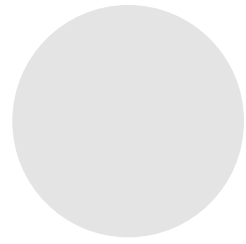
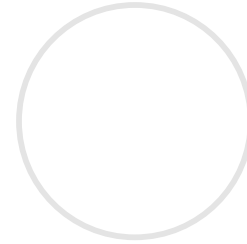
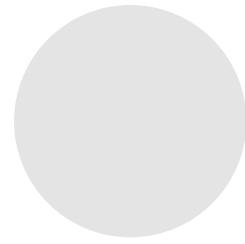
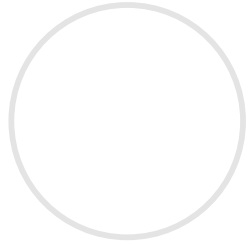
- Dislocation of Det from Nom:
alte Professoren liebt sie keine
old.pl professors.pl loves she no.pl
'she loves no old professors'
- Not for singular count nouns:
*alten Professor liebt sie keinen
old.sg professor.sg loves she no.sg
- But, improves if N is ambiguous:
Koffer hat sie keinen
suitcase.sg/pl has she no.sg



Another empirical technique

- Is there another method that is sensitive to differences in cognitive representation?
- Yes: syntactic priming!

Priming



- What is it?

- If two stimuli are related only along one particular dimension, and
- the processing of one stimulus affects the processing of the other for reasons attributable to that relationship

- Why is it useful?

- we can infer that the cognitive system is sensitive to that dimension, and that it treats the two stimuli as related within that dimension

(Branigan, et al 1995)

Syntactic priming (Bock 1986)



- Processing one construction facilitates the processing of subsequent similar construction(s)
 - e.g makes it more likely to be produced
- Can be used to test hypotheses about cognitive representation of syntactic structure (Branigan et al 1995)



Representation of Passives: Locative *by*-primes

Bock and Loebell (1990)

Method

- Picture description:

PRIMING SENTENCES

ACTIVE:
ONE OF THE FANS
PUNCHED THE
REFEREE.

PASSIVE:
THE REFEREE WAS
PUNCHED BY ONE
OF THE FANS.

TARGET PICTURES



Materials

A decorative graphic at the top of the page consists of a horizontal row of five circles. The first circle is solid grey and partially overlaps the word 'Materials'. The second circle is white with a thin grey outline. The third circle is solid grey. The fourth circle is white with a thin grey outline. The fifth circle is solid grey.

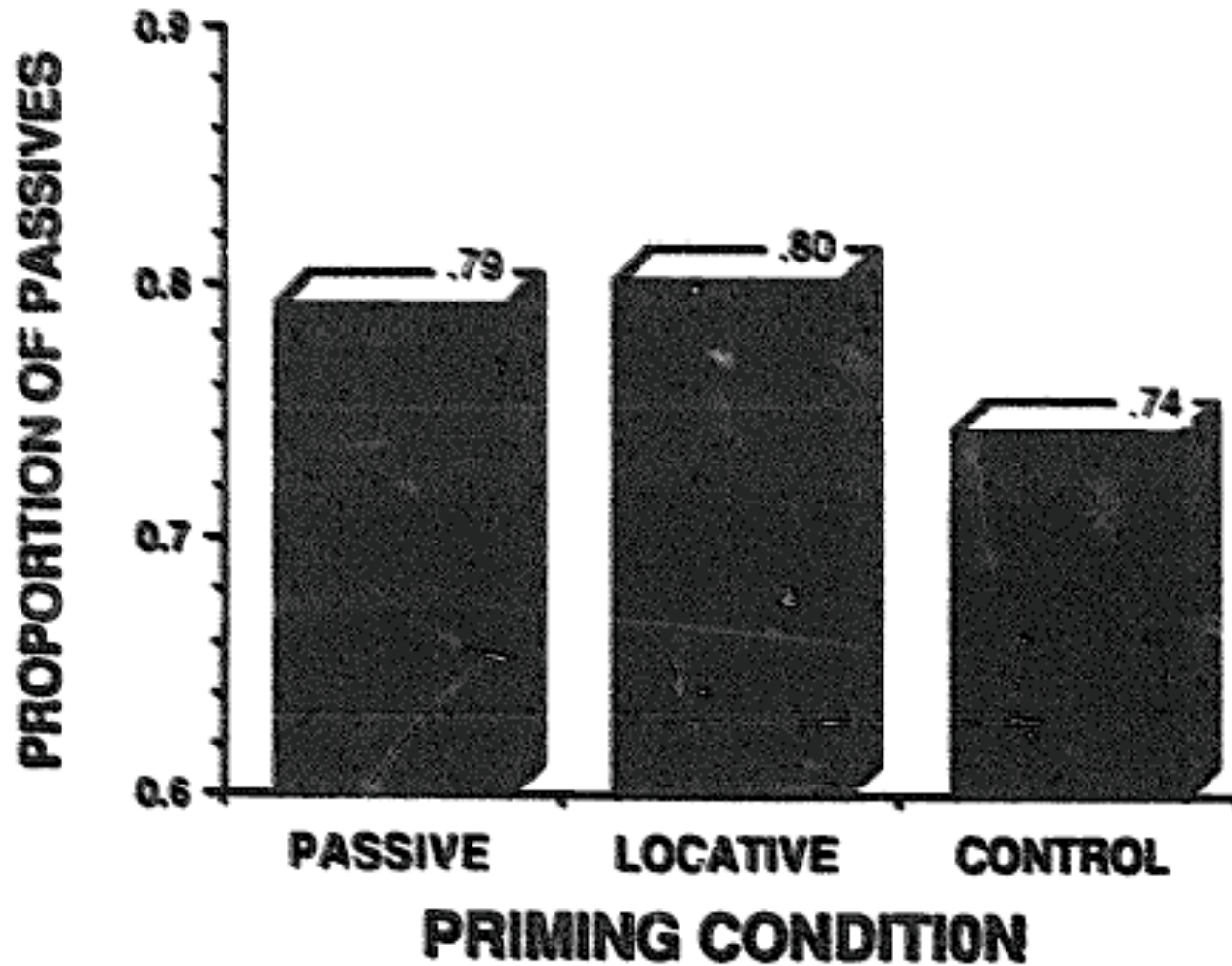
Passive
Locative
Active

*The construction worker was hit by the bulldozer.
The construction worker was digging by the bulldozer.
The construction worker drove the bulldozer.*

Passive
Locative
Active

*The minister was cut by the broken stained glass window.
The minister was praying by the broken stained glass window.
The minister fixed the broken stained glass window.*

Results





Interim summary

- Passives and locatives with *by*-phrases share representation
- Consistent with lexicalist models of passive, but not transformational models



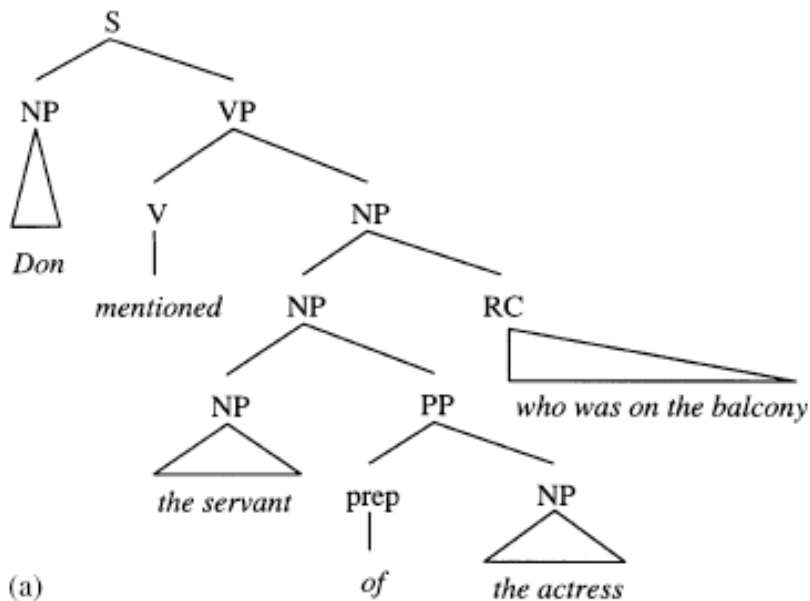
Relative clause attachment

(Scheepers 2003; Desmet et al 2006)

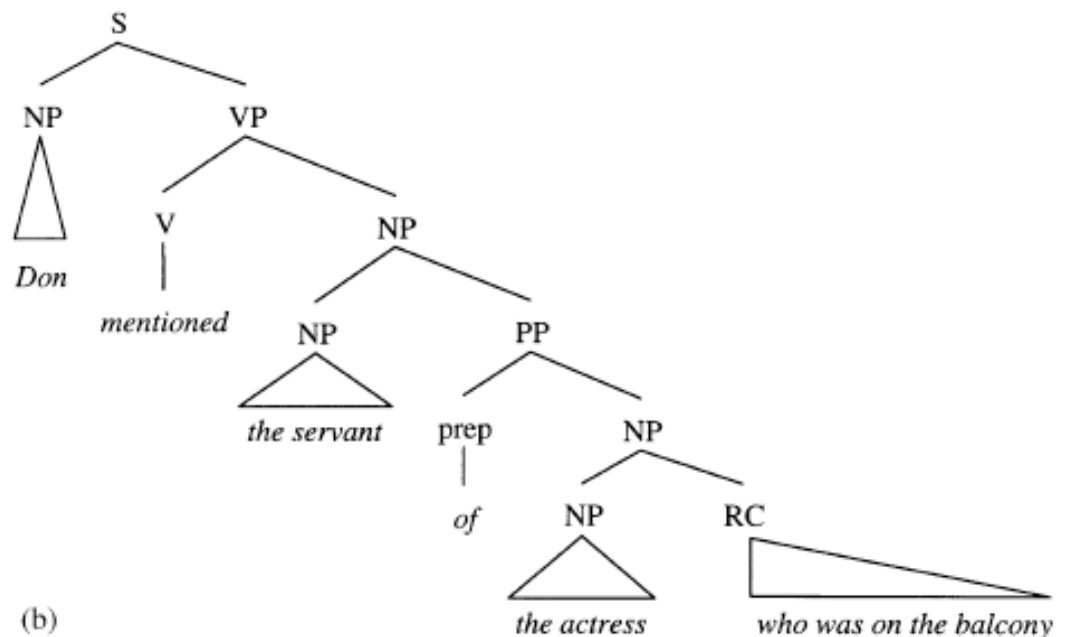
Priming RC attachment height

- Don mentioned the servant of the actress who was on the balcony

High:



Low:



Methods



- Sentence completion (Pickering and Branigan 1998)
- Force particular RC attachment in prime by manipulating (Desmet et al 2006):
 - Humanness of relativizer
 - Number (sg/pl) of nouns
- e.g:
 - Prime: The audience applauded the play of the director who
 - Target: The shopper insulted the employees of the storeowner who

Results

- German RC attachment (Scheepers 2003):

	HA target	LA target	UC target
HA prime	104 (44%)	116 (50%)	14 (6%)
LA prime	66 (29%)	149 (65%)	14 (6%)
BL prime	75 (33%)	142 (62%)	14 (6%)

- Argued for hierarchical representation of NPs

But..



- Representation could be linear dependencies (a la Dependency Grammar, Tesniere 1959), not hierarchical trees:

- Don mentioned the servant of the actress who was on the balcony
- Don mentioned the servant of the actress who was on the balcony



Empirical consequences

- With dependency representation, predict same priming of RC attachment regardless of internal NP structure



The image features five light gray circles arranged in a loose pattern. Two are solid and three are hollow. The text is centered over the hollow circles.

Sentence-completion Experiment

Design



- Attachment height (2) x NP structure (2)
- Prime:
 - *David had...*
 - Flat:
 - HI - the chat with the grandmothers about the child who are
 - LO - the chat with the grandmothers about the child who is
 - Embedded:
 - HI - the chat with the grandmothers of the child who are
 - LO - the chat with the grandmothers of the child who is
- Target - embedded NP structure:
 - Emily heeded the warning of the hunters of the fugitive who

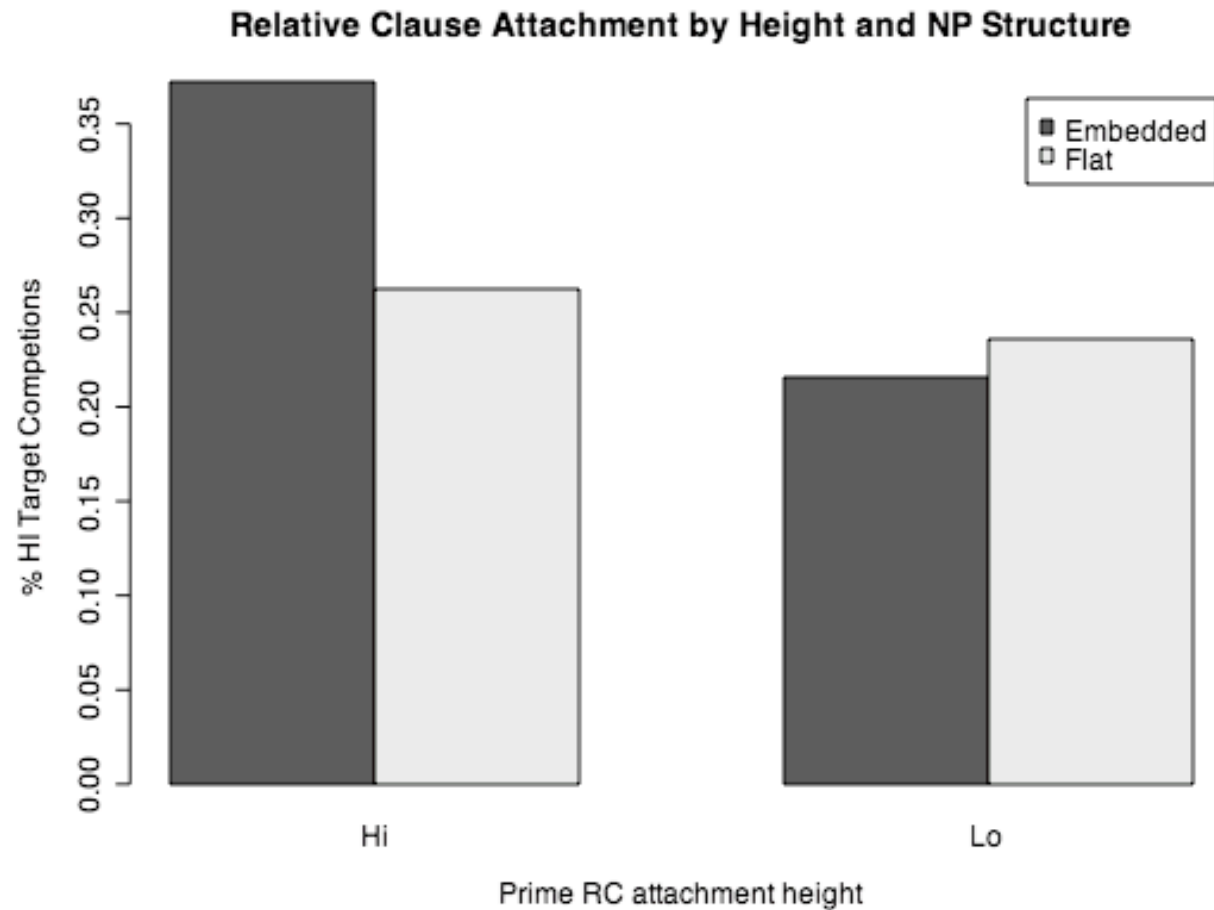


Methods and analysis

- 25 subjects, 24 items
- Subjects completed list of incomplete sentences (expt'al items and fillers) at a computer
- Responses modeled by mixed-model logistic regression
 - Controls for random effects of *Subject* and *Item*

Results

- Significant interaction between height and NP structure ($p < .03$)
- No main effects





Summary

- Relative clause attachment height can be primed
- BUT, only when the prime and target NPs have the same internal structure
- Evidence for hierarchical representation of RC attachment, unlike dependency grammars



Conclusions

- English NPs represented by hierarchical, CFG-like representations, rather than DG
- Syntactic priming can be used to test theories of grammar
 - Simple experimental methodologies (sentence completion, picture description)
 - Also can be found in corpora (Szmrecsanyi 2005; Gries 2005)

Acknowledgments



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- Florian Jaeger
- Tim Desmet

- And **thank you!**

- Slides at: *www.stanford.edu/~snider*