Structural change and L2 sentence processing

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Background

- Processing of garden-path sentences provides a window into how human parser integrates new information from language input into a previously computed analysis and how misanalysis if any can be resolved – ambiguity resolution.

(1) While the man hunted the deer **ran** into the woods. (Christianso et al., 2001)
……the man hunted the deer (object) ……ran……
……the deer (subject) ran into the woods……

Previous studies

- 1) Verb bias used in ambiguity resolution
  - lexically specific frequency information about whether a verb is most likely to take a direct object (DO) or a sentential complement (SC) (Garnsey et al., 1997; Traxler, 2005).

E.g., (2) a. The professor forgot the theory revealed the underlying mechanism. (DO-bias)

b. The professor proved the theory revealed the underlying mechanism. (SC-bias)

- 2) Learners well used such information for ambiguity resolution (Dussias & Cramer-Scaltz, 2008; Qian et al., 2019).
  - Shorter RTs on *revealed* for (2b) than for (2a)

Research gap

- Verb bias as a non-structural factor
- How about manipulating the structural aspects of a verb while controlling for its non-structural properties such as verb bias in L2 sentence processing?
- Structural change pertaining to verbs

Structural change

- (1) The Australian woman saw the famous doctor has been drinking quite a lot. (Complement-clause)
  - See + NP/S

- (2) Before the woman visited the famous doctor has been drinking quite a lot. (Adjunct-clause)
  - Visit + NP/Z (zero complement)

Which one is more difficult (1) or (2) ?

Principle-based parsing - Pritchett (1992)

- Parsing is the local application of global syntactic principles.

- Reanalysis is difficult when it results in a major rearrangement of thematic structure, but easy if it doesn't.

- NP/Z would be harder than NP/S as NP/Z requires a constituent to be moved out of its *thematic domain*.

Research question

- 1) Is processing difficulty at disambiguation greater in NP/Z ambiguity than in NP/S ambiguity for L1 and L2 learners?

- 2) Do L1 and L2 learners equally show sensitivity to verb-related structural properties during L2 sentence processing?
  - L2 learners arguably are less sensitive to structural information during processing.

- 3) Does proficiency modulate learners' sensitivity to verb properties?

Methods

- Participants
  - 24 English native speakers; 65 Chinese learners of English
- Design
  - 2 (Complement type: NP/S vs. NP/Z) *2 (Ambiguous vs. Unambiguous)
- Martials
  - 32 sets of items in 4 conditions (Adapted from Strut et al., 1999)
- Tasks:
  - Self-paced reading (SPR) – RT (Ibex Farm)
    - The Australian woman / saw the famous doctor / had been drinking / quite a lot.

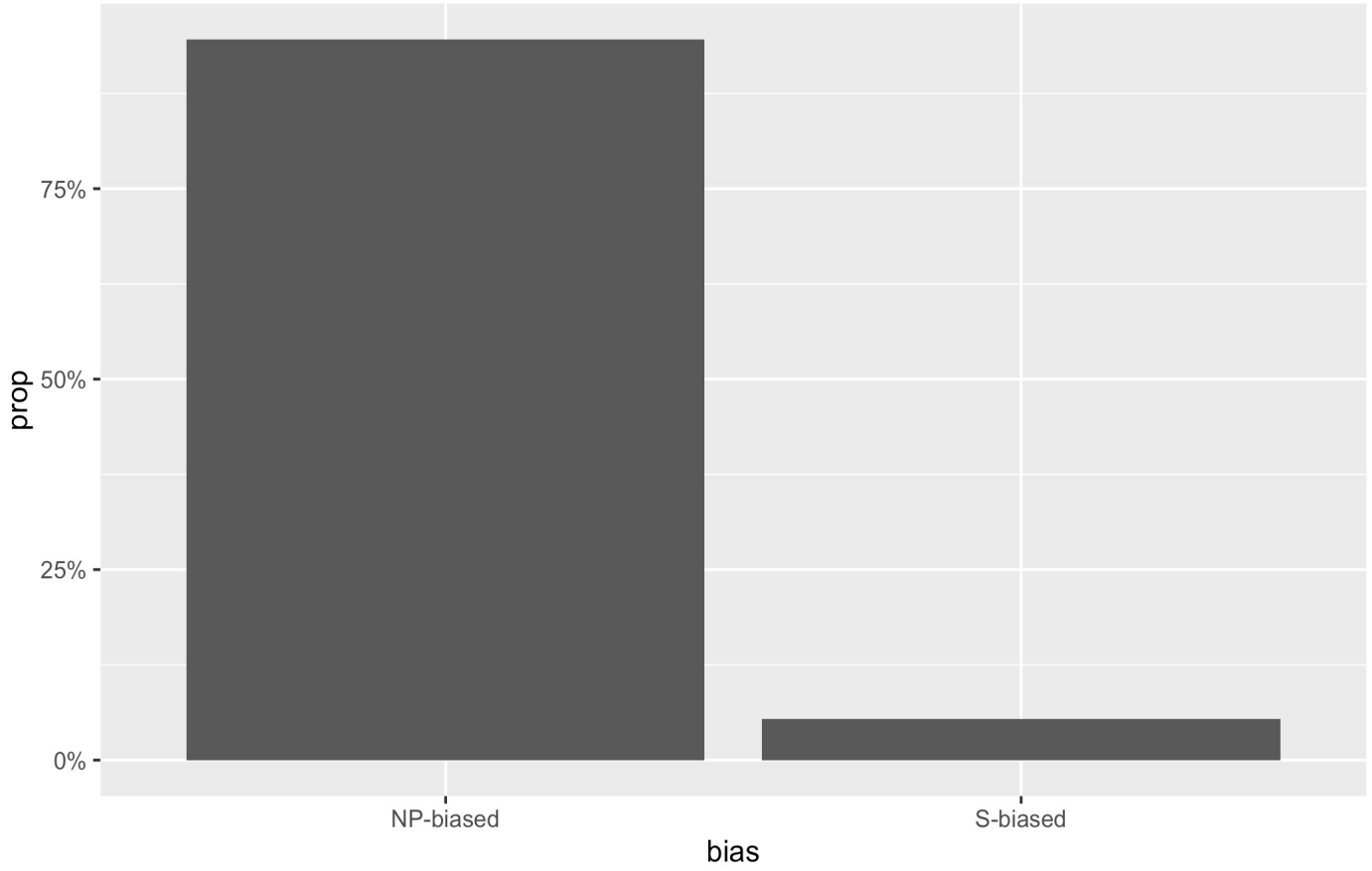
      CQ: Is the woman an Australian?
  - Acceptability judgment task (AJT) to ensure material plausibility – 1-7 Likert Scale (Qualtrics)
    - E.g., The Australian woman saw the famous doctor.

Condition	Example sentence
Ambiguous-NP/S	(1). The Australian woman / saw the famous doctor / had been drinking / quite a lot.
Ambiguous-NP/Z	(2). Before the woman / visited the famous doctor / had been drinking / quite a lot.
Unambiguous-NP/S	(3). The Australian woman saw that the famous doctor had been drinking quite a lot.
Unambiguous-NP/Z	(4). Before the woman visited, the famous doctor had been drinking quite a lot.

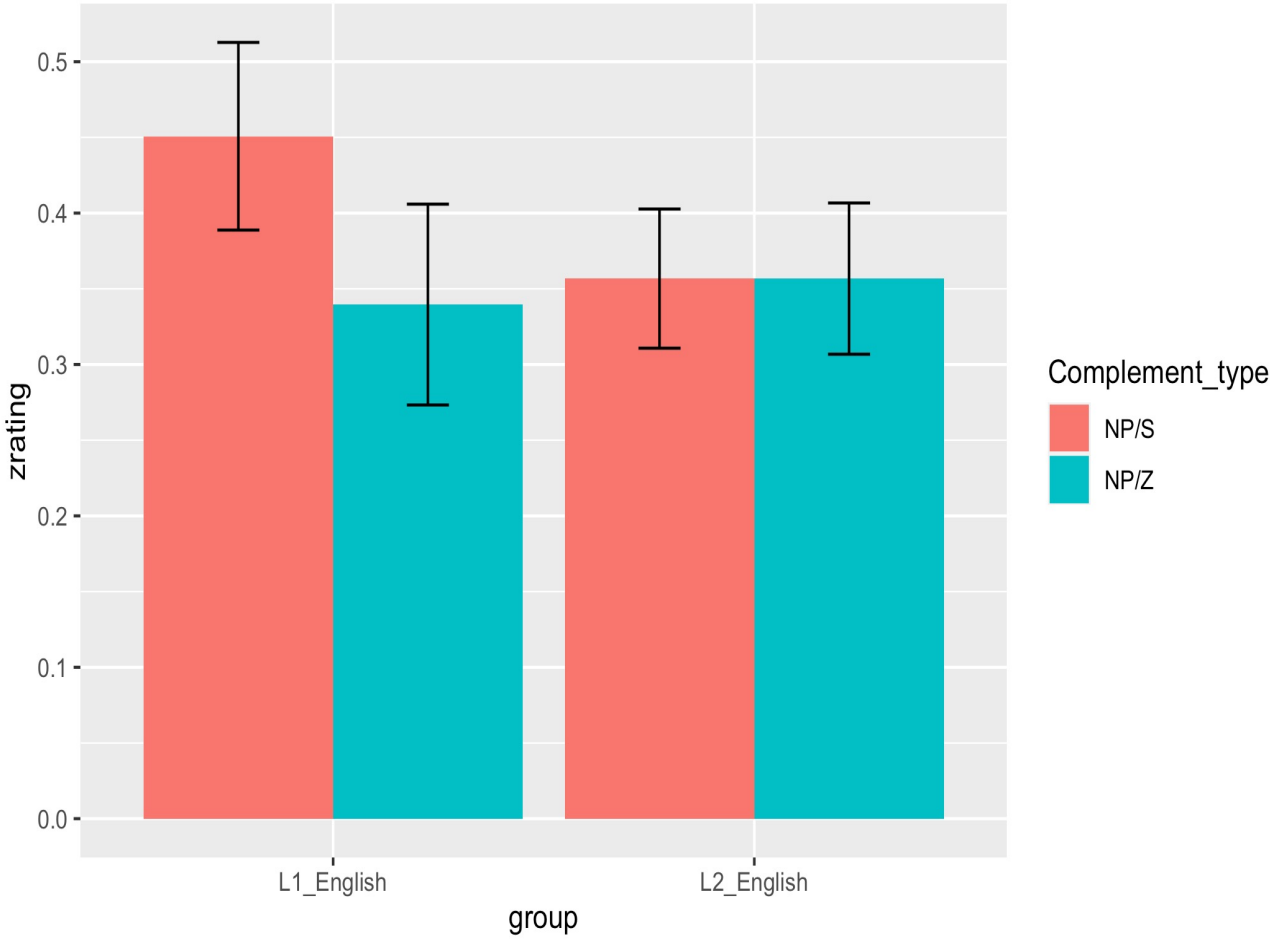
COCA

- To ensure the verbs are statistically biased toward the NP reading

- E.g., if ‘accepted’ + that / NN+VBN -> S-biased, otherwise -> NP-biased



AJT



1. AJs z-scored by participant and language to mitigate scale bias.

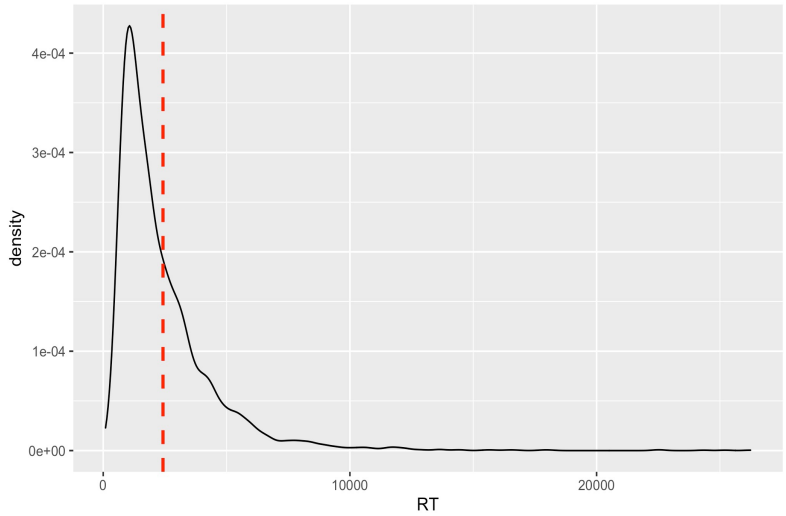
2. Linear mixed-effects models (LMEM) showed that ratings did not significantly differ by condition (β=-0.05, *SE*=0.09, *p*=.554) and language group (β=-0.04, *SE*=0.06, *p*=.543), thus ruling out plausibility as a potential confound.

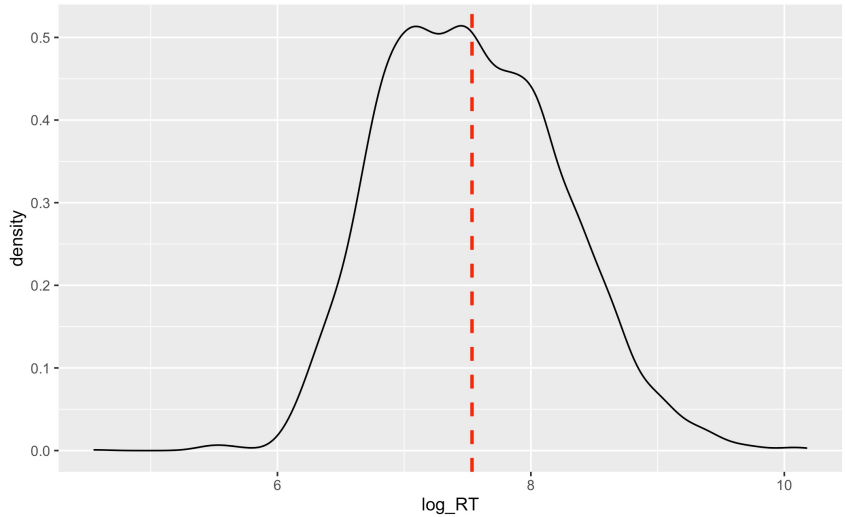
SPR

- Data trimming:
  - Participants whose accuracy on CQs lower than 80% excluded
    - 1 L1 speakers excluded, remaining for 94.3 %
    - 6 L2 learners excluded, remains for 90.3 %
    - LMEM indicated a reliable higher accuracy for L1 than for L2 speakers (β=-0.11, *SE*=0.002, *p*=.014)
  - RTs beyond 2.5 SDs from the mean removed
    - 2.6 % affected for L1
    - 2.5 % affected for L2

Data trimming *cont'd*

- RTs were then log transformed to approach normal distribution





- Residualized the log-transformed RTs to adjust for the variability in word length and individual reading speed

Modeling procedures

- Only R3 was analyzed, as it's the critical region for the effects to be shown

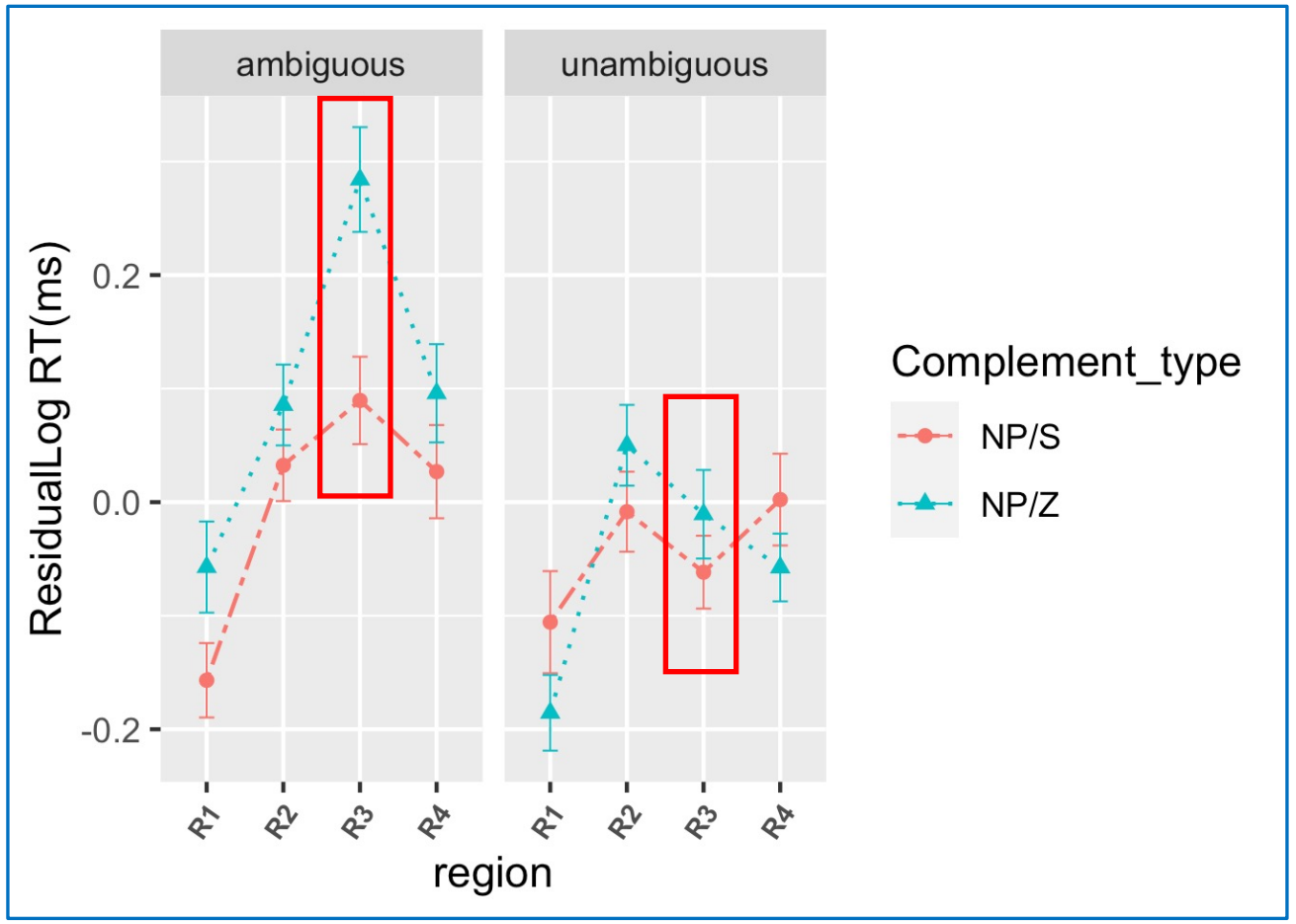
For L1 speakers

- Random effect structure kept maximal
  - by-item, by-subject intercept
  - by-subject random slope for Ambiguity*Complement type
  - Random effect structures simplified only when models converge
- Fixed effects for complement type and ambiguity sum coded

For L2 speakers

- Identical as above, except that by-item random slope for Language Proficiency was additionally added in the random effect structure

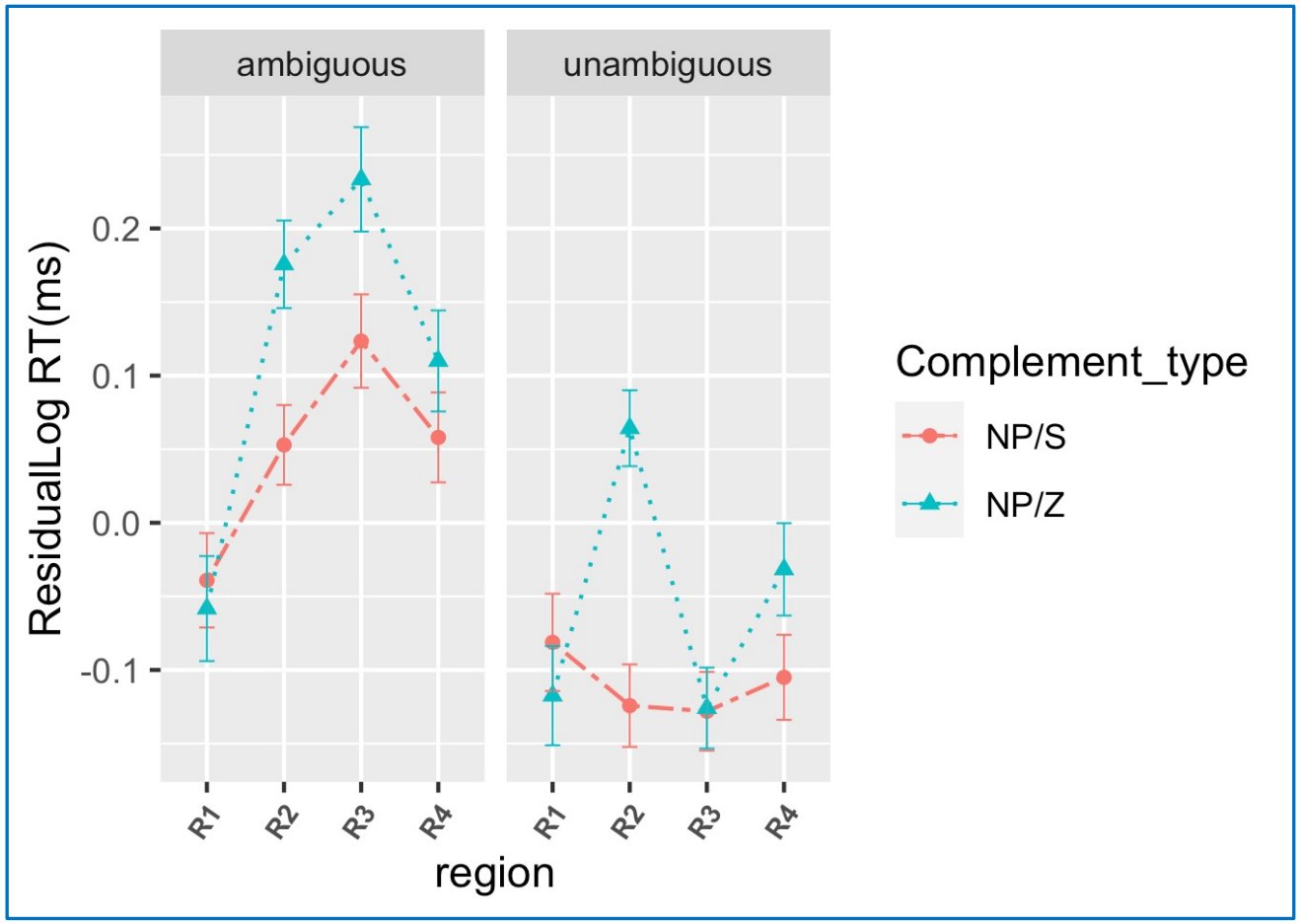
L1 results



Results:

1. Main effects of ambiguity and complement type
   - Unambiguous sentences were read faster their ambiguous counterparts (*β*=0.224, *SE*=0.039, *p<.0001*). NP/S sentences were read more quickly than NP/Z sentences (*β*=-0.124, *SE*=0.039, *p*=.0016)
2. Interaction between complement type and ambiguity
   - NP/S sentences were read faster than NP/Z sentences only in the ambiguous condition (*β*=-0.194, *SE*=0.055, *p*=.0005)

L2 results



Results:

1. Main effects of ambiguity and complement type
   - Unambiguous sentences were read faster their ambiguous counterparts (*β*=0.31, *SE*=0.029, *p<.0001*). NP/S sentences were read more quickly than NP/Z sentences (*β*=-0.059, *SE*=0.030, *p*=.0445)
2. Interaction between complement type and ambiguity
   - NP/S sentences were read faster than NP/Z sentences only in the ambiguous condition (*β*=-0.117, *SE*=0.042, *p*=.0054)
3. Proficiency modulated only the overall RTs but not the extent to which learners were sensitive to structural properties (*β*=0.044, *SE*=0.018, *p*=.0137)

Conclusion

- 1) Is processing difficulty at disambiguation greater in NP/Z ambiguity than in NP/S ambiguity for L1 and L2 learners?

YES

- 2) Do L1 and L2 learners equally show sensitivity to verb-related structural properties during L2 sentence processing?
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YES

- 3) Does proficiency modulate learners' sensitivity to verb properties?

NO

Future research

a. Eye-tracking with overt measures (e.g., regressive eye movements) for reanalysis.
b. Comprehension questions following test sentences added to explicitly capture reanalysis.
c. Statistical distribution of verb complement examined in learner corpora.

Thank you

- All the verbs are biased toward the NP reading, only when can it be ensured that sentences will be initially misanalysed, because reanalysis is assumed to occur after misanalysis.

- Reanalysis is the research focus