

Structural frequency affects processing cost: Evidence from Chinese relative clauses

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1. TWO COMPETING EXPLANATIONS FOR RELATIVE CLAUSE PROCESSING

a. Frequency-based accounts:

Rare continuations are more difficult to process than frequent ones. (Jurafsky, 1996; Hale, 2001; Levy, 2008)

b. Retrieval-based accounts:

Retrieving a distant constituent is more difficult than retrieving a local one. (Gibson, 2000; Lewis & Vasishth, 2005)

2. CHINESE RELATIVES

The facts

The gap-head distance is shorter in ORs than in SRs.

Corpus counts show that SRs are more frequent. (Hsiao & Gibson, 2003)

Predictions

Frequency-based accounts:

SR advantage in the RC region, the relativizer, the head noun and possibly beyond.

Retrieval-based accounts:

OR advantage at the head noun and possibly beyond.

Experimental evidence

The evidence is conflicting. There are studies showing an SR advantage but others showing an OR advantage.

Open problem

There are several temporary ambiguities in Chinese relatives that might induce garden-path effects.

How can we syntactically eliminate these ambiguities when testing out-of-context Chinese relatives?

3. FOUR OUT-OF-CONTEXT CONDITIONS

A. Subject-modifying Subject Relative:

Na ge zuowan zou le fuwusheng yi dun de guke jian guo laoban ...
 DET CL last.night hit ASP waiter one CL REL customer see ASP boss ...
 "That customer who hit the waiter last night had seen the boss before ..."

B. Subject-modifying Object Relative:

Na ge zuowan fuwusheng zou le yi dun de guke jian guo laoban ...
 DET CL last.night waiter hit ASP one CL REL customer see ASP boss ...
 "That customer who the waiter hit last night had seen the boss before ..."

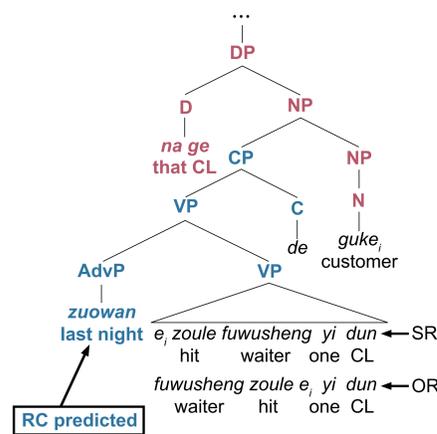
C. Object-modifying Subject Relative:

Laoban jian guo na ge zuowan zou le fuwusheng yi dun de guke ...
 boss see ASP DET CL last.night hit ASP waiter one CL REL customer ...
 "The boss had seen that customer who hit the waiter last night before ..."

D. Object-modifying Object Relative:

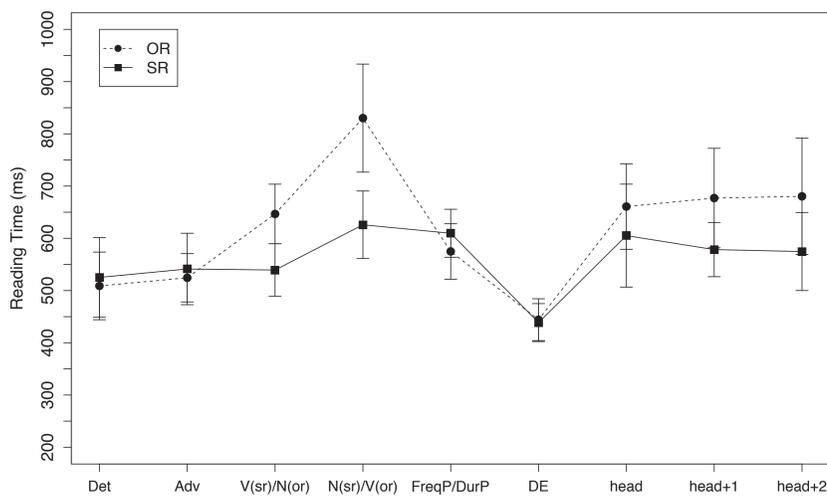
Laoban jian guo na ge zuowan fuwusheng zou le yi dun de guke ...
 boss see ASP DET CL last.night waiter hit ASP one CL REL customer ...
 "The boss had seen that customer who the waiter hit last night before ..."

4. HOW THE RC IS SYNTACTICALLY DISAMBIGUATED

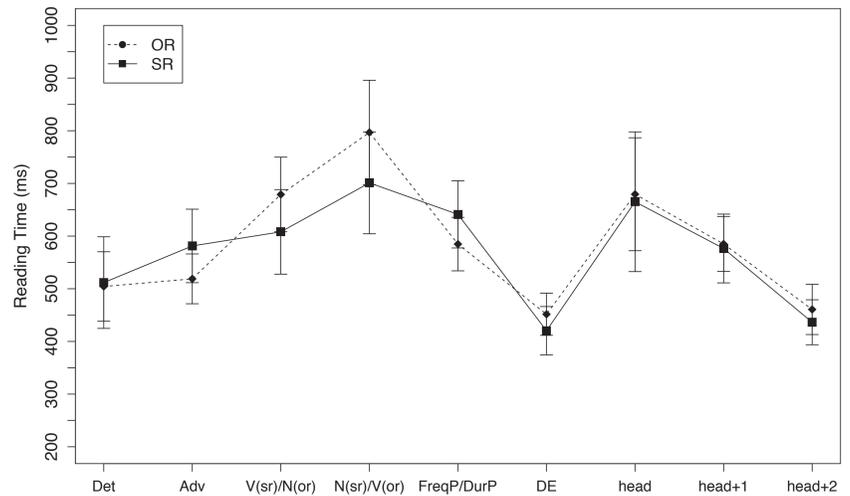


- ▶ In all conditions, the temporary ambiguities are eliminated by inserting Det+CL followed by an AdvP at the onset of the RC;
- ▶ A postverbal frequency/durational phrase eliminates the ambiguity of the relativizer "de" being analyzed as a possessive marker;
- ▶ The fully crossed design tests SRs and ORs in both subject- and object-modifying positions.

5. RESULTS (SELF-PACED READING, N=49): SUBJECT RELATIVE ADVANTAGE



(a) Subject-modifying Relative Clauses, 95% CIs



(b) Object-modifying Relative Clauses, 95% CIs

Question-response latencies: OR slower than SR in subject-modifying conditions ($t=2.17$).

RC region (V+N / N+V): Faster reading times in SRs in both subject-modifying ($t=3.85$) and object modifying conditions ($t=3.24$).

Head noun: Marginally significant SR advantage ($t=2.0$) in subject modifications.

Spillover region: Two words after the head, there is an SR advantage ($t=2.79$) in subject modifications and a main effect of modification ($t=-5.22$) with subject-modifying RCs being read faster.

6. DISCUSSION

- ▶ To our knowledge, this is the first experiment that investigates out-of-context Chinese RCs without temporary ambiguities (a major problem in previous work).
- ▶ The SR advantage is found in the RC region before the head noun in both subject and object modifications.
- ▶ At the head noun, this SR advantage becomes marginal but reaches significance again two words downstream in the subject modifications.
- ▶ The SR advantage in the pre-head region is consistent with frequency-based accounts (Jurafsky, 1996; Hale, 2001; Levy, 2008), but can't be explained by memory retrieval or storage costs (Gibson, 2000; Hsiao & Gibson, 2003; Gibson & Wu, in press).
- ▶ The SR advantage at the head noun and the spillover region can be explained by frequency-based accounts, but is inconsistent with retrieval-based explanations (Hsiao & Gibson, 2003; Gibson & Wu, in press).

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