Locality Cost in Sentence Comprehension: Evidence from Chinese Relative Clauses

Zhong Chen[1] and Shravan Vasishth[2]

Cornell University, USA[1], Universität Potsdam, Germany[2]

zc77@cornell.edu, vasishth@uni-potsdam.de

I. Introduction: Structural Integration Cost and DLT

Gibson (1998, 2000) in his **Dependency Locality Theory** suggests that it is harder to integrate two dependents (such as an argument and a head, or a gap and a head) if the distance between them is increased by interposing a phrase that introduces a discourse referent such as a noun or a tensed verb. Much empirical evidence has emerged for this view. (Hsiao & Gibson, 2003; Warren & Gibson, 2005; Grodner & Gibson, 2005)

QUESTION: How to determine the structural integration cost?

- The number of **Discourse Referent** introduced; or
- The number of **Words**

We report results from a **Chinese Relative Clauses** experiment and show that

- Consistent with **DLT**: **Intervening discourse referents may be crucial**
- Inconsistent with **DLT**: **No Object Relative Clause Preference**

II. Our Method

To answer the question above, we investigate prenominal object relative clauses in Chinese. A self-paced reading study was conducted in Nanjing, China with 72 participants and 32 items presented in a counter-balanced manner; reading times were recorded at each segment (demarcated by |). Although subject relative clauses conditions cannot be used to compare the change of the structure integration cost, they are also shown to participants in order to obtain an overall comparison between **OR** versus **SR** preferences at the head noun.

8 conditions we use are shown below where DE indicates a RC in Chinese and de denotes an adjective or a PP as attributives.

- Condition B: **OR**; **Adjective** intervener (with no discourse referent intervener)
- Condition D: **OR**; **Prepositional Phrase** intervener (with a discourse referent intervener)
- Condition A and C: **OR**; Control conditions (keeps constant the position of the head noun)
- Condition E–H: **SR**; all with intervener; used to compare SR/OR preference

Conditions on Chinese Relative Clauses

A. OR, no intervener:

adj	subj	verb	**GAP**	DE	**obj**	...
chese de	jiaoshou	renshi	**GAP**	DE	**zuojia**	...
outstanding	professor	know	**GAP**	DE	**writer**	...

"the writer who the outstanding professor knows..."

B. OR, adjective intervener:

subj	verb	**GAP**	DE	adj	**obj**	...
jiaoshou	renshi	**GAP**	DE	chese de	**zuojia**	...
professor	know	**GAP**	DE	outstanding	**writer**	...

'the outstanding writer who the professor knows..."

C. OR, no intervener:

PP	subj	verb	**GAP**	DE	**obj**	...
che li de	jiaoshou	renshi	**GAP**	DE	**zuojia**	...
car in	professor	know	**GAP**	DE	**writer**	...

"the writer who the professor in the car knows..."

D. OR, PP intervener:

subj	verb	**GAP**	DE	PP	**obj**	...
jiaoshou	renshi	**GAP**	DE	che li de	**zuojia**	...
professor	know	**GAP**	DE	car in	**writer**	...

"the writer in the car who the professor knows..."

E. SR, adjective not modifying head-noun:

GAP	verb	adj	obj	DE	**subj**	...

F. SR, adjective modifying head-noun:

GAP	verb	obj	DE	adj	**subj**	...

G. SR, PP not modifying head-noun:

GAP	verb	PP	obj	DE	**subj**	...

H. SR, PP modifying head-noun:

GAP	verb	obj	DE	PP	**subj**	...

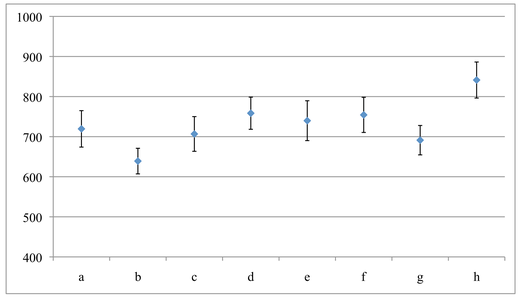
III. Results

A linear mixed model (Bates & Sarkar, 2007) was fitted with items and participants as crossed random effects; PP insertion and adjective insertion were treated as fixed effects, coded as orthogonal centered contrasts (the baseline conditions A and C were coded -1, and the intervener conditions B and D as 1). The analysis was carried out on log reading times after removing all RTs greater than 2000 ms from the data (6% of the data was excluded as a result) these data points were removed because an initial model with the full data yielded highly skewed residuals. Moreover, the centered log reading time at the region preceding the critical one was also taken as a predictor of the RT at the critical region; this was done in order to control for the possibility of differential spillover effects from the preceding regions (Mitchell, 1984), (Vasishth & Lewis, 2006).

The results of the analysis as well as the mean RT (ms) of the head noun for all 8 conditions are summarized below. Standard errors are illustrated as error bars.

Analysis Results

Contrast	Estimate	Std Error	t value
OR Adjective Insertion (A vs B)	-0.0128	0.0170	-0.75
OR PP Insertion (C vs D)	0.037694	0.017225	2.19 *
Preceding Region RT	0.260078	0.018966	13.71 *
OR vs SR (ABCD vs EFGH)	0.0077	0.0086	0.90



Mean reading times (ms) at the critical region (head noun) for 8 conditions

Consistent with the locality theory of Gibson (2000), interposing an adjective did not increase reading time at the head noun (t=-0.75), whereas interposing a PP resulted in longer reading time at the head noun (t=2.19, p<0.05). We also found a significant OR-advantage as predicted by **DLT** (t=2.25, p<0.05), but this effect was no longer significant once we took spillover from the preceding region into account (t=0.90, n.s.). The RT from the preceding region is a significant predictor of RT at the head noun (t=13.71).

IV. Conclusions

- Consistent with **DLT**: The cost of introducing a discourse referent may be a critical component that determines the difficulty of completing a head-dependency relationship.
- Inconsistent with **DLT**: No OR preference is found after we take spillover effects of the preceding region of the head into consideration.

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