

Does the parser exclusively use structure-sensitive search in reflexives? Evidence from Mandarin Chinese

Much recent work (Xiang et al. 2009, Phillips et al. to appear, Dillon et al. submitted) has argued, *inter alia*, that the human parsing mechanism employs an intelligent search process that uses grammar-based constraints. For example, in (1) the reflexive *herself* resolves to the c-commanding antecedent *woman* ('grammatically accessible' antecedent) without experiencing any confusion due to the noun *Katie*, which matches *herself* in gender marking but does not c-command it. As Phillips et al. (to appear) put it: "we tentatively suggest that argument reflexives are immune to interference from structurally inaccessible antecedents because antecedents are retrieved using only structural cues".

Although the parser may use an intelligent search process using structural cues, the retrieval process is also subject to interference arising from cue-based retrieval difficulty (Lewis & Vasishth 2005). I.e., a grammatically inaccessible noun like *Katie* in (1) would cause increased difficulty in resolving the antecedent of the reflexive, due to the gender match between the reflexive and the inaccessible noun.

Support for the Phillips et al. structure-sensitive search view is necessarily based on null results, usually with small sample sizes (low power). An obvious question is: would interference effects emerge if power were high enough? Using a larger sample size (n=120), we investigated the opposing claims of the structure-sensitive-search versus the cue-based retrieval account in a self-paced reading study.

In Chinese structures like (2), the noun phrase *fanduipai-lingxiu* 'the opposition leader' is the only legal antecedent for the reflexive *ziji*, 'self' (which requires an animate antecedent). In Chinese the antecedent is not necessarily clause-bound (2a,b). Under the structure-sensitive search view, the parser should never consider an intervening noun like *kangyizhe*, 'protester', as an antecedent because it is inside an adverbial phrase and cannot c-command the reflexive *ziji*; this predicts no reading time difference between cases where the intervening noun is *kangyi* 'protest' (2a,c) versus *kangyizhe* 'protestor' (2b,d). By contrast, the cue-based retrieval account predicts slower reading time in (2b,d) versus (2a,c).

The reading times and results of statistical analyses at the critical region (the reflexive *ziji*) and post-critical region (spillover region) are presented in Table 1 and 2. We replicated the locality effect of *ziji* reported by Dillon et al. (submitted) suggesting that the parser prefers the local antecedent over the non-local one. We also found an interference effect as predicted by the cue-based retrieval account, and inconsistent with the exclusively-structure-sensitive search account: interference caused slowdowns at *ziji* and the word following it (in 2a,c vs b,d). These results suggest that, although the parser may well consult grammatical constraints when resolving dependencies, i.e., the parser may rely on the structure-sensitive search, cue-based retrieval interference is unavoidable due to a partial feature match (here, animacy match) between the intervening noun and the reflexive.

(1) The woman that {Fred|Katie} treated in the military hospital introduced herself to all the nurses.

(2) **a. Long-distance, no interference:**

fanduipai-lingxiu_i ... [zhege-shengming [zai kangyi shikong de-shihou] ... ziji_i ...]
 opposition-leader ... [this-announcement [at protest out of control time] ... ziji ...]

‘The opposition leader indicated that this announcement warned his party members when the protest was out of control.’

b. Long-distance, high interference:

fanduipai-lingxiu_i ... [zhege-shengming [zai **kangyizhe** shikong de-shihou] ... ziji_i ...]
 opposition-leader ... [this-announcement [at **protestor** out of control time] ... ziji ...]

‘The opposition leader indicated that this announcement warned his party members when the protester was out of control.’

c. Short-distance, no interference:

zhege-shengming ... [fanduipai-lingxiu_i [zai kangyi shikong de-shihou] ... ziji_i ...]
 this-announcement ... [opposition-leader [at protest out of control time] ... ziji ...]

‘This announcement indicated that the opposition leader warned his party members when the protest was out of control.’

d. Short-distance, high interference:

zhege-shengming ... [fanduipai-lingxiu_i [zai **kangyizhe** shikong de-shihou] ... ziji_i ...]
 this-announcement ... [opposition-leader [at **protestor** out of control time] ... ziji ...]

‘This announcement indicated that the opposition leader warned his party members when the protester was out of control.’

Table 1: Reading times at the critical and post-critical region

	a	b	c	d	Differences:
ziji	410.1	447.9	410.6	414.8	b-a: 37.8 ms d-c: 4.2 ms
ziji+1	371.1	387.6	362.5	371.9	b-a: 16.5 ms d-c: 9.4 ms

Table 2: Linear mixed model with participants and items as crossed random factors.

	contrast	coef	se	t		contrast	coef	se	t
	Locality	-0.0319	0.0158	-2.0*		Locality	-0.02367	0.01046	-2.3*
ziji	Interference	0.0268	0.0158	1.7	ziji+1	Interference	0.02349	0.01046	2.3*
	Loc x Int	-0.0220	0.0158	-1.4		Loc x Int	-0.00987	0.01046	-0.9

References:

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