Classifier as a cue for structure building in head-final relative clause

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Previous studies have suggested a predictive mechanism for relative clause (RC) processing in languages that have a head-final RC structure, like Japanese (Yoshida et al., 2004) and Mandarin Chinese (Hsu, 2006; Wu, 2009). However, it still remains unknown what type of information the parser utilizes to anticipate the structure of an upcoming RC and how detailed such structure building is before receiving information from the head noun directly. To address this, we investigated how the semantic information provided by different classifiers (CL) in Mandarin Chinese (human, non-human, general) guides structure building of upcoming RCs.

Chinese "classifier + transitive verb" sequences are temporarily ambiguous between a subject gapped RC (1a) and a (null subject) object gapped RC construction (1b). Although the parser is bias to adopt a subject RC analysis, semantic cues of a CL may be used to guide which of these two RC structures is initially adopted. Non-human CLs in particular may guide the parser away from a subject RC analysis by indicating that the head noun is unlikely to be an eligible subject for a subject RC. We predicted that this should facilitate the analysis of a null subject RC. With human and general CLs, the parser may be more likely to assume a subject gap and expect a noun to fill the object position. This predicts reading disruption upon encountering an unexpected relativizer and head noun. In a series of studies, CL type was manipulated to examine whether the parser uses CL type to predict the gap site in a head-final RC.

Sentence completion: A sentence completion survey (N=439) was conducted online to investigate the parser's bias for subject RC and null subject object RCs. The results suggest that the mismatch between a dislocated CL and following verb guides the parser to a RC structure (88.7%) and the RC type is influenced by the CL type. Human CLs produce an overwhelming preference for subject-gapped RC (92.2%). General CLs also elicit a subject-gapped preference (71.4%). Non-human CLs, however, produce more object-gapped RC (85.9%).

Eye-tracking: Verbs and head nouns were selected based on the responses in the completion study and used as stimuli in an eye-tracking while reading experiment (N=42). Using general CL as baseline, results of linear mixed effect model show reading facilitation with non-human CL at the relativizer region in first fixation (Est=-12.24 ms, t=-2.399, $p<0.05$), first pass (Est=-14.17 ms, t=-2.545, $p<0.05$), go past (Est=-39.38 ms, t=-2.077, $p<0.05$) and total fixation (Est=-48.62 ms, t=-4.139, $p<0.001$). Human CL show greater reading disruption compared with general CL in go pass reading (Est=66.30 ms, t=3.499, $p<0.01$) and total fixation time (Est=46.59 ms, t=3.969, $p<0.001$). These effects are largely recapitulated at the head noun region. In non-human CL condition, facilitation is significant in go past reading (Est=-58.27 ms, t=-2.842, $p<0.01$) and total fixation (Est=-81.35 ms, t=-3.314, $p<0.01$). For human CL, disruption is significant in first pass reading (Est=14.33 ms, t=2.326, $p<0.05$), go past reading (Est=86.64 ms, t=4.310, $p<0.001$) and total fixation (Est=58.67, t=2.39, $p<0.05$).

Self-paced reading: We extended the results using self-paced reading, keeping the head nouns as the same across different conditions by separately comparing non-human CL vs. general CL(N=43) and human CL vs. general CL(N=40). Both human and non-human conditions show reading disruptions at the verb (Est=35.08 ms, t=2.898, $p<0.01$; Est=30.37 ms, t=2.892, $p<0.01$), suggesting greater mismatch between the CLs and the verb. In human CL condition, disruptions continue in relativizer (Est=24.71 ms, t=2.413, $p<0.05$) and head noun (Est=37.16 ms, t=2.75, $p<0.01$) while in non-human CL condition, reading was facilitated at the relativizer (Est=-36.93 ms, t=-3.916, $p<0.001$) and the head noun (Est=-47.27 ms, t=-4.941, $p<0.001$).

Conclusion: The results indicate that the semantic properties of CLs can help parser to make structural predictions in head-final RC processing before accessing the head noun. In particular, non-human CLs guide the parser away from preferred subject-gapped RC structure, facilitating a null subject object-gapped analysis.

(1) a. 那 个 扔掉 垃圾 的 小孩 得到 了 表扬。 (subj RC)
That CL throw rubbish REL child receive PERF praise
That child who threw rubbish received praise.

b. 那 个 扔掉 的 娃娃 变得 脏兮兮的 了。 (obj RC + null subj)
That CL throw REL doll become dirty PERF
That doll which (someone) threw away became dirty.

Sentence completion: Example stimuli:

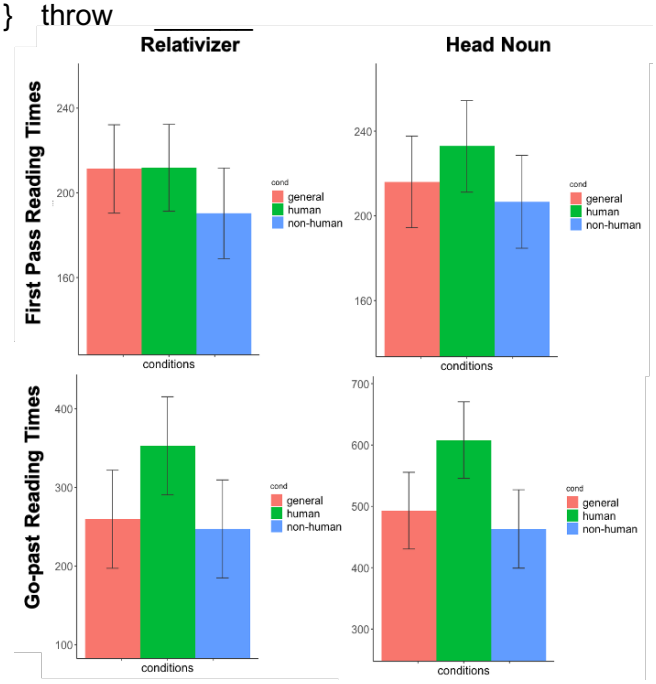
那 { 个 / 名 / 张 } 扔掉 _____
That { General.CL/ Human.CL / Nonhuman.CL } throw _____

Eye-tracking:

a. Human classifier condition:
那 名 捡到 **的** **孩子** 已经 醒过来 了。
That CL find **REL child** already awake PERF
The child that (someone) found is already awake.

b. General classifier condition:
那 个 捡到 **的** **硬币** 已经 脏兮兮的 了。
That CL find **REL coin** already dirty PERF
The coin that (someone) found is dirty.

c. Non-human classifier condition:
那 张 捡到 **的** **银行卡** 已经 还给 失主 了
That CL find **REL card** already return owner PERF
The credit card that (someone) found has already been returned to its owner



Self-paced reading:

Non-human vs. general classifier

a. Non-human classifier condition:
那 **条** 忽略 的 线索 是 破 案 的 关键。
That **CL** ignore REL clue is solve case POSS. key
The clue that (someone) ignored is the key to solve the case.

b. General classifier condition:
那 个 忽略 的 线索 是 破 案 的 关键。
That **CL** ignore REL clue is solve case POSS. key
The clue that (someone) ignored is the key to solve the case.

Human vs. general classifier

c. Non-human classifier condition:
那 **名** 忽略 的 证人 是 破 案 的 关键。
That **CL** ignore REL passerby is solve case POSS. key
The passerby that (someone) ignored is the key to solve the case.

d. General classifier condition:
那 个 忽略 的 证人 是 破 案 的 关键。
That **CL** ignore REL passerby is solve case POSS. key
The passerby that (someone) ignored is the key to solve the case.