

Effects of Structural and Semantic Prominence on Online Pronoun Resolution in Mandarin-Speaking Adults and Children Aged 9 to 11

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Background. Prior eye-tracking studies in adults [1] and in children [2,3] have shown that online pronoun interpretation is influenced by both structural prominence (e.g., first-mention bias) and semantic prominence (e.g., implicit causality, IC). Although adult studies suggest that IC information can be activated very early in comprehension, prior work has not clearly separated anticipatory processing after the causal marker from cue integration triggered by the ambiguous pronoun itself, nor established whether children show an adult-like pattern across these stages. In the present study, this issue was addressed by comparing adults and children in the online processing of sentences in which the causal marker *yinwei* 'because' was separated from the ambiguous pronoun *ta* 'he/she/it' (see Examples 1–4).

Methods. This study investigated whether Mandarin-speaking 9- to 11-year-olds ($n=51$, $M=118$ months, $SD=9.9$) differ from adults ($n=38$) in using structural and semantic prominence cues in a web-based visual-world eye-tracking paradigm. For IC verbs, we included six NP1-biased Stimulus–Experiencer (SE) verbs and six NP2-biased Experiencer–Stimulus (ES) verbs. Subject fixations were analysed in two time windows: (1) from the offset of *yinwei* 'because' to pronoun onset, and (2) from pronoun offset to the onset of the disambiguating NP. In each window, cluster-based permutation (CPA) analyses were conducted on 100-ms bin-wise mixed-effects models testing Condition, Group, and their interaction.

Results. Adults showed clear condition differentiation in both windows, with greater looks to NP1 in the SE than in the ES condition. The CPA confirmed a reliable negative effect of Condition (i.e., reduced looks to the subject in the ES condition relative to the SE condition) in Window 1 (700–2200ms after *yinwei* offset; cluster mass=192, $p<.001$) and Window 2 (1000–1900ms after pronoun offset; cluster mass=121, $p<.001$). Children showed only limited condition differentiation in Window 1, with a brief negative effect of Condition late in the window (1500–1600ms; cluster mass=14.1, $p=.008$), but a clearer and more sustained effect in Window 2 (0–1300ms after pronoun offset; cluster mass=152, $p<.001$).

Conclusions. Overall, the results suggest that Mandarin-speaking adults used IC-based semantic cues anticipatorily after the causal marker and before pronoun onset, and that this condition-dependent bias continued after pronoun offset. Children, by contrast, showed only limited pre-pronoun differentiation, with clearer condition-based divergence emerging only after the pronoun. These findings suggest a less predictive use of semantic cues in children than in adults during online pronoun resolution.

References

- [1] Järvikivi, J., Van Gompel, R. P., & Hyönä, J. (2017). The interplay of implicit causality, structural heuristics, and anaphor type in ambiguous pronoun resolution. *Journal of psycholinguistic research*, 46(3), 525-550.
- [2] Pyykkönen, P., Matthews, D., & Järvikivi, J. (2010). Three-year-olds are sensitive to semantic prominence during online language comprehension: A visual world study of pronoun resolution. *Language and Cognitive Processes*, 25(1), 115-129.
- [3] Blything, L. P., Azpiroz, M. I., Allen, S., Hert, R., & Järvikivi, J. (2022). The influence of prominence cues in 7- to 10-year-olds' pronoun resolution: Disentangling order of mention, grammatical role, and semantic role. *Journal of Child Language*, 49(5), 930-958.

Figure 1 (left). E-logit-transformed looks to NP1 and NP2 in the SE and ES conditions for adults and children in Window 1. Time 0 ms represents the offset of *yinwei* 'because'.
Figure 2 (right). E-logit transformed looks to NP1 in the SE and ES condition for adults and children in Window 1. Time 0ms represents the offset of *yinwei* 'because'. Shaded areas indicate significant clusters identified by the CPA.

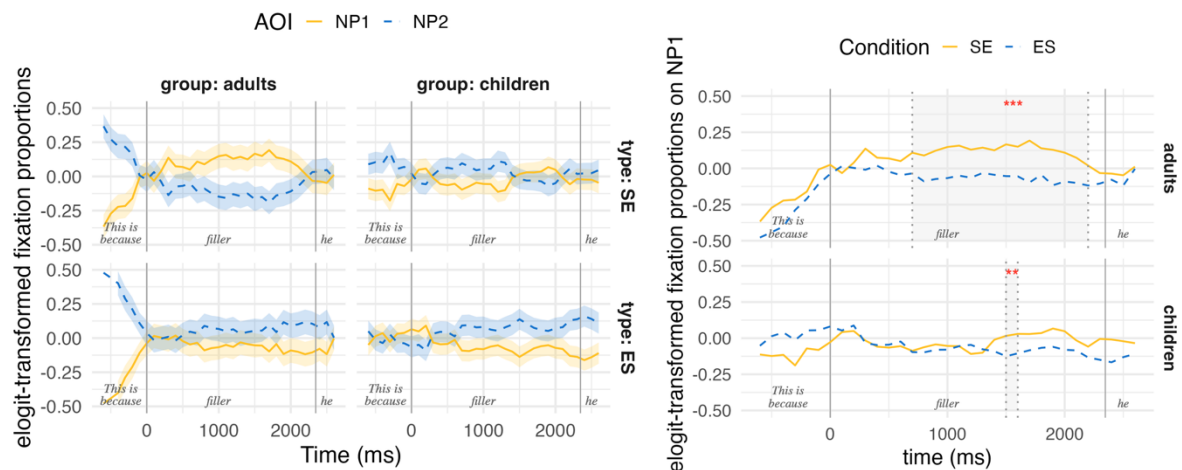
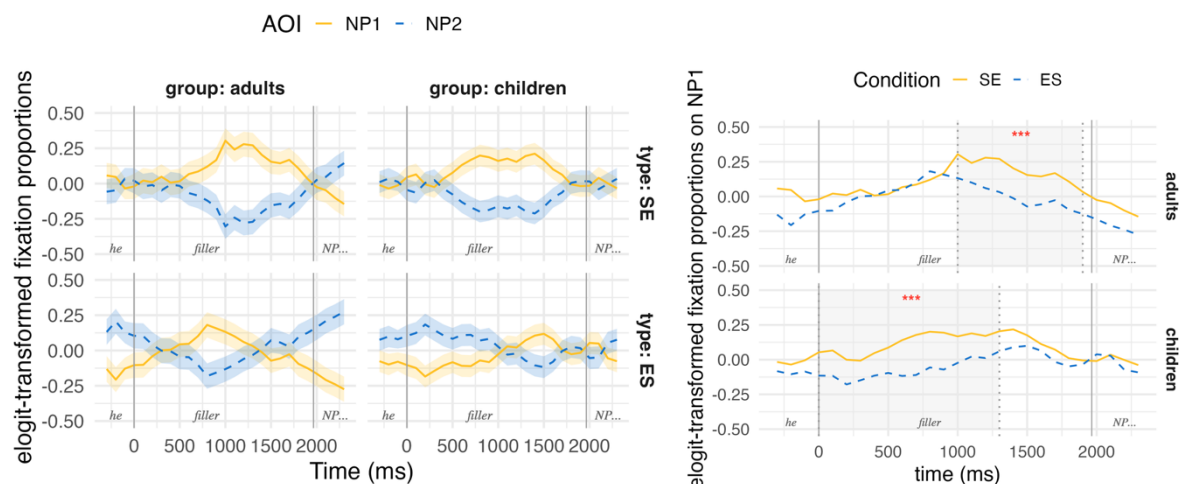


Figure 3 (left). E-logit-transformed looks to NP1 and NP2 in the SE and ES conditions for adults and children in Window 2. Time 0 ms represents the offset of the pronoun *ta*.
Figure 4 (right). E-logit transformed looks to NP1 in the SE and ES condition for adults and children in Window 2. Time 0ms represents the offset of the pronoun *ta*. Shaded areas indicate significant clusters identified by the CPA.



Sample experimental sentences

(1) NP1-biased SE Verbs with congruent NP1 reference:

小猫逗笑了兔子。这是因为，刚才上课前，它花了半个小时给兔子讲笑话。

Xiaomao	douxiao-le	Tuzi.
Cat	amuse-PFV	Rabbit

Zheshi	yinwei	gangcai	shangke	qian,
this is	because	just now	take-class	before

ta	hua-le	ban-ge	xiaoshi	gei	Tuzi	jiangxiaohua
it	spend-PFV	half-GE	hour	to	Rabbit	tell jokes

'The cat amused the rabbit. This is because, just before class, he spent half an hour telling the rabbit jokes.'

(2) NP1-biased SE Verbs with incongruent NP2 reference:

小猫逗笑了兔子。这是因为，刚才上课前，它花了半个小时听兔子讲笑话。

Xiaomao	douxiao-le	Tuzi.
Cat	amuse-PFV	Rabbit

Zheshi	yinwei	gangcai	shangke	qian,
this is	because	just now	take-class	before

ta	hua-le	ban-ge	xiaoshi	ting	Xiaomao	jiangxiaohua
it	spend-PFV	half-GE	hour	listen	Cat	tell jokes

'The cat amused the rabbit. This is because, just before class, he spent half an hour listening to jokes told by the cat.'

(3) NP2-biased ES condition with congruent-NP2 reference:

小猫讨厌兔子。这是因为，刚才上课前，它花了半个小时讲小猫的坏话。

Xiaomao	taoyan	Tuzi.
Cat	dislike	Rabbit

Zheshi	yinwei	gangcai	shangke	qian,
this is	because	just now	take class	before

ta	hua-le	ban-ge	xiaoshi	jiang	Xiaomao-de	huaihua.
it	spend-PFV	half-GE	hour	say	Cat-DE	bad word

'The cat dislikes the rabbit. This is because, just before class, he spent half an hour badmouthing the cat.'

(4) NP2-biased ES condition with incongruent-NP1 reference:

小猫讨厌兔子。这是因为，刚才上课前，它花了半个小时听兔子的坏话。

Xiaomao	taoyan	Tuzi.
Cat	dislike	Rabbit

Zheshi	yinwei	gangcai	shangke	qian,
this is	because	just now	take class	before

ta	hua-le	ban-ge	xiaoshi	ting	Tuzi-de	huaihua.
it	spend-PFV	half-GE	hour	listen	Rabbit-DE	bad word

'The cat dislikes the rabbit. This is because, just before class, he spent half an hour listening to bad words about Rabbit.'