Phase c-command and cataphora resolution in Chinese

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Introduction This study examines whether the *phase c-command principle* (e.g., Huang&Lin'21), according to which <u>coreference is disallowed when a pronoun phase c-commands its co-indexed referent</u>, strictly constrains real-time cataphora resolution in Chinese. We test whether structural cues are prioritized relative to semantic (gender) cues during the early and late processing stages, a foundational issue that is still debated (e.g., Badecker&Straub'02; Sturt'03; Chow et al.'14).

To this end, self-paced reading (Exp.1) and reading eye-tracking (Exp.2) methods were used to probe the processing of cataphoric pronouns in Chinese. To preview the results, we find that the phase-c-command principle strictly guides cataphora resolution at the *early* processing stages but can be defeated at *later* stages, supporting a 'defeasible filter' account (e.g., Sturt'03).

Methods In the self-paced reading (Exp.1, N = 68) and reading eye-tracking (Exp.2, N = 52) experiments, the factors *Structure* (Licensed/Unlicensed) and *Gender* (Match/Mismatch) were crossed in 2x2 factorial design. See ex.(1). In the Licensed structure, the cataphoric pronoun does not phase c-command its potential postcedent ('antecedent' that follows a pronoun), which means that cataphoric binding is allowed (by the phase c-command principle); in the Unlicensed structure, the pronoun phase c-commands its postcedent, rendering coreference illicit. The factor *Gender* refers to gender congruency (match/mismatch) between the pronoun and the postcedent.

If cataphoric binding is attempted (regardless of whether or not the structural constraint allows it), we expect reading slowdowns when the genders of the pronoun and the postcedent do not match, which is called "**the gender mismatch effect**". Exp.1 and Exp.2 share the same 24 target items (and 36 fillers in Exp.1; 48 fillers in Exp.2). In Exp.1, we also probed native Chinese speakers' post-reading interpretation of the pronoun (but not reported here due to space).

Results Mixed effects linear regressions (*lmer* in R) were run over reading times (RTs). **Fig.1** shows RTs in Exp.1. Prior to the critical postcedent ('boy') region, Unlicensed conditions (object relative clauses) were harder to process – longer RTs – than Licensed conditions (subject RCs) at 'scold' and DE, which is expected (i.e., subject RC processing advantage) but not crucial to our purposes. At the postcedent, a *Structure* x *Gender* interaction reaches significance ($p < 0.01$) as the gender mismatch effect emerges only in the Licensed conditions ($p < 0.001$) but not in the Unlicensed conditions. This suggests that initially the phase c-command principle constrains real-time cataphora resolution. Intriguingly, at the following spillover region (e.g., 'in-classroom'), a *reversed gender mismatch effect* appears for the Unlicensed conditions. Following prior work (e.g., Kazanina et al.'10; Kush & Dillon'21), we posit that at a somewhat later stage, the structural constraint (i.e., phase c-command principle) may compete with (or do not have absolute priority over) the semantic cue (i.e., gender match), which leads to processing difficulties.

The eye-tracking Exp.2 aims to provide more information on native speakers' processing profiles using a more natural reading task. Four eye-tracking measures – first fixation time, first pass duration, regression path duration, total reading time – were analyzed (see **Fig.2** for RTs at the critical region 'boy'). Similar to our findings in Exp.1, at the early processing stages, a *Structure* x *Gender* interaction appears ($p < 0.05$), and gender mismatch only leads to reading slowdowns in the Licensed conditions ($p < 0.05$). This echoes our findings for Exp.1 that, early on, the structurally inaccessible referent in the Unlicensed conditions does not impact cataphora resolution (despite gender (mis)match). A similar interaction also characterizes the total reading times, reflecting later processing stages. (No reversed gender mismatch effect has been found in Exp.2; RTs related to relative clause processing are not discussed here.)

Conclusion This study provides converging evidence from self-paced reading and eye-tracking tasks that the phase c-command principle strictly guides real-time cataphora resolution in Chinese at least during the early processing stages. At later processing stages, the phase c-command principle may be defeasible, as suggested by the results of in Exp.1, whose results are more in line with the *defeasible filter hypothesis* (e.g., Sturt'03).

(1) Example of target set in Exp.1-2 (BEI is a passive marker; DE is a complementizer; subscripts indicate regions for analysis in self-paced reading and eye-tracking experiments):
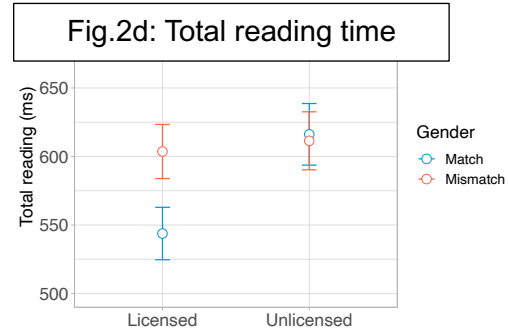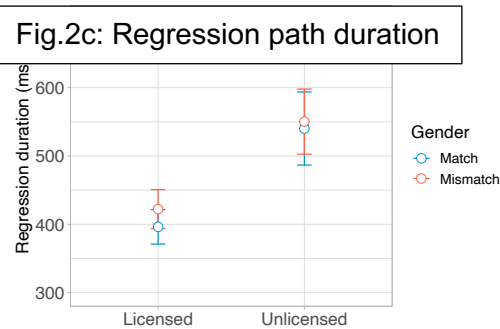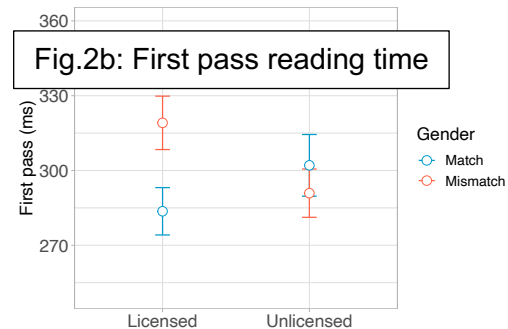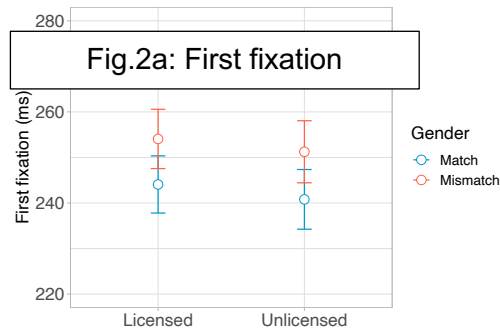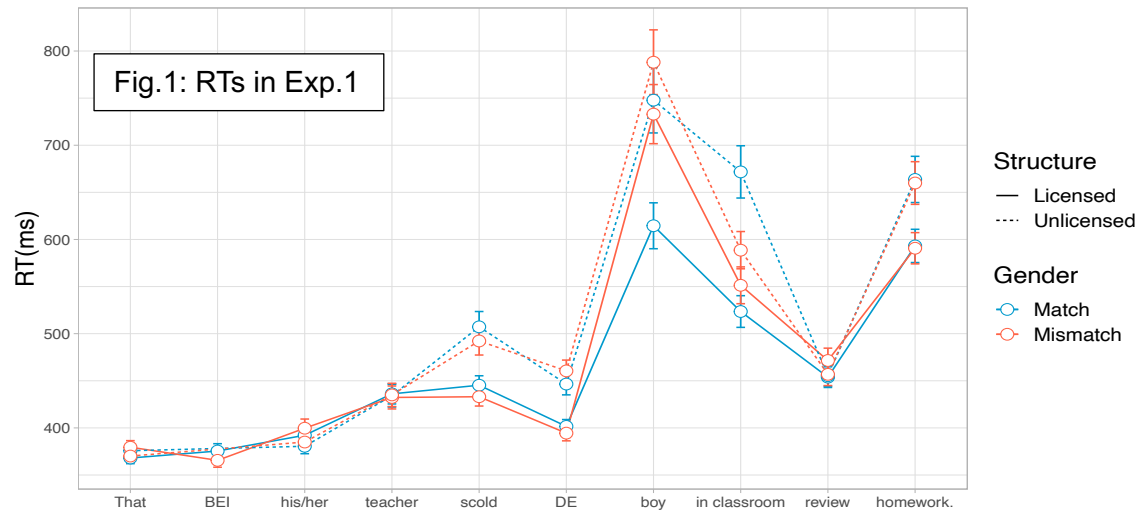
a. Licensed (pronoun does not phase c-command 'boy'; cataphoric binding is grammatical)
That-CL$_1$ [$_{SRC}$ ___BEI$_2$ his/her$_3$ teacher$_4$ scold$_5$ DE$_6$] boy$_7$ in-classroom$_8$ review$_9$ homework.$_{10}$

b. Unlicensed (pronoun phase c-commands 'boy'; cataphoric binding is not grammatical)
That-CL$_1$ [$_{ORC}$ his/her$_3$ teacher$_4$ scold$_5$ ___DE$_6$] boy$_7$ in-classroom$_8$ review$_9$ homework.$_{10}$
'That boy {who was scolded by his/her teacher, who his/her teacher scolded} was reviewing…'

Fig.1: RTs in Exp.1

Fig.2a: First fixation

Fig.2b: First pass reading time

Fig.2c: Regression path duration

Fig.2d: Total reading time

Selected references

Badecker & Straub'02. The processing role of structural constraints on the interpretation of pronouns and anaphors. Chow et al.'14. Immediate sensitivity to structural constraints in pronoun resolution. Huang & Lin'21. Quantificational binding without surface c-command in Mandarin Chinese. Sturt'03. The time-course of the application of binding constraints in reference resolution.