Reflexive Reference Resolution in Mandarin: An Eye-tracking Study

Matthew Ganquan SHI[1]; Chin-Lung YANG[1]; Haihua PAN[1]

[1]The Lab of Theoretical Psycholinguistics, Dept of Linguistics & Modern Languages, CUHK

Introduction

- Mandarin reflexive pronouns ***ta-ziji*** **'him-/her-self'**, ***ziji*** **'self'** do not strictly obey Chomskyan Binding Condition A (BCA) (Chomsky, 1981) and they permit long-distance binding (LDB) (Pan, 1997, 1998; Pan & Hu, 2003; Tang, 1989), as in (1).

(1) *Zhāngsān$_i$ shuō zhè piān bàodǎo hài-le tā-zìjǐ$_i$/ zìjǐ$_i$.*
ZS say this CL report harm-ASP him-self self
'ZS$_i$ said that this report harmed (him)self$_i$.'

- More specifically, literature reports that the simple reflexive *ziji* is **more liberal** w.r.t. LDB than the complex *ta-ziji*, the latter considered to prefer structurally closest **animate/person** antecedent (Pan, 1998; Pan & Hu, 2003).

(2) *Zhāngsān$_i$ shuō Lǐsì$_j$ hài-le tā-zìjǐ$_{\#i/j}$/ zìjǐ$_{i/j}$.*
ZS shuō LS harm-ASP him-self self
'ZS$_i$ said that LS$_j$ harmed himself$_{\#i/j}$/ self$_{i/j}$.'

- However, this structural constraint of *ta-ziji* is not stringent and may be overridden, as in (3), where **a teacher-student relationship** reinforces LDB.

(3) *Lǐ **Lǎoshī**$_i$ shuō Yuēhàn$_j$ hài-le tā-zìjǐ$_{?i/j}$/ zìjǐ$_{i/j}$ de **xuéshēng**.*
Li teacher shuō John harm-ASP him-self self DE student
'Teacher Li$_i$ said John$_j$ harmed the student of himself$_{?i/j}$/ self$_{i/j}$.'

- Additionally, discourse factors like "logophoricity" have been suggested to modulate reflexive resolution, with reflexives **preferring the center of consciousness/perspective** (Culy, 1994; Kuno, 1972, 1987; Sells, 1987).
- In this project, we used the eye-tracking reading paradigm to **simulate natural reading** and to examine the role of two semantic/discourse factors in interpreting the reflexive *ta-ziji*: (a) **logophoric** contexts (**Logo**) and (b) **semantically** forced (non)local bindings by **V3** (**Locality**). (*See below*)
- **Why eye-tracking?**
  - Wang (2017) argues that *ta-ziji* tends to prefer LDB as evidenced in off-line processing, but the data lack temporal-sensitivity.
  - Previous research has explored the syntax-discourse interface in the online processing of English reflexives (Kaiser et al., 2009; Sturt, 2003a, 2003b), but rarely in the context of *ta-ziji*.

Research Questions

- Can the **semantics/discourse effects**, as manipulated by context, compete with the Binding Condition A in interpreting *ta-ziji*?
- If they can, at what stage do these effects manifest and how does their strength compare to BCA?

Materials and Experimental Design

Sample stimulus (adapted from Wang 2017):
'The {**carer**$_j$/**doctor**$_i$} {**said**/**saw**} that the {**doctor**$_i$/**carer**$_j$} helped a patient whom he himself$_{i/j}$ **diagnosed** today.'

Condition (Logo-Locality)					***Reflexive***	***Adv***	***V3*** *Disambiguating*		
H-local	護工 hùgōng carer	說 shuō say	醫生 yīshēng doctor	幫助了 bāngzhùle help	他自己 tā-zìjǐ him-self	今天 jīntiān today	診治 zhěnzhì diagnose	的 de DE	患者。 huànzhě patient
H-dist	醫生 yīshēng		護工 hùgōng						
L-local	護工 hùgōng	看到 kàndào see	醫生 yīshēng						
L-dist	醫生 yīshēng		護工 hùgōng						

NB-a: H = high logophoricity; L = low logo; Local = (forced) local binding; Dist = (forced) distant binding.
NB-b: The most embedded verb ***diagnose*** s-selects for the ***doctor*** as its subject, making it the only **felicitous** binder of the reflexive.

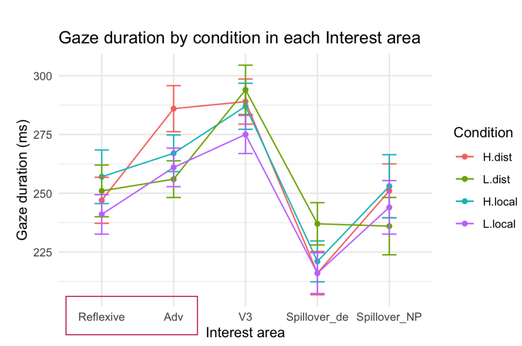
- **2x2 design**: 4 experimental trials per condition, & 112 stimuli per subject.
- **32 experimental items are created**, among which we leave out the 16 control items where the relative clause part '**Reflexive-Adv-V3**' is replaced by *ta-ziji*. Therefore, we have 16 experimental trials for analysis.
- **Logo**: Following Culy's (1994) logophoricity hierarchy of predicates, high logo verbs create a logophoric context.
  - The verb ***shuō*** **'say'** and its variants represent **H** ⇒LDB is preferred.
  - The verb ***kàndào*** **'see'** and its variants represent **L** ⇒no **Logo** effect.
- **Locality**: The post-reflexive verb (V3) disambiguates the antecedent choice and thus forces local (**Local**) or distant binding (**Dist**).
- **H-dist** and **L-local**: Two factors converge in the antecedent preference.
- **H-local** and **L-dist**: Two factors contrast.

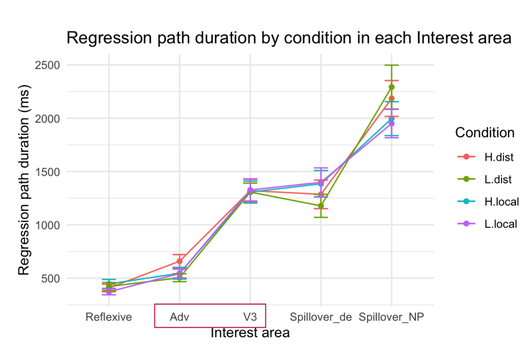
Predictions

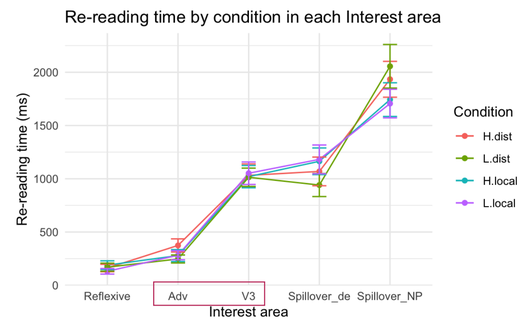
- **Effect of Logo**: The **high logo** is expected to compete with the default local antecedent in and/or after the **Reflexive** region, which may result in *longer* reading times (RT) in the earlier stages.
- **Effect of Locality**: In the **V3 disambiguating** region, when the **V3** forces a local antecedent, which aligns with BCA, the RT is anticipated to be shorter during integration.

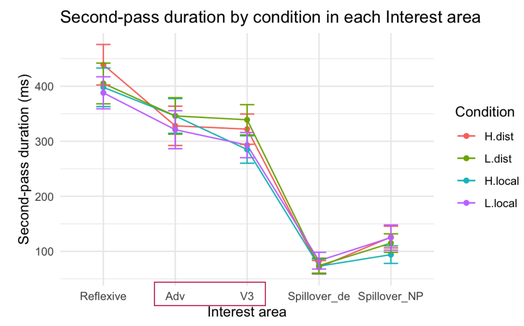
Results

- **Eye-tracking measures:**
  - First-pass measures: gaze duration (**Gaze**), regression path duration (**RPD**), re-reading time (**RRT**, calculated as **RPD** - **Gaze**).
  - Second-pass measures: second-pass duration (**SPD**, as total reading time - **Gaze**).
- Definitions:
  - **Gaze duration**: The sum of all fixations in a region before moving to another region.
  - **Regression path duration**: The summed duration of all fixations from first entering a region until moving rightward to another region.
  - **Total reading time**: The sum of all fixations within a region.
- Data of **100 valid subjects** who are native Mandarin speakers were calculated.
- Graphs of **Gaze**, **RPD**, **RRT**, and **SPD** (error bars = standard errors).









Statistics

- The eye-tracking data were analyzed with **linear mixed-effects regression models**, with maximal random effects constructed unless their presence is vacuous in model comparisons.
- **Statistic results** were **highlighted**:

Regions		Reflexive		Adv		V3		de		NP	
Measure	Effect	β	t	β	t	β	t	β	t	β	t
Gaze	Logophoricity	-0.01	-0.56	-0.07	-2.88**	0.01	0.36	-0.03	-0.40	-0.02	-0.56
	Locality	-0.01	-0.52	0.00	0.18	0.04	1.55	0.02	0.73	0.00	0.03
	Logo x Locality	0.05	1.07	-0.05	-1.09	0.03	0.71	0.10	1.54	-0.04	-0.57
RPD	Logo	-0.06	-1.43	-0.08	-1.52	0.06	1.13	-0.03	-0.40	0.05	0.74
	Locality	0.01	0.20	0.02	0.48	0.07	1.33	-0.13	-1.60	0.06	0.95
	Logo x Locality	0.03	0.36	-0.19	-2.07*	0.09	0.93	0.03	0.16	-0.04	-0.33
RRT	Logo	-0.10	-0.74	-0.07	-0.40	0.16	0.93	-0.05	-0.20	0.20	1.27
	Locality	0.00	0.03	-0.02	-0.14	0.17	1.02	-0.48	-1.92	0.16	1.04
	Logo x Locality	-0.15	-0.54	-0.84	-2.48*	0.21	0.62	-0.10	-0.20	-0.06	-0.19
SPD	Logo	-0.16	-1.07	-0.06	0.70	0.11	0.79	0.03	0.13	0.08	0.44
	Locality	0.03	0.23	-0.10	-0.62	0.11	0.53	-0.16	-0.81	0.10	0.58
	Logo x Locality	-0.34	-1.16	0.70	2.16*	0.03	0.11	0.07	0.19	-0.38	-1.11

- **Early stage**: A sig. **effect of Logo** at **Adv** region
  $(Gaze: t(961.6) = -2.88, p = .004)$.
  →This results in a longer **Gaze duration** in ***High*** logo contexts.
- **First pass stage**: A sig. **interaction effect** at **Adv** region
  $(RPD: t(915.8) = -2.07, p = .039; RRT: t(967.8) = -2.48, p = .013)$.
  →The effect of **Logo** is stronger when **Locality** = ***Dist*** (***H-dist*** > ***L-dist***).
- **Second-pass stage**: A sig.**crossover interaction effect** at **Adv** region
  $(SPD: t(949.7) = 2.16, p = .029)$.
  →**Logo** has a reverse effect on **SPD** between ***Dist*** and ***Local***.
- No main effect of **Locality** is observed.

Discussions

- The main effect of **Logo** predicts longer **Gaze duration** in ***high*** logo contexts in the post-reflexive spillover **Adv** region. This suggests that the semantic/discourse factor may influence reading early on, competing with the default local antecedent.
- Also at the **Adv** region, the interaction effects during the first-pass stages could reflect the effect of parafoveally previewing the following verb **V3**. This interaction suggests that **Logo** has a stronger effect when the semantics of the verb forces a nonlocal antecedent, causing longer RT in ***H-dist***. It indicates that the competition between local/nonlocal binding is escalated in ***H-dist*** compared with ***L-dist***, as more semantic factors in the former compete with binding condition A.
- In later integration stages, the crossover interaction effect correlates with whether the two independent variables converge in antecedent preference. The **SPD** tends to be quicker when they converge, reflecting the ease of integration.
- The absence of a main but the presence of an interaction effect of **Locality** suggests that forced antecedent binding does not compete with BCA per se, but interacts with other semantic/discourse factors. This could partially indicate that syntactic locality is not absolutely predominant in Mandarin.

shgqmatthew@link.cuhk.edu.hk chinlungy@gmail.com panhaihua@cuhk.edu.hk