

## Gender effects on gender neutral reflexives resolution

Yuhang Xu, Jeffrey Runner and Michael Tanenhaus (University of Rochester)

[yuhang.xu@rochester.edu](mailto:yuhang.xu@rochester.edu)

Studies on anaphor resolution demonstrate that people use a variety of constraints to identify antecedents (1, 2). However, how these constraints interact during resolution still remains unclear (3). **One possibility**, following cue-based retrieval models (5, 6), is that anaphor resolution is a “cue-feature” matching process employing cues derived from the anaphoric form and its local syntactic context to select antecedents (e.g., feminine gender on “herself” and its referential domain determined by binding principles). One relevant phenomenon is the similarity-based interference (4) where antecedents sharing the same features compete with each other during resolution. **Another possibility**, following probabilistic generative approaches to language processing (7– 9), is that people constantly make predictions and apply constraints in a context-sensitive weighted fashion to determine the appropriate antecedent: candidates sharing the same features will have a similar probability of being the antecedent at a particular time point. The two approaches make the same predictions about the “final product” of resolution (e.g., final interpretations of the anaphor and error rates in decisions). However, they differ on the process of the resolution: i.e., competition during memory retrieval vs. dynamic changes in the probability of being a potential antecedent. Here, we aim to **adjudicate between these two hypotheses** using the **gender-neutral Chinese reflexive *ziji* as a test bed** to explore if people are sensitive to contextual gender information both in final interpretations (Exp1) and during the initial stages of resolution (Exp2). **Predictions.** Because *ziji* does not require a gender-matching antecedent, cue-based retrieval models would not predict any gender effect during resolution. The probabilistic generative approach, on the other hand, predicts that even before encountering the reflexive, people are sensitive to contextual information—including gender information—that determines the probability of each potential antecedent.

**Exp1.** Off-line judgment task. 43 Mandarin Chinese native speakers were asked to choose the antecedent of the reflexive *ziji* in bi-clausal sentences (“NP1-V1-NP2-V2-*ziji*”) and provide their acceptability ratings (Table 1). We manipulated the gender of NP1 (male/female) and the gender type of the two NPs (same/differ gender) using stereotyped names taken from (11). Figure 1 shows that people generally preferred NP1 (matrix subject) as the antecedent. Also, people had more alternative choices (i.e., NP2 choices) when the two NPs shared the same gender ( $\beta=-.76$ ,  $z=-2.38$ ). Results indicated that people were sensitive to the gender information even when the anaphoric form did not provide a gender cue.

**Exp2.** Visual world eye-tracking. Another 40 Mandarin Chinese native speakers were asked to click on the image representing the last word they just heard (critical item: “NP1-V1-NP2-PP-V2-*ziji*”) from a display containing images of two NPs (occupations) and a locative PP mentioned in the sentence. We manipulated the gender of NP1 (male/female) and the gender pair of the two NPs (same/differ gender) using gender marked clipart (Table 2). We analyzed people’s eye-movements for 1200ms starting 200ms prior to the onset of the reflexive *ziji* (Figure 2, “NP1 advantage”: NP1/(NP1+NP2)). We found an early “gender” effect: more competition (i.e., fewer NP1 fixations) between the two NPs when they differed in gender (i.e., two different gender images presented; -200-200ms:  $\beta=0.98$ ,  $z=4.17$ ). This trend carried over to the 200~600ms window ( $\beta=1.02$ ,  $z=1.96$ ). During this early stage of resolution, people tended to use the contextual gender information to guide their antecedent search. This effect occurred even before the onset of *ziji*, providing strong evidence that people were making predictions of upcoming forms using all contextually available cues.


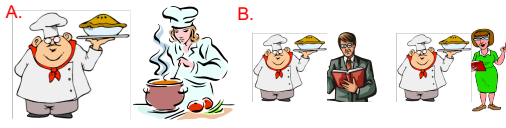
**Taken together**, both approaches can explain the final interpretation of *ziji*: e.g., the cue-based retrieval approach takes it as a similarity-based competition due to interference (10) when facing two same gender candidates (Exp1). Only the probabilistic generative approach explains the pattern that the different gender pair induced more competition between two candidates before encountering the reflexive (Exp2): we hypothesize that the gender cue in the different gender condition is weighted higher because this gender information could subsequently be used to distinguish two candidates differing in gender. These expectation-based effects are above and beyond the cue-feature matching-based memory retrieval during resolution.

## Design and Materials

Table 1: Exp1 Off-line judgment task:

<b>Task:</b>	1. Antecedent choice task “Who does <i>ziji</i> refer to?”		2. Judgment task (7-point scale) “How do you feel about this sentence?”		
<b>Manipulations:</b>	<i>NP1 gender type:</i> Male vs. Female name		<i>Gender pair type:</i> Same vs. Differ gender names		
<b>Stimuli:</b>	16 items+40 fillers.		See a sample below:		
<i>NP1</i>	<i>V1("say")</i>	<i>NP2</i>	<i>PROG</i>	<i>V2</i>	<i>Reflexive</i>
张豹/方梅	表示	洪钢/陈霞	在	谈论	自己
Male/Female Name	say	Male/Female Name	PROG	talk about	Self

Table 2: Exp2 Visual-world eye-tacking:

<b>Task:</b>	“Click on the image that represents last word you have just heard.”				
<b>Display:</b>	<b>Manipulations:</b>				
	<p>A. <i>NP1 gender type:</i> Male vs. Female image</p> <p>B. <i>Gender pair type:</i> Same vs. Differ gender pair</p> 				
<b>Stimuli:</b>	16 items+36 fillers; spoken materials				
<i>NP1</i>	<i>V1("say")</i>	<i>NP2</i>	<i>PP</i>	<i>V2</i>	<i>Reflexive</i>
张厨师	表示	李老师	在邮局	谈论了	自己
Chef Zhang	say	Teacher Li	in the post office	talked about	self

## Results

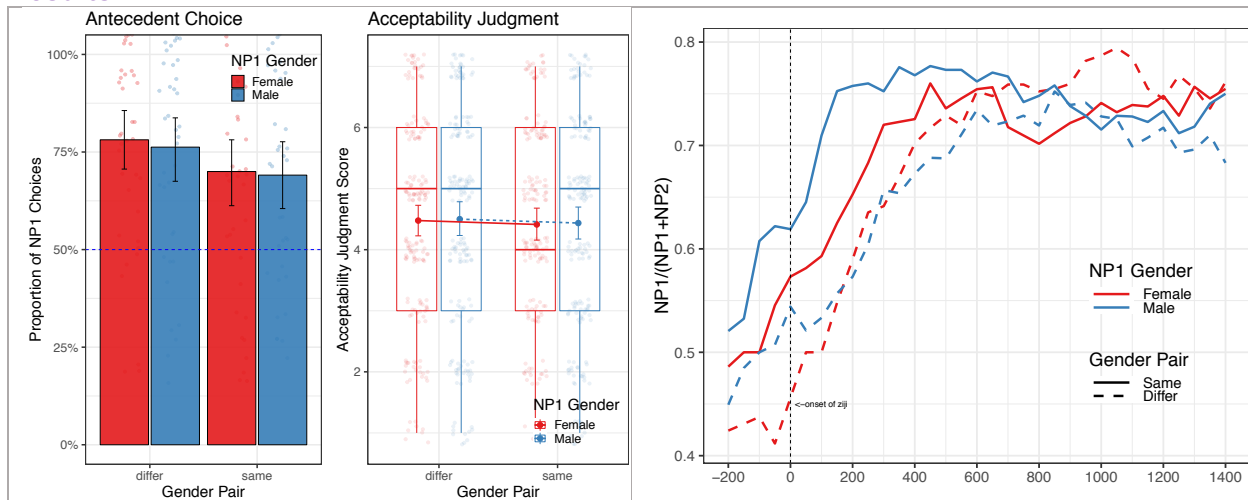


Figure 1: Off-line judgment task results

Figure 2: Visual world eye-tracking results

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