Mandarin speakers predict upcoming arguments in dative constructions based on categorical and gradient verb bias

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Background & Research Questions

- English speakers make use of both categorical and gradient constraints of dative verbs to predict upcoming ditransitive constructions (Scheepers et al., 2007; Safak & Hopp, under review; Tily et al., 2008).

- Chen et al. (2022) employed a visual world structural priming paradigm and found that Mandarin speakers' predictions of upcoming arguments were influenced by both prime type and bias of alternating verbs.

An example sentence from Chen et al. (2022):

	1000ms	550ms			
Yeye	huan	**QIU**yuan	yi	fu	**QIU**pai.
grandpa	return	football player	one	CL	racket.

"The grandpa returns the football player a racket."

Research Questions:

1. Do Mandarin speakers predict upcoming arguments based on **categorical** constraints of dative verbs?
2. Do Mandarin speakers predict upcoming arguments based on **gradient** constraints of dative verbs?

Compared to Chen et al., the present study:

i. examines processing in the **absence of priming**;
ii. includes **non-alternating** in addition to **alternating** ditransitive predicates;
iii. includes a **longer ambiguous region** between the verb and the first post-verbal noun.

Dative alternation in Mandarin

Table 1. Dative alternation in Mandarin by verb type

	Double-object (DO) dative						Prepositional (PO) dative						
MAKE	*Mali	zuo	le	Dawei	yi	ge dangao.	Mali	zuo	le	yi	ge	daogao	gei Dawei.
	Mary	make	ASP	David	a	CL cake	Mary	make	ASP	a	CL	cake	GEI David
	'Mary made David a cake.'						'Mary made a cake for David.'						
TELL	Mali	gaosu	le	Dawei	yi	ge mimi.	*Mali	gaosu	le	yi	ge	mimi	gei Dawei.
	Mary	tell	ASP	David	a	CL secret	Mary	tell	ASP	a	CL	secret	GEI David
	'Mary told David a secret.'						'Mary told a secret to David.'						
GIVE	Mali	song	le	Dawei	yi	ge dangao.	Mali	song	le	yi	ge	daogao	gei Dawei.
	Mary	give	ASP	David	a	CL cake	Mary	give	ASP	a	CL	cake	GEI David
	'Mary gave David a cake.'						'Mary gave a cake to David.'						

References

Chen, X, Wang, S & Hartsuiker, RJ. (2022). Error-based structure prediction in language comprehension: Evidence from verb bias effects in a visual-world structural priming paradigm for Mandarin Chinese. *JEP:LMC, 48*.

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Tily, H, Hemforth, B, Arnon, I, Shuval, N, Snider, N, & Wasow, T. (2008). Eye movements reflect comprehenders' knowledge of syntactic structure probability. Talk presented at *AMLaP 14*.

The visual world eye tracking experiment

- 46 native Mandarin speakers, mean age = 28.0 (20-43)
- 6 **non-alternating** verbs:
  - 3 **MAKE** verbs (i.e., *zuo4,* to make; *chao3,* to fry; *hua4,* to draw) each appear 3 times in PO
  - 3 **TELL** verbs (i.e., *gao4su,* to tell; *jiao1,* to teach; *wen4,* to ask) each appear 3 times in DO
- 4 **alternating** verbs, bias information based on a norming study in Chen et al. (2022):
  - 1 **DO-biased** *GIVE* verb (i.e., *song4,* to give) appears once in PO, twice in DO;
  - 3 **PO-biased** *GIVE* verbs (i.e., *fen1,* to share; *zu1,* to rent; *jie4,* to borrow/lend) each appear once in DO, twice in PO
- 30 fillers; on 15 filler trials, participants judged whether the speaker's sentence included every entity in the scene

An example target dative (DO):

	520ms	1420ms						
Nanren	song	le	yi	ge	daxuesheng	yi	ge	shafa.
Man	give	PRF	one	CL	college student	one	CL	sofa

"The man gave a college student a sofa."

Fig.1 Illustration of experimental item (PRF = perfective marker; CL = general classifier)

Summary and future directions

To summarize:

- Mandarin speakers predict upcoming dative constructions based on **categorical** constraints of dative verbs even in the absence of priming.
- Some indication for prediction based on **gradient** verb bias, but based on limited and unbalanced number of items.

Future directions:

- Do these effects generalize to L2 users of Mandarin? *(in progress)*
- Do L1 and L2 Mandarin users **adapt their prediction** of the upcoming argument based on recent exposure to distransitives in a separate priming session? *(in progress)*
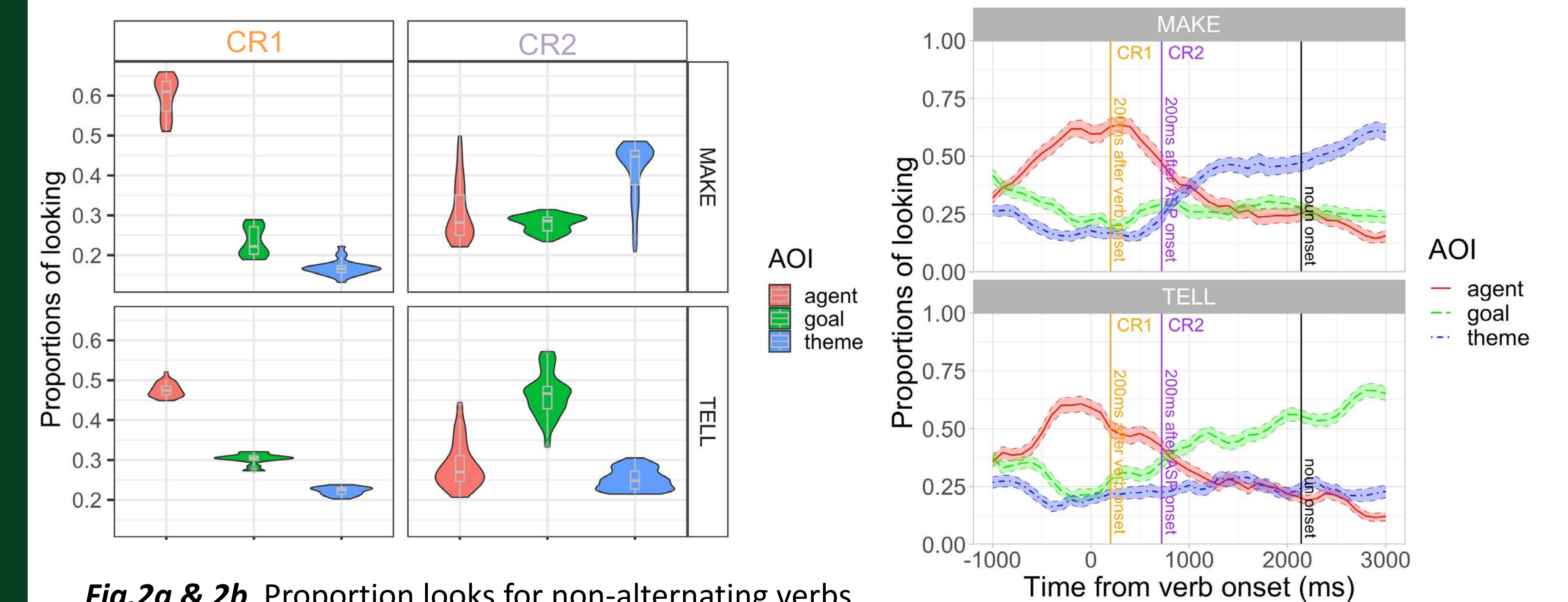
Results

Fig.2a & 2b Proportion looks for non-alternating verbs

RQ1: categorical constraints
- Dependent variable (DV): more looks to theme than to goal = 1, more looks to goal than to theme = 0 (by trial and window)
- `glmer: DV ~ CR * verb type + (1 + verb type|Participant) + (1|Item)`
  - CR ($b = 0.18$, $p = .22$); verb type ($b = -.69$, $p = .09$)
  - CR * verb type interaction ($b = -1.41$, $p < .001$)
- Follow-up models by window: Verb type modulated fixations in CR2 ($b = -1.32$, $p = .001$), but not in CR1 ($b = -.05$, $p = .93$).
- Follow-up models by verb type: From CR1 to CR2, looks to theme (relative to goal) increased following **MAKE** verbs ($b = .91$, $p < .001$), and decreased following **TELL** verbs ($b = -.56$, $p < .01$).
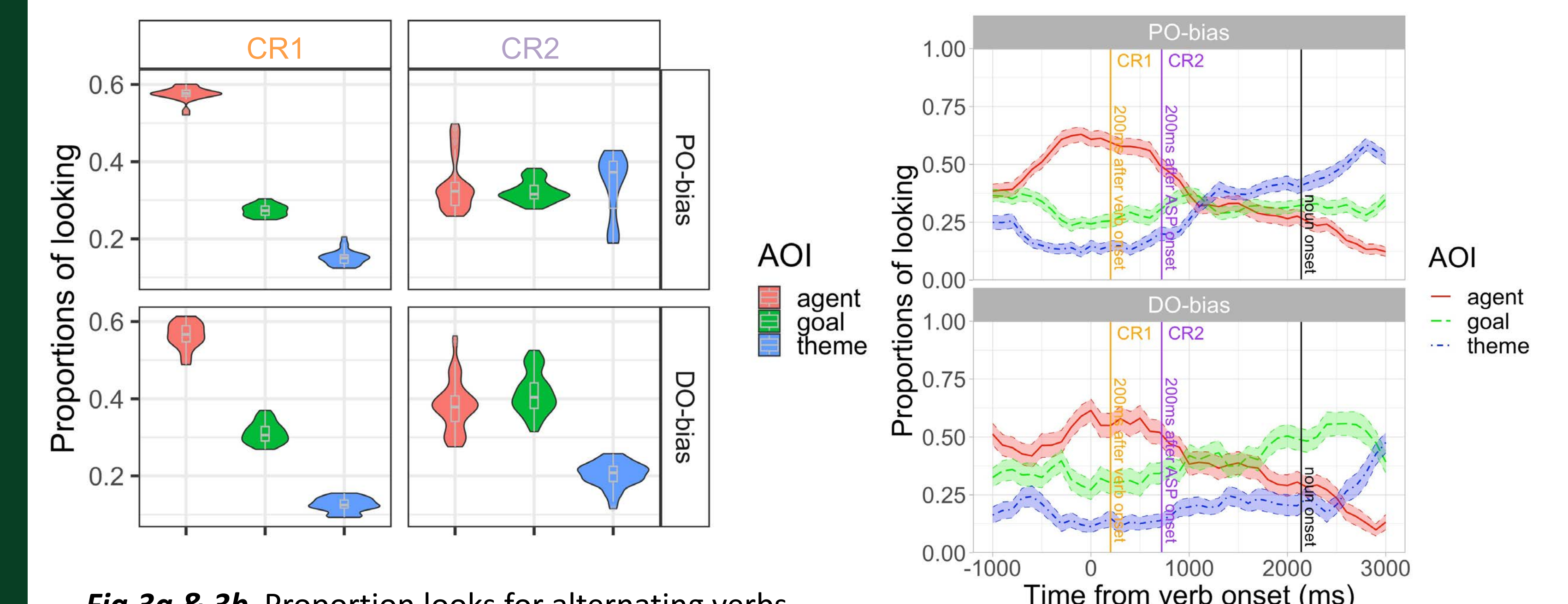

Fig.3a & 3b Proportion looks for alternating verbs

RQ2: gradient constraints
- `glmer: DV ~ CR * verb bias + (1|Item)`
  - CR ($b = 0.43$, $p = .03$); verb bias ($b = 1.20$, $p = .002$)
  - CR* verb type interaction ($b = -0.70$, $p = .07$)
- Follow-up models by window: The effect of verb bias was stronger in CR2 ($b = 1.28$, $p < .001$) than in CR1 ($b = 1.11$, $p = .10$);
- Follow-up models by verb type: Looks to theme (relative to goal) increased from CR1 to CR2 following PO-biased verbs ($b = .78$, $p < .001$) but did not change following the DO-biased verb ($b = .06$, $p = .86$).

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