L2 and heritage learners of Mandarin use categorical and gradient verb constraints to predict upcoming arguments in dative constructions

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Background & Research Questions

- **Native English speakers** make use of both categorical and gradient constraints of dative verbs to predict upcoming ditransitive constructions (Scheepers et al., 2007; Tily et al., 2008).
- Chen et al. (2022) employed a visual world structural priming paradigm and found that **native Mandarin speakers'** predictions of upcoming arguments were influenced by both prime type and bias of alternating dative verbs.
- **L2 English speakers** also use dative verb bias predictively, although these effects may be modulated by learners' L1 (Şafak & Hopp, 2023) and proficiency (Wolk et al., 2011).
- **No previous research on the predictive use of dative verb constraints among heritage speakers**; but prior studies showed mixed effects on predictive processing among heritage speakers (e.g., Fuchs, 2022a, 2022b; Ito et al., 2023; Karaca et al., 2023).

Research Question:

Do **sequential L2 speakers** and **heritage speakers** of **Mandarin** predict upcoming arguments based on categorical and gradient constraints of dative verbs?

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. Mary make ASP David a CL cake 'Mary made David a cake.'	Mali zuo le yi ge dangao gei Dawei. Mary make ASP a CL cake GEI David 'Mary made a cake for David.'
TELL	Mali gaosu le Dawei yi ge mimi. Mary tell ASP David a CL secret 'Mary told David a secret.'	*Mali gaosu le yi ge mimi gei Dawei. Mary tell ASP a CL secret GEI David 'Mary told a secret to David.'
GIVE	Mali song le Dawei yi ge dangao. Mary give ASP David a CL cake 'Mary gave David a cake.'	Mali song le yi ge dangao gei Dawei. Mary give ASP a CL cake GEI David 'Mary gave a cake to David.'

The visual world eye tracking experiment

Participants

- 59 native speakers ('L1') and 60 classroom learners ('CL') of Mandarin
  - The CL group includes 38 sequential L2 learners ('L2', $M_{LEXTALE\_CH}$ = 60.0, SD=9.9) and 22 heritage speakers ('HS', $M_{LEXTALE\_CH}$ = 63.1, SD=10.5), recruited from the same classrooms.
  - CLs' dominant languages varied, with English the most frequent (L2: 21/38, HS: 16/22).

Materials

- 30 experimental, 30 filler items; on 15 filler trials, participants judged whether the speaker's sentence included every entity in the scene.
- Experimental items contained:
  - 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 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

An example target dative (DO):
520ms 1420ms

Nanren song le yi ge daxuesheng yi ge shafa.
Man give PFV one CL college student one CL sofa
"The man gave a college student a sofa."

Figure 1. Illustration of experimental item (PFV = perfective marker; CL = general classifier)

Results
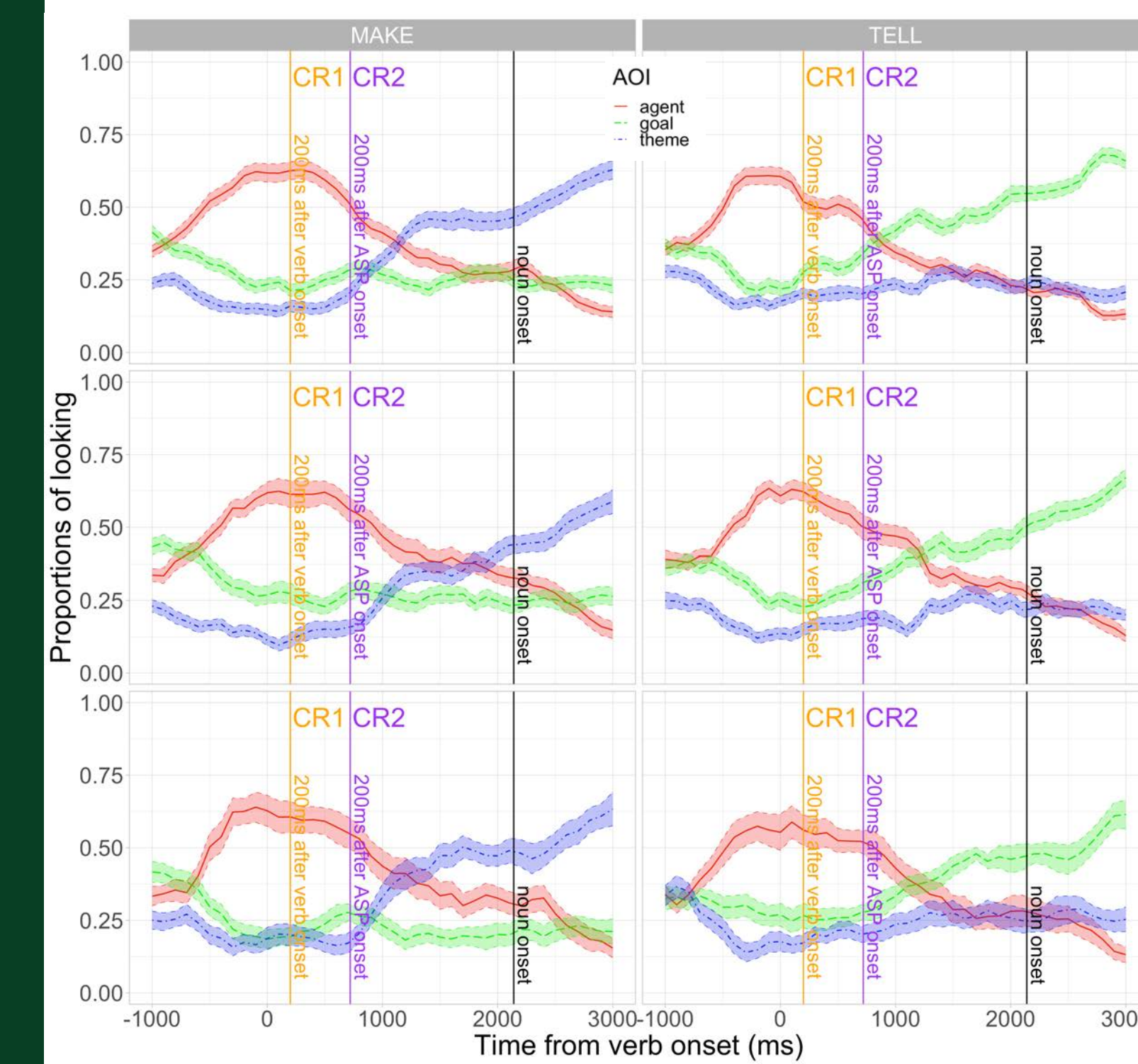
Categorical constraints

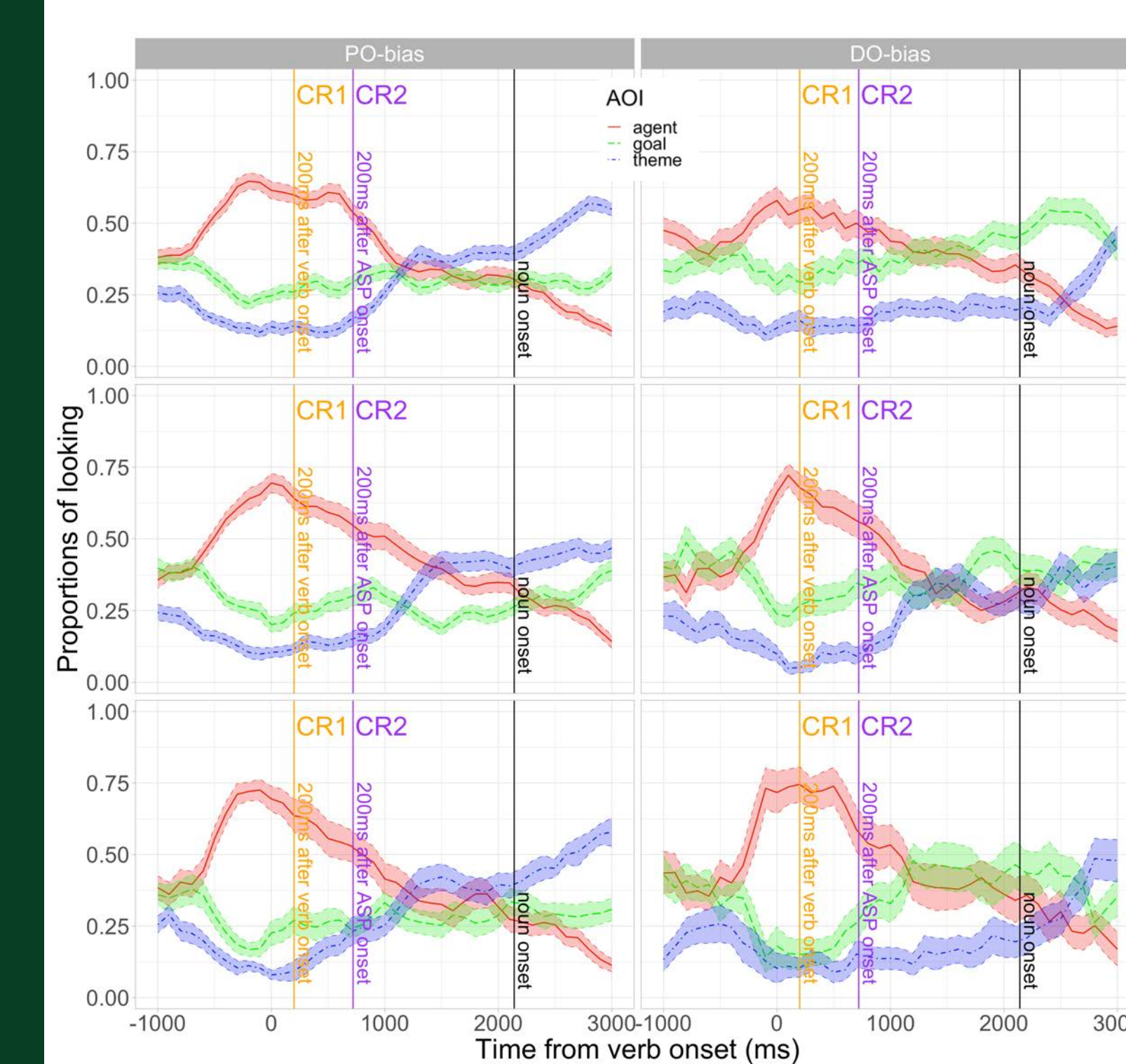*Figure 2.* Proportion looks for non-alternating verbs

Gradient constraints

Figure 3. Proportion looks for alternating verbs

- DV: log-ratio between fixations at theme vs. goal
- group = 2-level predictor: L1 vs CL

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lmer: DV ~ CR * verb type * group +
(1| Participant) +(CR + group | Item)
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➤ CR * verb type interaction (b = -.37, p <.001)
➤ **No effects or interactions with Group**

Follow-up models by CR (time window):
Verb type modulated fixations in CR2 (b = -.36, p =.002), but not in CR1 (b = .02, p = .88).

Follow-up models by verb type:
From CR1 to CR2, looks to theme (relative to goal) increased following **MAKE** verbs (b = .25, p <.001), and decreased following **TELL** verbs (b = -.13, p = .001).

Models with group as a 3-level predictor showed **no difference between L2ers and HSs.**

Additional models of the CL data showed **no modulating effects of proficiency or first/dominant language** (English vs. other) for categorical or gradient constraint.

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lmer: DV ~ CR * verb bias * group +
(1| Participant) +(CR + group | Item)
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➤ CR * verb bias interaction (b = .25, p <.001)
➤ **No effects or interactions with Group**

Follow-up models by CR (time window):
Verb bias modulated fixations in CR2 (b = .42, p <.001), but not in CR1 (b = .06, p = .46).

Follow-up models by verb bias:
From CR1 to CR2, looks to theme (relative to goal) increased following **PO-biased** verbs (b = .22, p <.001) but did not change following the **DO-biased** verb (b = -.01, p = .80).

Models with group as a 3-level predictor showed **no difference between L2ers and HSs for PO-biased verbs.**

Summary and future directions

- This study presents new evidence of active prediction of the dative alternation in Mandarin among **native, sequential L2** and **heritage** speakers, with **no delay or reduction** in the latter two groups.
- Different from Wolk et al. (2011), the prediction effects were **not modulated by L2 speakers' proficiency.**
- **Heritage speakers' native-like prediction** here aligns with results from Ito et al. (2023) on HS prediction based on verb constraints, yet contrasts with findings of recent studies on predictive use of morphosyntactic cues among HSs (e.g., Fuchs, 2022b, on gender markers; Karaca et al., 2023, on case markers), suggesting **heritage speakers' engagement in prediction may vary differentially depending on the nature of the linguistic cues involved.**

Future directions:

- Do Mandarin (L1, HS, & L2) users **adapt their prediction** of the upcoming argument based on recent exposure to distransitives in a separate priming session?

...in progress

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