

Multimodal predictors of early object noun recognition in Tzeltal



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Background

Caregiver object labeling and child object handling make unique contributions to early word learning in Western communities^{1,2}

Ethnographic accounts of Tzeltal (Mayan) early language environments describe them as non-child-centered and non-object-centered³⁻⁵

Early Tzeltal vocabularies include an over-representation of verbs, and not nouns⁶

What are the contributions of adult object labeling and child object handling to Tzeltal children's early noun learning?

Looking-while-listening experiment in the field

Participants

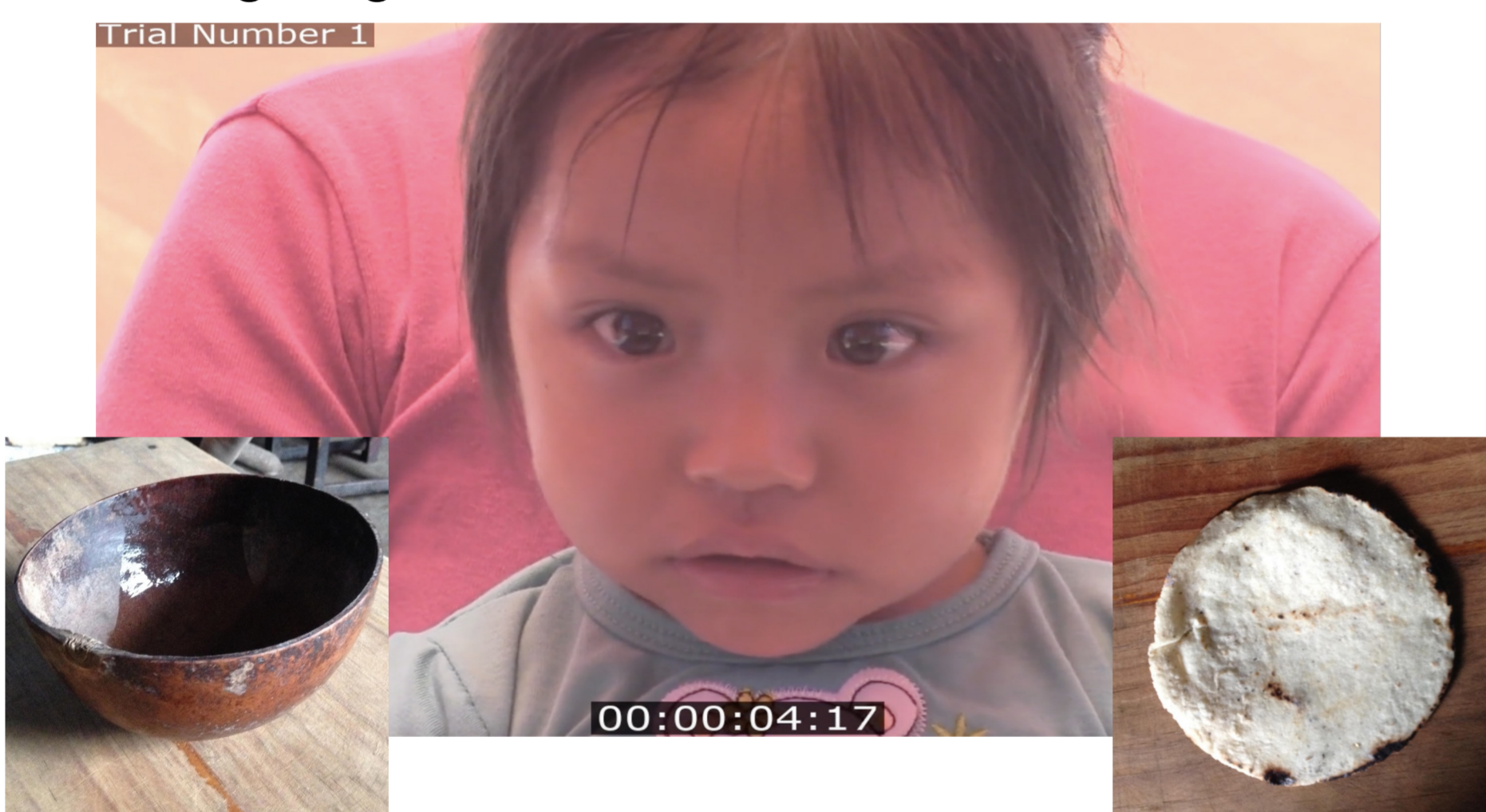
$N = 62$ Tzeltal-learning children
Age range = 0;09.09–3;11.24 (mean = 2;07.02)

Design

30 common community-specific object nouns
“Experi-ten” setup with stimulus images displayed on laptop



Gaze coded offline in ELAN⁶ and peyecoder⁷, with analyses based on the window from 365–2005ms following target noun onset



Input predictors estimated from daylong photo-linked audio recordings

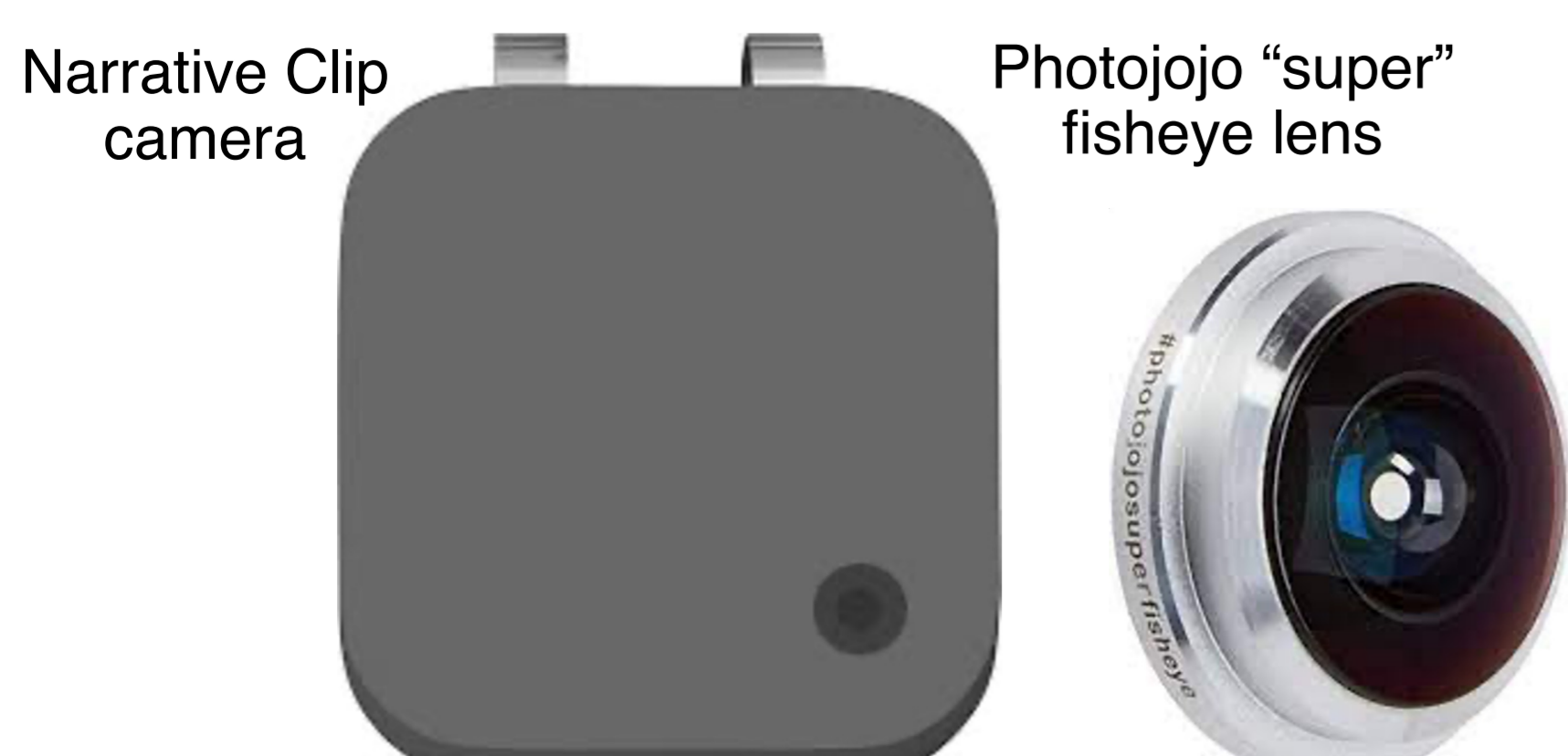
$N = 43$ children up to age 4;0 (31 overlapping with the LWL sample)

~9 hrs of continuous audio from a child-worn recorder

Photos captured ~2 times per minute using a child-worn camera with a 180° fisheye lens

Adult object labeling frequency estimated from 9 x 5-minute transcribed, randomly selected clips (target-child-directed language only)⁸

Child object handling frequency counted across all full daylong photo streams⁹



Key findings

Overall above-chance salience-corrected LWL accuracy, measured as the relative increase in proportion looking to a given stimulus image when it appeared as the labeled target vs. unlabeled distracter ($\beta = 0.19$, $SE = 0.01$, $p < 0.001$)

Significant age-related increases in LWL accuracy scores ($\beta = 0.01$, $SE = 0.002$, $p < 0.001$; **Figure 1**) and speed of target noun recognition

No significant effect of adult object labeling frequency or child object handling frequency on overall accuracy scores ($ps > 0.05$; **Figure 2**)

Exploratory growth-curve analyses¹⁰ reveal mixed evidence for the effect of the two multimodal input predictors on looking trajectories (**Figure 3**), including the following notable results:

- Two- and three-way interactions between labeling/handling frequency and the linear and cubic time terms ($ps < 0.01$)
- Negative two-way interaction between participant age and labeling ($p < 0.001$) but not handling frequency ($p = 0.816$)

Figure 1: Age-related increases in overall salience-corrected LWL accuracy

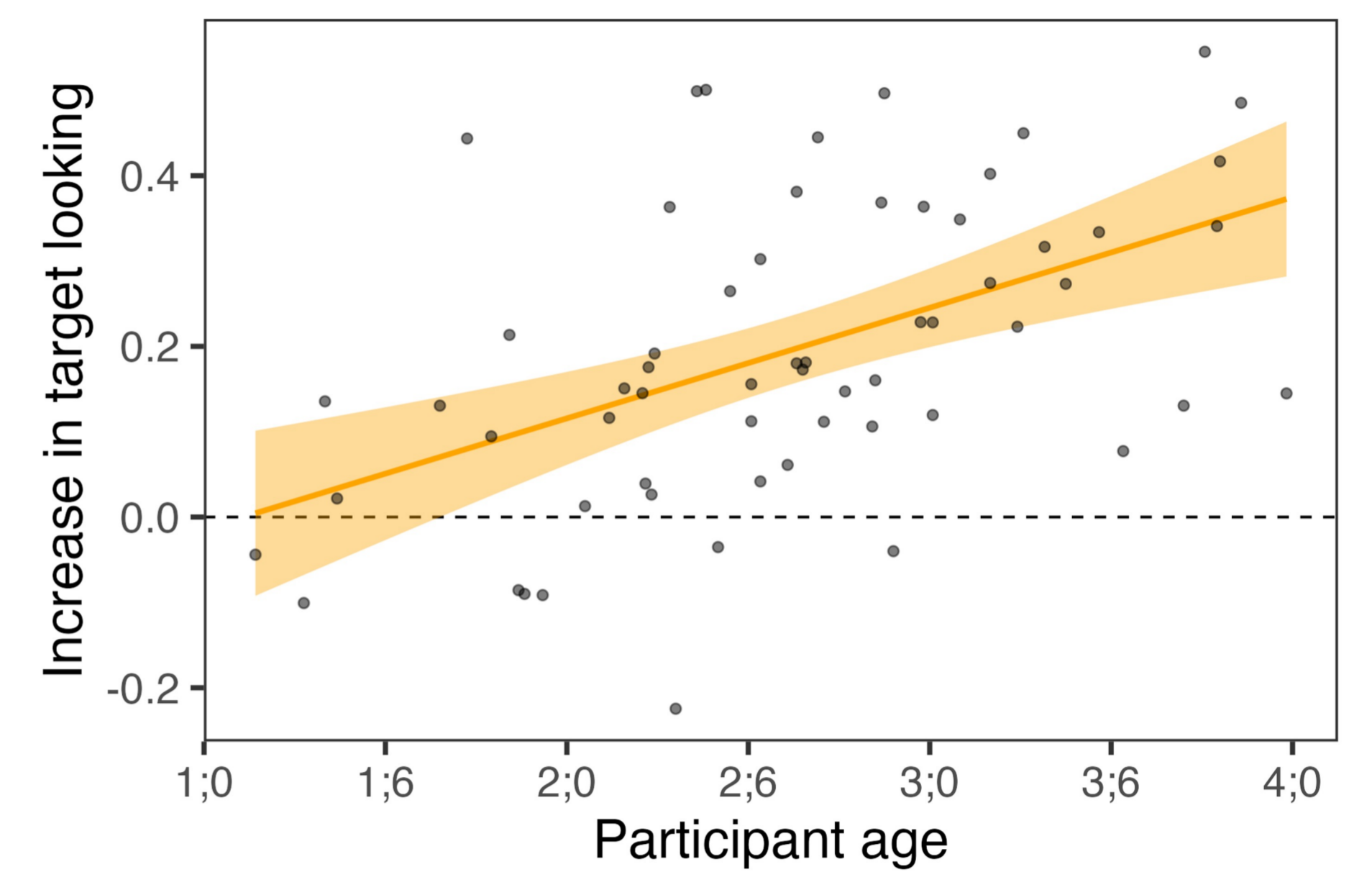


Figure 2: Item effects (no overall impact of multimodal input predictors on salience-corrected LWL accuracy)

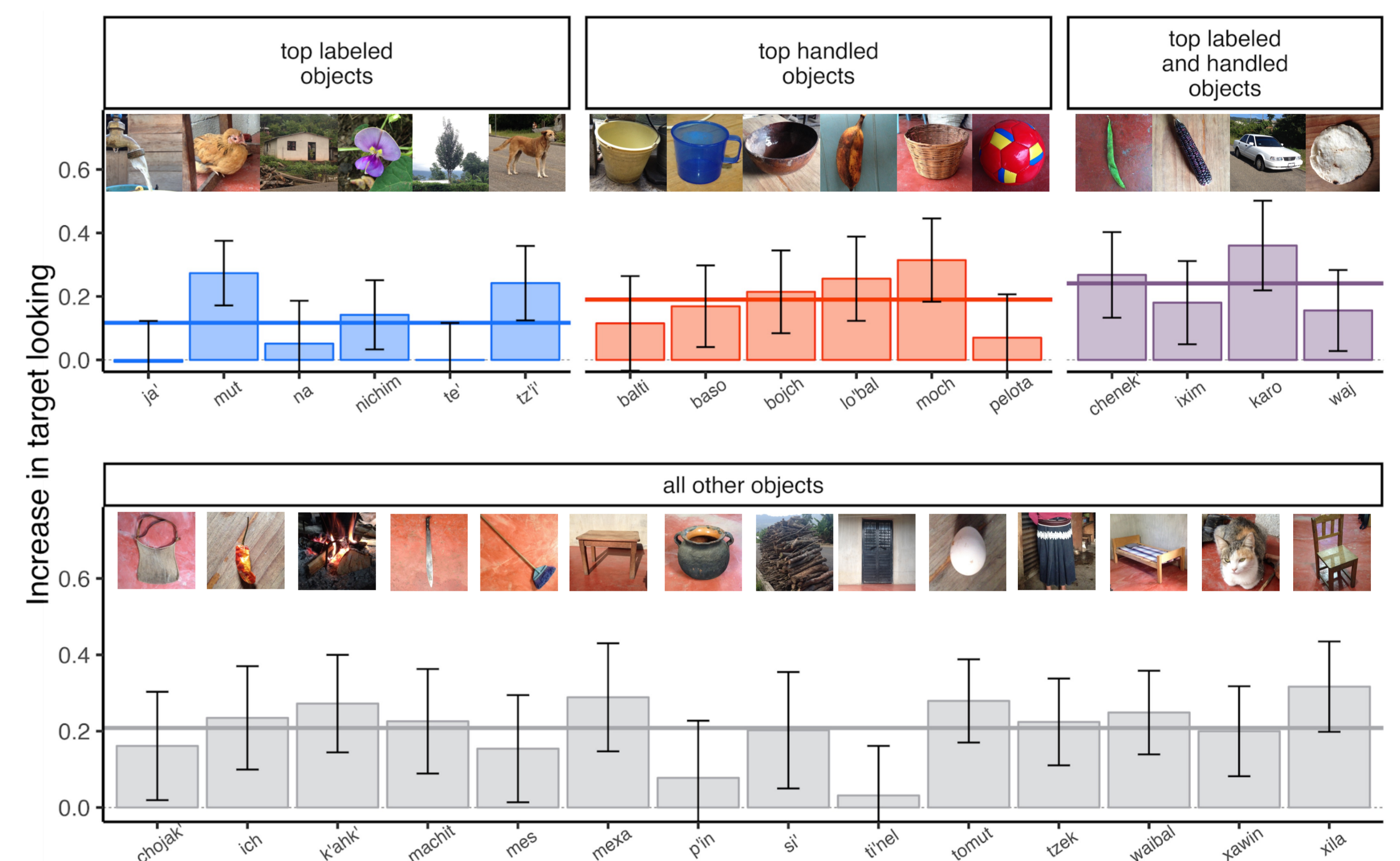
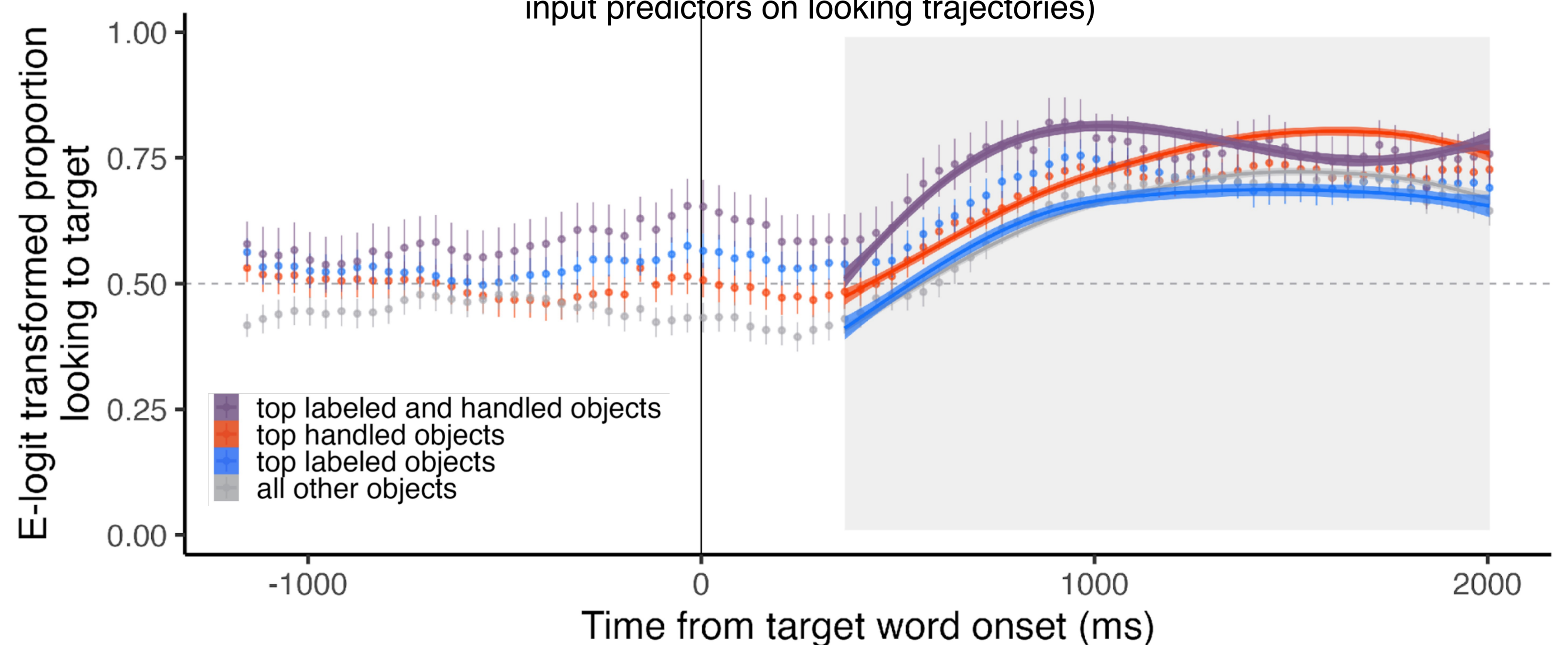


Figure 3: Growth-curve analyses (mixed evidence for the effect of multimodal input predictors on looking trajectories)



Discussion

Reliable evidence of early object noun recognition in a non-Western community where child-directed language is relatively infrequent and object noun labeling is relatively rare^{see also 11}

Equivocal evidence for the specific influence of adult object labeling frequency and child object handling frequency on Tzeltal children's online word recognition, but preliminary results suggest an advantage for objects that are among the most frequently labeled and handled in this Mayan community

Future research is needed to (a) consider the impact of overhearable language on Tzeltal children's word learning, (b) more densely sample children's multimodal home language experiences, (c) understand the frequency of co-occurrence between object labeling and handling, and (d) test for links between individual children's input patterns and their word learning outcomes

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