Variation in home language input is linked to predictive language processing

Disparities in young children's language input are implicated in language learning disparities. For example, Weisleder and Fernald (2013) find that toddlers who hear less language input tend to have smaller vocabularies than those who hear more language input. Results also reveal disparities in real-time language processing, such that low-input toddlers are slower and less accurate in comprehending familiar words. Moreover, these results indicate that language processing mediates the link between toddlers' language input and subsequent vocabulary size. Together, these findings suggest that external factors (i.e., language input, socioeconomic status) and internal factors (i.e., language processing) interact to create disparities in children's learning trajectories.

We hypothesized that a particular aspect of language processing – *prediction* – may play a role in explaining language learning disparities. Prediction refers to the ability to anticipate upcoming information in speech, and a number of theories propose that prediction is a key language learning mechanism (e.g., Christiansen & Chater, 2015). Supporting this view, toddlers can predict during language processing, and those that do predict tend to have larger vocabularies (Mani & Huettig, 2012). Thus, understanding differences in toddlers' prediction abilities could further our understanding of language learning disparities. Akin to prior findings (Weisleder & Fernald, 2013), we hypothesized that toddlers who hear more language input would be more likely to predict during language processing.

We recruited 28- to 32-month-old toddlers (n=30) from families with widely varying annual household incomes (range = \$20,000–\$200,000). We tested toddlers in two eye-tracking tasks. In the first task, toddlers viewed pairs of referents (e.g., cookie, book) and heard sentences with informative verbs that could be used to predict the target (e.g., *Eat the cookie*), and neutral sentences (e.g., *Look at the cookie*). In the second task, toddlers viewed pairs of referents (e.g., two cookies, one apple) and heard sentences with informative number marking (e.g., *There <u>are</u> the nice cookies*), and neutral sentences (e.g., *Look at the nice cookies*). We measured toddlers' looks to the target referent over time during each sentence.

To evaluate whether differences in language input are linked to prediction abilities, we used LENA technology to record each family at home for one full day. We divided toddlers into a High-Input group and a Low-Input group based on a median split of language input (Table 1). In the first eye-tracking task, we found an interaction of condition and time for High-Input (F(1,15)=2.97, p<0.001) but not Low-Input toddlers (F(1,15)=0.66, p=0.83). In the second eye-tracking task, we again found an interaction of condition and time for High-Input (F(1,15)=1.75, p=0.04) but not Low-Input toddlers (F(1,15)=0.56, p=0.90). Whereas High-Input toddlers used informative verb semantics and number marking to predict the upcoming noun, Low-Input toddlers did not (Figure 1).

Together, the present findings suggest that differences in language input influence the extent to which toddlers predict during language processing. If prediction is a key language learning mechanism[2,3] then differences in prediction abilities, in combination with differences in familiar word recognition, may play a role in creating divergent language learning trajectories.

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Group	Mean	SD	Min	Max
Low-Input	760	254	365	1036
High-Input	1462	310	1085	2025

Table 1: Mean number of adult words per hour, measured using LENA recorders, for Low-Input toddlers (n=15) and High-Input toddlers (n=15).

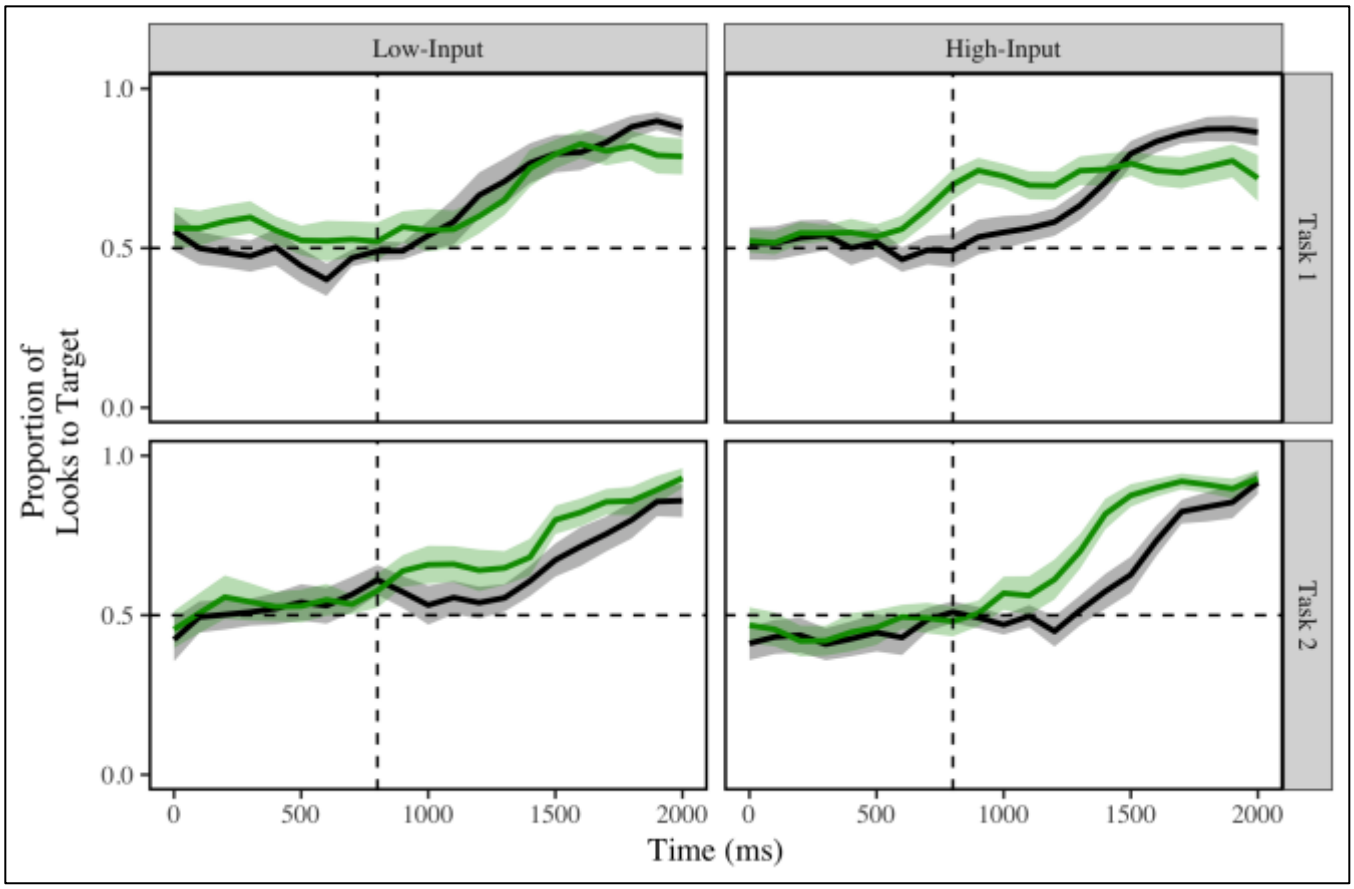

Figure 1: Proportion of looks to the target referent (e.g., cookie) during predictable sentences (green) and neutral sentences (grey). Horizontal dashed line indicates chance performance; vertical dashed lines indicates average noun onset (800 ms in both tasks). Shading represents one standard error from the mean for each condition, averaged by subjects.