

# Differential impacts of linguistic alignment across caregiver-child dyads and levels of linguistic structure

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In conversation, we tend to re-use each others' words, phrases, and structures, and become increasingly similar in our pronunciation and rate of speech. This process of *linguistic alignment* has been proposed to play a role in communicative success (Pickering and Garrod, 2004), and, recently, language acquisition: caregivers' alignment to their young interlocutors might reflect their 'tuning' of their child-directed speech (Denby and Yurovsky, 2019; Yurovsky et al., 2016), and even directly promote language learning by facilitating children's real-time speech processing and production. Alignment has typically been studied in adult conversation; however, recent analyses have used (largely cross-sectional) child language corpora to show that children align less than their caregivers, but more with age (Misiak et al., 2020), and to provide early evidence that syntactic alignment predicts vocabulary development (Denby and Yurovsky, 2019). Here, we capitalize on longitudinal data ideally suited to test (1) the robustness of these trends within individual dyads, and (2) the claim that alignment is broadly supportive of language development, by examining the relation between directional caregiver-child alignment at multiple levels of linguistic structure, and child vocabulary outcomes.

Our data represent 90-minute transcripts recorded every four months in the homes of 65 caregiver-child dyads, between the ages of 14 and 58 months (12 transcripts/child; 780 total), along with three administrations of the Peabody Picture Vocabulary Test (PPVT; Dunn and Dunn, 1981) at 30, 42, and 54 months. We quantified linguistic alignment at three levels of structure: LEXICAL, SYNTACTIC, and SEMANTIC. LEXICAL alignment reflected the proportion of shared words between speaker turns, while SYNTACTIC alignment measured the ratio of shared part-of-speech tags. SEMANTIC alignment was calculated by computing the similarity between adjacent utterances, represented in a high dimensional vector space (spacy2; Honnibal and Montani, 2017).

We first fit linear mixed effects models (Bates et al., 2015) to the alignment data for each level separately, including child age, speaker (CHILD/PARENT), the interaction of age and speaker, child sex, and maternal education as predictors. As expected, children aligned less than adults at the LEXICAL ( $\beta = -0.02$ ,

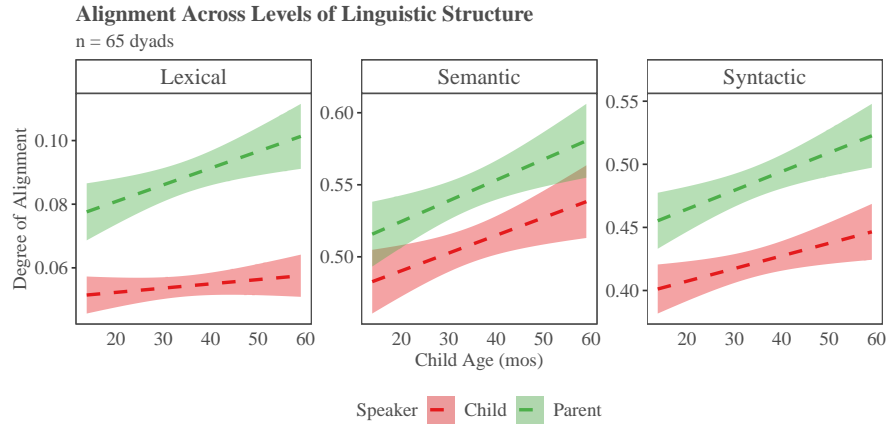


Figure 1: Developmental trajectories of child- and parent alignment at three levels of linguistic structure, across 65 dyads in the Language Development Project dataset (Goldin-Meadow et al., 2014).

$\chi^2(1) = 139.92, p < .001$ ) and SYNTACTIC levels ( $\beta = -0.05, \chi^2(1) = 72.01, p < .001$ ), and overall LEXICAL ( $\beta = 0.001, \chi^2(1) = 4.33, p < .05$ ) and SYNTACTIC ( $\beta = 0.002, \chi^2(1) = 4.51, p < .05$ ) alignment within dyads increased reliably with age (see Figure 1). To evaluate the hypothesis that increased alignment might itself promote language development, we predicted children’s PPVT scores from caregiver and child alignment, controlling for demographic variables known to correlate with vocabulary outcomes, including maternal education and child sex. Remarkably, caregivers’ levels of LEXICAL ( $\beta = 261.00, \chi^2(1) = 22.90, p < .001$ ) and SYNTACTIC ( $\beta = 129.00, \chi^2(1) = 14.46, p < .001$ ) alignment were significant predictors of children’s PPVT scores, while neither caregiver SEMANTIC alignment ( $\beta = 69.50, \chi^2(1) = 1.24, p = .26$ ), nor children’s tendency to align to their parents at any level were significantly related to their vocabulary scores.

Together, our results are consistent with proposals that alignment plays a causal role in advancing language development, but that its impact may differ across levels of linguistic structure — a question left open by previous research. Specifically, our results suggest that *lexical* and *syntactic* alignment, which reflect caregiver’s re-use of children’s immediately preceding words and sentence structures, may promote learning.

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