Developmental Pathways to Language: Intersensory Processing and Child Gesture Production

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ABSTRACT

Both intersensory processing (coordinating faces and voices during speech) and child gesture production are known to be important for language development, but research has not examined relations among these three domains. Our findings revealed that 18-month child gestures mediate the relationship between 12-month intersensory processing and 18-month receptive vocabulary.

BACKGROUND

Early developing skills serve as a foundation for children's capabilities later in development. Intersensory processing (coordinating temporally synchronous stimulation across sensory modalities) is a foundation for language development (Bahrick & Lickliter, 2012). For example, Gogate and Bahrick (1998) demonstrated that word-mapping is facilitated in 7-month-old infants by synchronous audiovisual stimulation (synchronously moving and labeling an object) as compared to asynchronous (moving and labeling object out of synch) or unimodal stimulation (pointing to object only). Further, infants ages 9.0-14.7 months show better word learning when objects are named with movement, providing audiovisual synchrony, as compared to unimodal stimulation of only moving the object (Rader & Zukow-Goldring, 2015).

Child gesture production (e.g., pointing, head-shaking) is also known to play a role in language development (McNeill, 1992). For example, child gestures at 18-months predict receptive vocabulary at 42-months (Rowe & Goldin-Meadow, 2009).

Research is just beginning to explore developmental pathways between intersensory processing and language development. Intersensory processing could be an earlier link in the developmental cascade between child gesture production and language development. We thus explored the relations among these three domains using an individual difference approach.

METHOD

The Intersensory Processing Efficiency Protocol (IPEP; Bahrick et al., 2018) was developed as an individual difference measure of intersensory processing appropriate for infants and children. Children view a 2x3 grid of 6 dynamic visual events (women speaking; see Figure 1) across 24 trials. On each trial, visible movements of speech are synchronized with the natural soundtrack for one visual event, while the other 5 events served as asynchronous distractors. Intersensory matching is calculated as the mean proportion of total looking time to the sound-synchronous target event across trials.

Thirty-two infants participated as part of an ongoing longitudinal study. At 12-months, they received the IPEP. At 18-months, we obtained parent-reports of child gestures and receptive vocabulary size from the MacArthur-Bates Communicative Development Inventory (Fenson et al., 2007).

Figure 1. Static events depicting dynamic social trials shown to the infants in the IPEP.

RESULTS

Results indicated intersensory matching was correlated with both child gestures (r = .478, p = .006) and receptive vocabulary (r = .433, p = .013). Child gestures and receptive vocabulary were also correlated (r = .628, p < .001; see Figure 2).

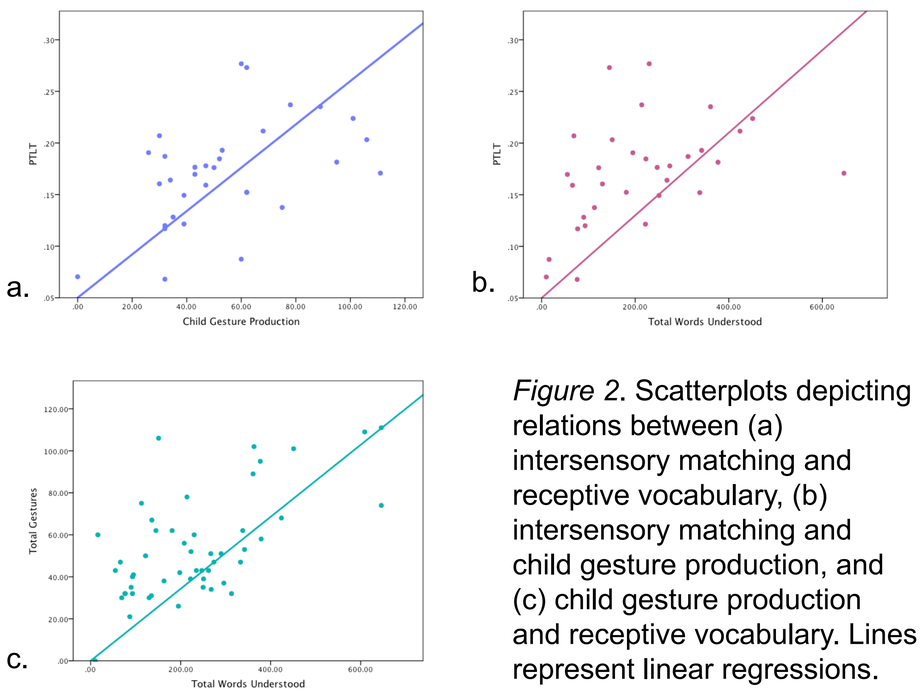

Figure 2. Scatterplots depicting relations between (a) intersensory matching and receptive vocabulary, (b) intersensory matching and child gesture production, and (c) child gesture production and receptive vocabulary. Lines represent linear regressions.

Next, we tested a mediation model (see Figure 3). Regression analyses indicated that intersensory matching positively predicted child gesture production, b = 246.57, SE = 82.76, p = .005. The effect of child gesture production on receptive vocabulary was also significant, b = 2.90, SE = .91, p = .003.The direct effect of intersensory matching on receptive vocabulary was not significantly different from zero, b = 519.15, 95% CI: -436.71, 1475.01. However, the indirect effect of intersensory matching on receptive vocabulary through child gesture production was significant, b =714.36, 95% CI: 28.75, 1582.15. 58% of the total effect of intersensory matching on receptive vocabulary was mediated by child gesture production as indicated by the ratio of the indirect effect to the total effect.

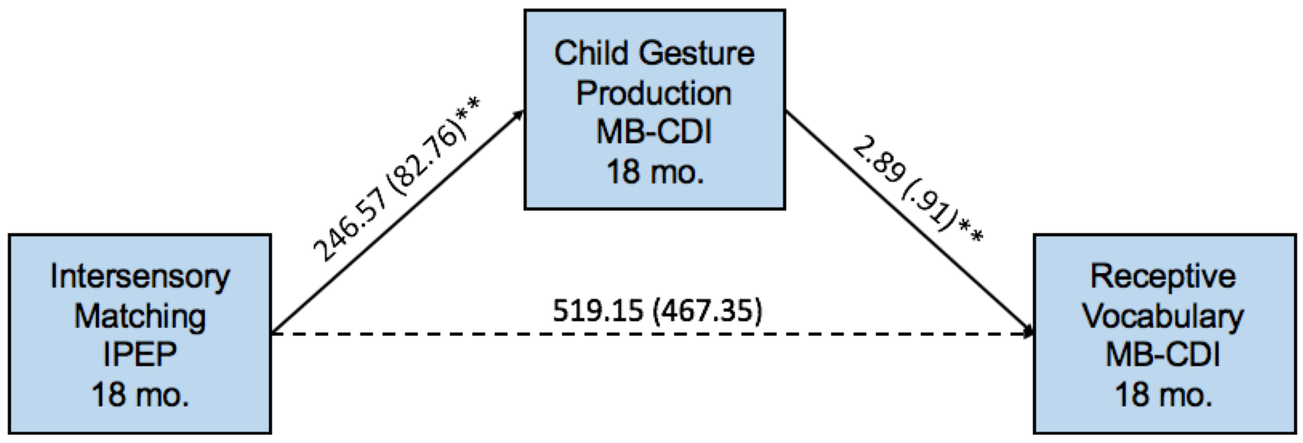

Figure 3. Unstandardized regression coefficients are presented for each path, with standard errors in parentheses. Note *p<.05 **p<.01

DISCUSSION

Findings are among the first to demonstrate a pathway from intersensory processing to language via child gesture production. Children who are better at processing synchronous faces and voices exhibit greater gesture production, and in turn, higher receptive vocabulary size. This may be the case because children experience gesture production in multimodal contexts that provide intersensory redundancy. These findings demonstrate the importance of early gesture production in the relation between intersensory processing and child language development. Moreover, this establishes the importance of intersensory processing in predicting child gesture production, with a novel link between the two. Future work will examine whether intersensory processing can predict later child gesture production and vocabulary.

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