Intersensory Processing of Faces and Voices at 6 Months Predicts Language Outcomes at 18, 24, and 36 Months of Age

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Introduction

Intersensory processing of faces and voices is thought to be foundational for language development. However, few studies have directly assessed the contribution of this critical, early developing skill in predicting later language outcomes in individual infants. This is due, in part, to a lack of sufficiently fine-grained measures of intersensory processing appropriate for infants. Two recently-developed assessments now fill this need, the Multisensory Attention Assessment Protocol (MAAP; Bahrick, Todd et al., 2018) and the Intersensory Processing Efficiency Protocol (IPEP; Bahrick, Soska et al., 2018). Previously, using the MAAP, we found that intersensory processing of faces and voices at 12 months predicted language outcomes at 18 and 24 months, holding traditional predictors (parent language input, SES) constant (Edgar et al., 2022). The Intersensory Processing Efficiency Protocol (IPEP; Bahrick et al., 2018b) is a more fine-grained assessment of just intersensory processing, indexing both speed and accuracy in the context of multiple distractors, and is capable of revealing smaller differences in intersensory processing skills in infants. Here, we used the IPEP to assess whether intersensory processing of faces and voices in younger infants (6 months) would predict language outcomes further into development, at 18, 24, and 36 months, holding traditional predictors (parent language input, SES) constant.

Methods

Infants (N = 103) participating in a longitudinal study received the IPEP at 6 months. IPEP trials depicted a 2 x 3 grid of six women speaking, only one of whom was synchronous with the appropriate soundtrack (target event; Figure 1). *Predictors*: We calculated two measures of intersensory processing: accuracy (proportion of total looking to the target event) and speed (latency to fixate the target event). Also, at 6 months, we transcribed parent language input quality (number of unique words) and quantity (total number of words) from a brief, lab-based parent-child interaction. *Language Outcomes*: At 18, 24, and 36 months, we transcribed child speech production quality and quantity (from parent-child interactions). At 18 and 24 months, we assessed children's expressive vocabulary size (MB-CDI). At 36 months, we assessed receptive (PPVT) and expressive vocabulary (EVT). *Covariate*: Maternal education level served as a proxy for SES.

Figure 1. Static image of the dynamic audiovisual social events from the IPEP.
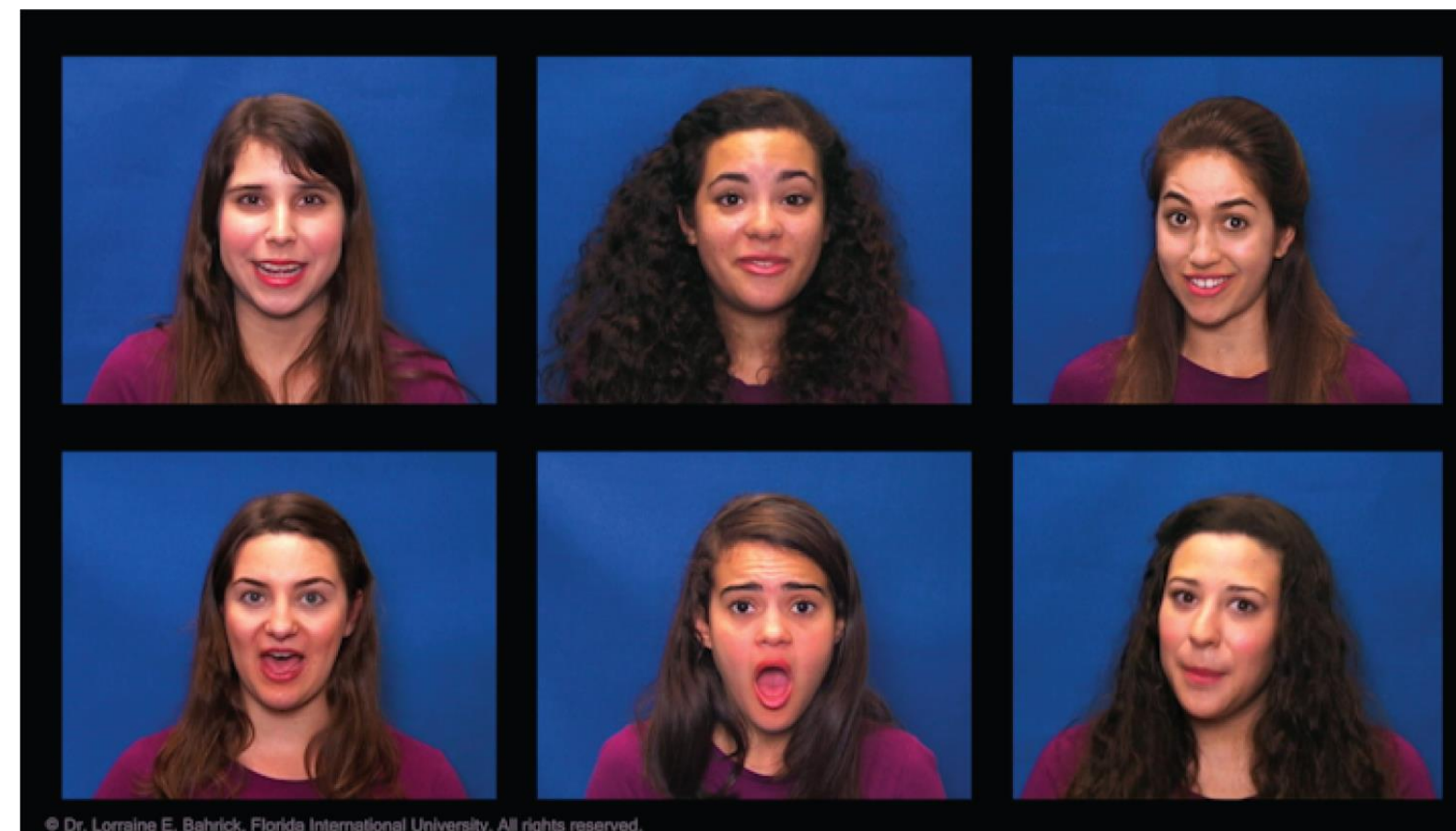
Table 1. Amount of unique variance accounted for by each predictor variable in predicting child language outcomes at 18, 24, and 36 months.

Predictors	18-Month Language Outcomes			
	Quantity	Quality	Expressive	Receptive
Total Variance	.18†	.27**	.16	.02
Unique Variance				
6-Month Intersensory Matching				
Accuracy	.11**	.13**	.08*	.00
Speed	.03*	.04*	.04	.02
6-Month Parent Language Input				
Quantity	.00	.02	.00	.00
Quality	.01	.02	.00	.00
Maternal Education	.04	.06*	.01	.01

Predictors	24-Month Language Outcomes		
	Quantity	Quality	Expressive
Total Variance	.29**	.35***	.15
Unique Variance			
6-Month Intersensory Matching			
Accuracy	.14***	.10**	.06*
Speed	.02	.00	.00
6-Month Parent Language Input			
Quantity	.01	.00	.01
Quality	.01	.00	.00
Maternal Education	.08*	.14***	.03

Predictors	36-Month Language Outcomes			
	Quantity	Quality	Expressive	Receptive
Total Variance	.02	.08	.32**	.30**
Unique Variance				
6-Month Intersensory Matching				
Accuracy	.00	.03	.08*	.15***
Speed	.00	.00	.03	.00
6-Month Parent Language Input				
Quantity	.00	.00	.03	.00
Quality	.00	.00	.04*	.00
Maternal Education	.00	.04*	.17**	.13**

Note: ***p< .001, **p< .01, *p <.05

Figure 2. Scatterplots depicting the relations between 6-month intersensory processing and A: 24-month expressive vocabulary, B: 36-month receptive vocabulary C: 24-month quality of speech production, and D: 18-month quality of speech production.
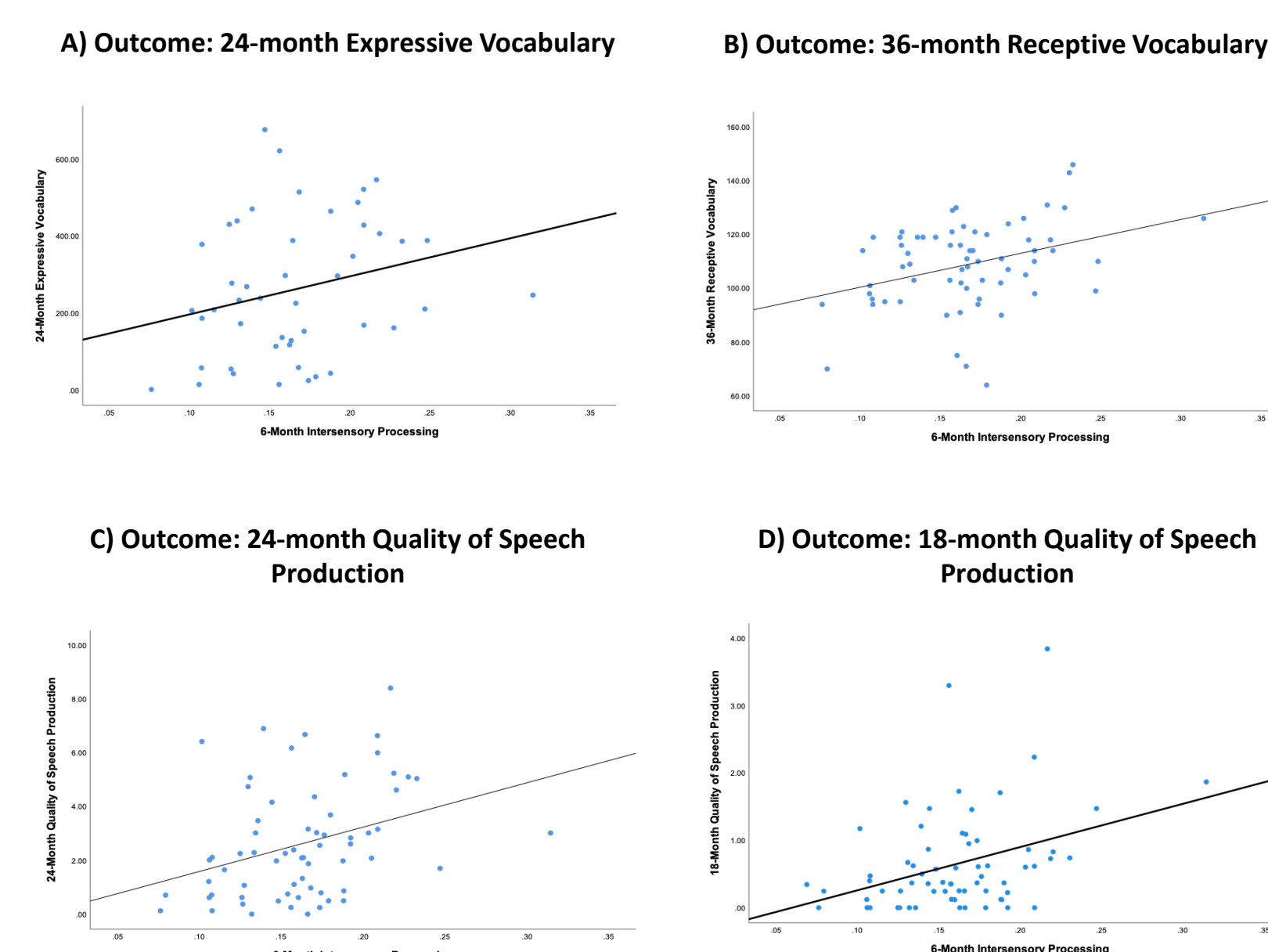
Results

We conducted multiple regression analyses to assess whether accuracy and speed of intersensory processing at 6 months would predict child language outcomes at 18, 24, and 36 months, holding parent language input and SES constant. Results indicated that 6-month accuracy of intersensory processing explained significant unique variance (i.e., change in $R2$; variance explained by each predictor when all other predictors were held constant) in multiple child language outcomes: child speech production (quality and quantity at 18 and 24 months), receptive (36 months) and expressive (18, 24, and 36 months) vocabulary (ps < .05; Table 1; Figure 2A-2D). Six-month speed of intersensory processing predicted significant unique variance in only two outcomes: 18-month quantity and quality of child speech production (ps < .05). SES also predicted several child language outcomes, whereas 6-month parent language input only predicted one outcome at 36 months.

Conclusions

Results mirrored and extended those of our previous study. Accuracy of intersensory processing of faces and voices was a strong and significant predictor of multiple child language outcomes at 18, 24, and 36 months, including quantity and quality of child speech production at 18 and 24 months, receptive vocabulary at 36 months, and expressive vocabulary at 18, 24, and 36 months. Strikingly, intersensory processing remained a strong and significant predictor even when holding traditional predictors (parent language input and SES) constant. In contrast, speed of intersensory processing was more limited in its ability to predict outcomes, predicting only child speech production at 18 months. Findings demonstrate that infant intersensory processing of faces and voices is an important foundation for language development. Further, fine-grained individual differences in intersensory processing can be assessed as early as 6 months and predict language outcomes even 2½ years later.

References

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