Longitudinal Development of Intersensory Perception to Social and Nonsocial Events from 6 to 24 months of age

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Introduction

Intersensory processing, coordinating redundant stimulation across multiple sensory modalities (e.g., audiovisual speech), guides attention to unitary multimodal events and provides a foundation for language and social development (Bahrick & Lickliter, 2012). Intersensory processing develops rapidly across infancy. However, until recently, the development of intersensory skills has been characterized by group-level data (e.g., intermodal preference, habituation). Thus, the relative competencies of individual children and developmental pathways to outcomes remain poorly understood. We developed the Intersensory Processing Efficiency Protocol (IPEP; Bahrick et al., 2018) to address this gap. The IPEP indexes fine-grained individual differences in intersensory processing of social and nonsocial events. Here, using the IPEP, we explore developmental change in intersensory processing speed and accuracy for both social and nonsocial events across the first two years of life.

Methods

The IPEP was administered to 95 infants longitudinally at 6, 12, 18, and 24 months of age. On each of the 48 8-s trials, infants viewed a 2x3 grid of 6 dynamic visual events of women speaking (social events) or objects impacting a surface (nonsocial events; see Figure 1). One of the events was synchronous with its natural soundtrack (target event), and the other five events were asynchronous with the soundtrack. Eye-tracking (Tobii X120) was used to derive two measures of accuracy: (1) how often infants found the target event (proportion of trials on which the target was fixated – PTTF) and (2) how long infants looked to the target event (proportion of total looking time to the target – PTLT), as well as one measure of speed: how quickly infants located the target (reaction time – RT).

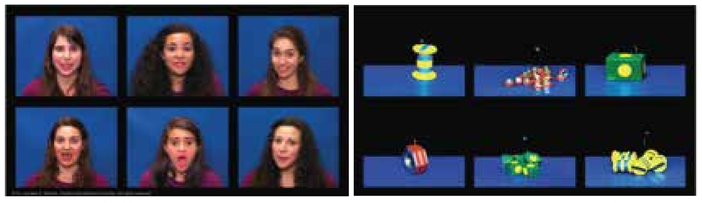

Figure 1. Static images depicting the dynamic social (left) and nonsocial (right) events shown to children in the IPEP.

Results

We assessed longitudinal trajectories of all three measures (PTTF, PTLT, and RT) using SEM-based latent growth curve modeling (see Figure 2). For social events, PTTF and RT exhibited significant linear increases across age, and PTTF, PTLT, and RT all exhibited significant quadratic increases across age (see Figure 3). All models exhibited good model fit (X^2s range: .712-6.16, ps>.13) and significant improvement in model fit relative to no-growth models ($X^2_{difference}$ range: 10.75-39.40, ps<.05). For nonsocial events, only PTTF (but not PTLT or RT) exhibited significant linear growth across age. The model exhibited moderate model fit, X^2=16.13, p<.01; but significant model improvement relative to the no-growth model, $X^2_{difference}$=14.45, p=.006. In contrast, models assessing nonsocial PTLT and RT exhibited poor model fit. Parameter estimates and model fit statistics are presented in Table 1.

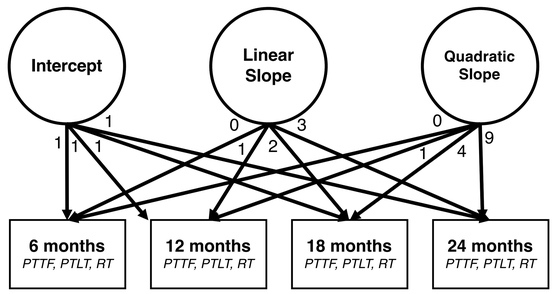

Figure 2. An example of an SEM latent growth model to assess quadratic growth. Rectangles indicate observed variables, and circles indicate latent variables.

Table 1. Intercept and slope coefficients, and model-fit statistics for growth curve models of intersensory selection (PTTF), matching (PTLT), and speed (RT).

	Accuracy of Selection (PTTF)		Accuracy of Matching (PTLT)		Speed of Matching (RT)	
	Social	Nonsocial	Social	Nonsocial	Social	Nonsocial
Intercept	0.45***	0.58***	0.51***	0.54***	2.56***	2.89***
Linear Slope	0.04**	0.02*	-0.02	--	-0.14***	--
Quadratic Slope	0.001	--	0.01*	--	0.09*	--
Model Chi-Square	0.71 (p=.70)	16.13 (p=.006)	4.07 (p=.13)	7.74 (p=.46)	6.16 (p=.05)	6.99 (p=.54)
CFI	1.00	0.28	0.66	1.00	0.00	1.00
RMSEA	0.00	0.15	0.10	0.00	0.15	0.00

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

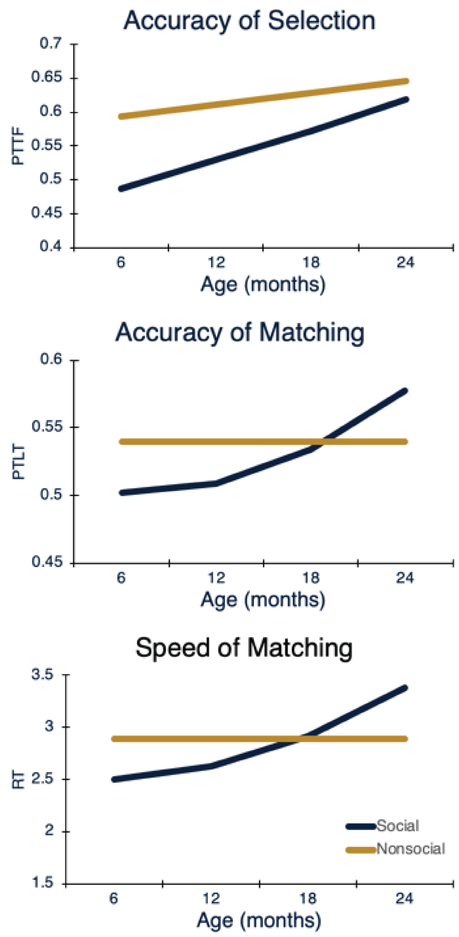

Figure 3. SEM-based latent growth curves depicting developmental change in accuracy of selection (PTTF; top), accuracy of matching (PTLT; center) and speed of selection (RT; bottom) to social events (blue) and nonsocial events (gold)

Discussion

Findings provide the first developmental trajectories characterizing speed and accuracy of intersensory processing across the first two years of life. Developmental change was most evident for social events, whereas evidence of change for nonsocial events was mixed. For social events, all three measures showed significant growth across age. Frequency of finding the target increased steadily across age. Accuracy and speed of intersensory matching both exhibited quadratic growth, meaning they increased gradually earlier in development, and rapidly later in development. Interestingly, intersensory processing speed for social events increased across age, with children showing slower speed of target selection with age. This may reflect the use of different task strategies across age. In contrast, for nonsocial events, only one measure of accuracy (PTTF, frequency of finding the target) showed significant developmental improvement. Future research will assess the ability of individual longitudinal trajectories of intersensory processing measures to predict outcomes including executive functions, and language and social development.

References

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