

Intersensory Processing in 12-Month-Olds is Related to Shared Gaze to Toys

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Introduction

- Detecting intersensory redundancy (coordinated temporally synchronous patterns of stimulation across sensory modalities) is a basis for perceiving unitary multisensory events (people speaking; labeling an object).
 - It is a foundation for social and language development (Bahrack & Lickliter, 2012).
 - Highly salient to young children and recruits attention to multimodal events (Bahrack & Lickliter, 2012).
 - Facilitates infant learning of arbitrary object-label relationships (Gogate & Bahrack, 1998; 2001), which is a basis for word learning and early language development
- We developed the Multisensory Attention Assessment Protocol (MAAP; Bahrack, et al. under review) to assess individual differences in children's detection of intersensory redundancy (intersensory matching) in audiovisual social and nonsocial events.
- Caregiver-child interactions provide a wealth of redundant sensory information across modalities. One type of multisensory information coordinated across social partners is joint attention (shared gaze to objects and events).
 - It requires infants to coordinate overlapping multisensory information (e.g. eye gaze, object movement, and verbal labels) across sensory systems
 - It is a reliable predictor of vocabulary development (Mundy, et al., 2007)
- We expect that Individual differences in detecting intersensory redundancy are related to the development of joint attention
- The present study tests our hypothesis that children with better intersensory matching should exhibit more frequent instances of joint attention in dyadic interactions.

Methods

- Thirty-seven 12-month-olds ($M = 12.05$ months, $SD = .22$; 16 male, 21 female) participated in the MAAP and an 8-minute caregiver-child interaction (CCI).
- The MAAP is a 24-trial video-based procedure (see Figure 1). Each trial begins with a 3-second dynamic central event, followed by two 12-second lateral events, one of which is synchronous with its natural soundtrack.
 - Blocks of social (women speaking) and nonsocial trials (objects dropping) are presented.
 - Intersensory matching was calculated on each trial as the proportion of total looking time (PTLT) to the sound-synchronous event.
- The CCI is an 8-minute lab-based play interaction between the child and caregiver. Caregivers (30 mothers, 5 fathers, 2 grandmothers) and children played together with toys across from one another at a table (see Figure 2).
- Child and caregiver gaze was coded frame-by-frame to assess fixations to 1) the partner's face, 2) one of the toys, or 3) some other location. Joint attention was calculated as the dyad's frequency of temporally co-occurring looks to the toy.



Figure 1. Still images of dynamic stimuli from the Multisensory Attention Assessment Protocol (MAAP). Images depict social high competition (top) and nonsocial high competition (bottom) trials. On low competition trials, the central event is absent during the presentation of the lateral events.



Figure 2. Static images of a child and mother participating in the Caregiver-Child Interaction (CCI) Both child and mother are fixating the toy blocks held by the mother.

Results

- Table 1 presents descriptive statistics for intersensory matching and joint attention.
- To assess relations between intersensory matching and joint attention between dyads, Poisson regression analyses were used because joint attention measures were derived from counts (see Table 2).
 - Findings revealed that greater intersensory matching (across all trials) was associated with more instances of joint attention ($p < .001$).
 - This pattern of findings was evident for both social and nonsocial events ($ps < .01$; see Figure 3).

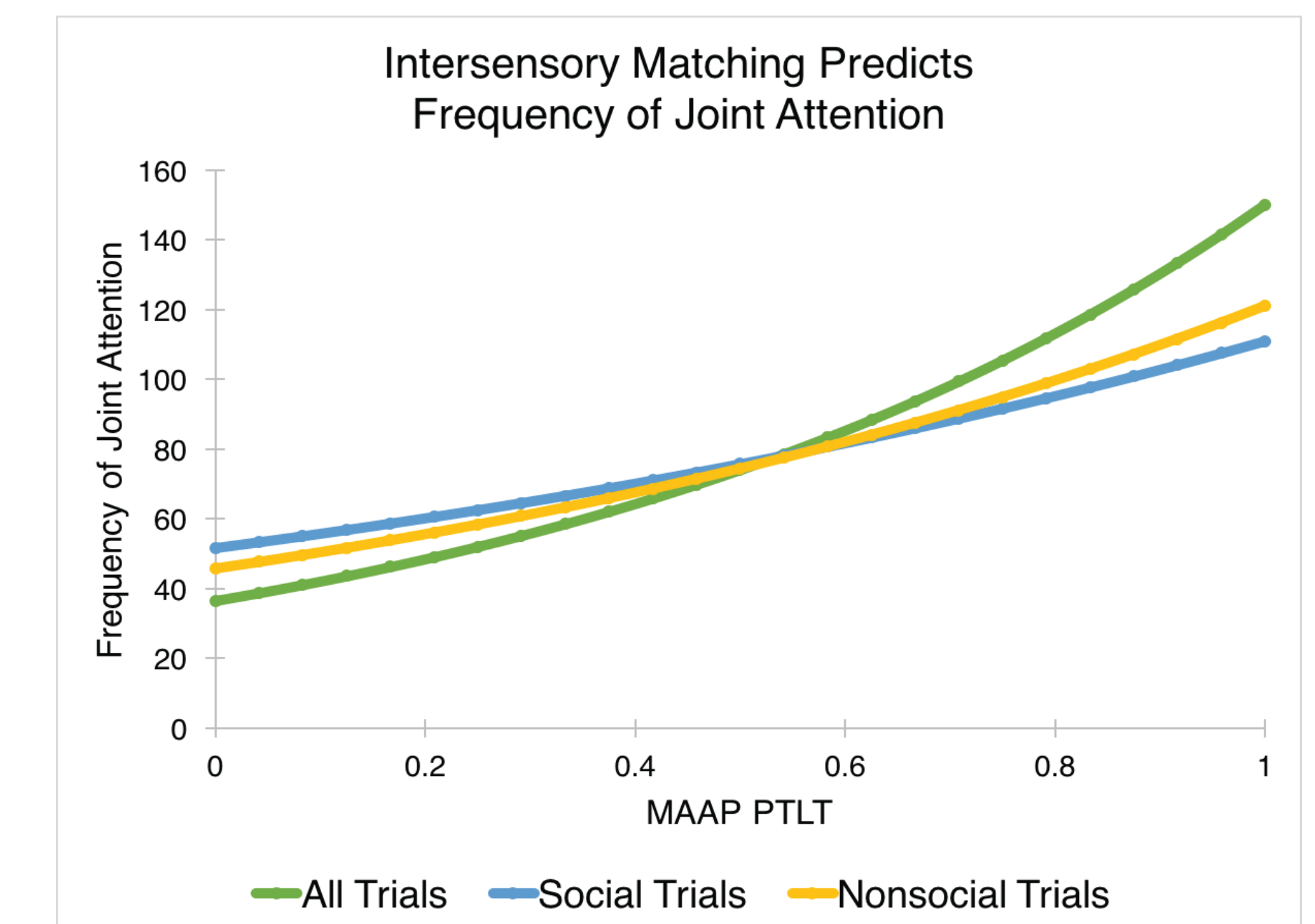


Figure 3. Poisson regression models predicting the frequency of joint attention from intersensory matching on the MAAP.

Table 1

Descriptive statistics for the MAAP and CCI

MAAP PTLT	M	SD
All Trials	0.524	0.060
Social Trials	0.518	0.071
Nonsocial Trials	0.530	0.086
Frequency of Joint Attention	Median	Range
	73	39 - 146

Note: PTLT = Proportion of Total Looking Time to the target (Intersensory Matching).

Table 2

Poisson Regression Predicting Joint Attention from Intersensory Matching

	Frequency of Joint Attention to Toys		
	χ^2	b	$R^2_{deviance}$
All Trials	19.474***	1.411***	0.090
Social Overall	8.303**	0.765**	0.380
Nonsocial Overall	18.164***	0.970***	0.085

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

Discussion

- Findings are among the first to demonstrate a relationship between children's intersensory matching and engagement in joint attention.
- Children who showed greater attention to sound-synchronous events had more instances of joint attention with their caregivers
- Intersensory matching and joint attention are both proposed foundations for language development. Joint attention occurs in multisensory contexts, and thus requires flexible, efficient attention to multisensory information.
- We proposed that enhanced sensitivity to the intersensory redundancy provided by social interactions may lead to increased opportunities for joint attention and, in turn, improved outcomes for language and social development.
- Future research will address how these skills interact to promote social and language development.

References

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