

Intersensory Processing and Social Orienting in Children with Autism Spectrum Disorders: Integrating Typical and Atypical Development

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Background:

Children with autism spectrum disorders (ASD) show altered intersensory processing and impairments in social orienting (Bebko et al., 2006; Dawson et al., 2004; Newell et al., 2007). In contrast, findings of intersensory processing and preferential attention to social over nonsocial events are well established in typically developing infants in the first 6 months of life (Bahrack, 2010). Compared to nonsocial events, social events are more variable, complex, and provide an extraordinary amount of intersensory redundancy (e.g., synchrony, rhythm, and intensity changes invariant across the senses). Further, intersensory redundancy is highly salient and organizes the typical development of attention and perception in infancy (Bahrack & Lickliter, 2002). We hypothesize that the salience of intersensory redundancy plays a fundamental role in the emergence of social orienting across infancy and that an early disturbance of intersensory processing may lead to reduced social attention in ASD.

Objective:

Little is known about how social orienting emerges in typical development. Our aims were to investigate the emergence of social attention in typically developing (TD) infants, characterize atypical social attention in children with ASD, and evaluate the role of intersensory processing in the development of attention to social events. Our goal is to begin to bridge the gap between knowledge of typical and atypical development of social attention.

Method:

First, to examine the typical emergence of social orienting and the role of intersensory redundancy, we evaluated cross-sectional data from 703 2- to 8-month-old TD infants who participated in infant control habituation procedures with social (women speaking) or nonsocial (objects impacting a surface) events. We assessed attention maintenance (processing time - mean length of time to reach habituation) to films of social or nonsocial events providing intersensory redundancy (audiovisual synchrony) or no redundancy (unimodal visual, silent).

Second, to assess intersensory processing and attention in ASD, data from 33 2- to 5-year old children with ASD, developmental delays (DD), and TD were collected using our Behavioral Attention Assessment Protocol (BAAP; Bahrack et al., 2010). Children received trials of a central stimulus followed by two side-by-side peripheral events in blocks of social neutral, social positive, and nonsocial events. One peripheral event was synchronous with the natural soundtrack and the other was out of synchrony. Intersensory audiovisual matching and attention maintenance were evaluated.

Finally, to assess orienting vs. disengagement of attention to social and nonsocial events in ASD, data from children with ASD (N=11) and TD (N=11) were collected using an earlier version of the BAAP (Newell et al., 2007). We assessed latency to shift attention from a competing central stimulus to one of two peripheral social or nonsocial events (disengage trials) vs. latency to shift attention when there was no competing central stimulus (orient trials).

Results:

Attention to social vs. nonsocial events in infancy. TD infants showed a gradual emergence of enhanced attention to social events across infancy as a function of intersensory redundancy. Attention (processing time) for audiovisual social events (which provide intersensory redundancy) was maintained across age, from 2- to 8-months. In contrast, attention to all other event types decreased across age, including audiovisual nonsocial events (which provide somewhat less intersensory redundancy), and unimodal visual social and nonsocial events (which provide no intersensory redundancy; see Figure 1).

Intersensory processing in ASD. Children with ASD showed impaired intersensory processing with no evidence of audiovisual matching for social or nonsocial events. In contrast, TD and DD children showed significant audiovisual matching for social events and TD children also matched nonsocial events (see Figure 2).

Attentional disengagement and maintenance in ASD. Children with ASD showed reduced attention maintenance for social but not nonsocial events compared with TD children (see Figure 3). Although children with ASD showed no impairment in attention orienting, they showed impaired disengagement (longer latencies) to look to social events, but no impairments to look to nonsocial events as compared with TD children (see Figure 4).

Figure 1. Attention to social vs. nonsocial events in infancy.

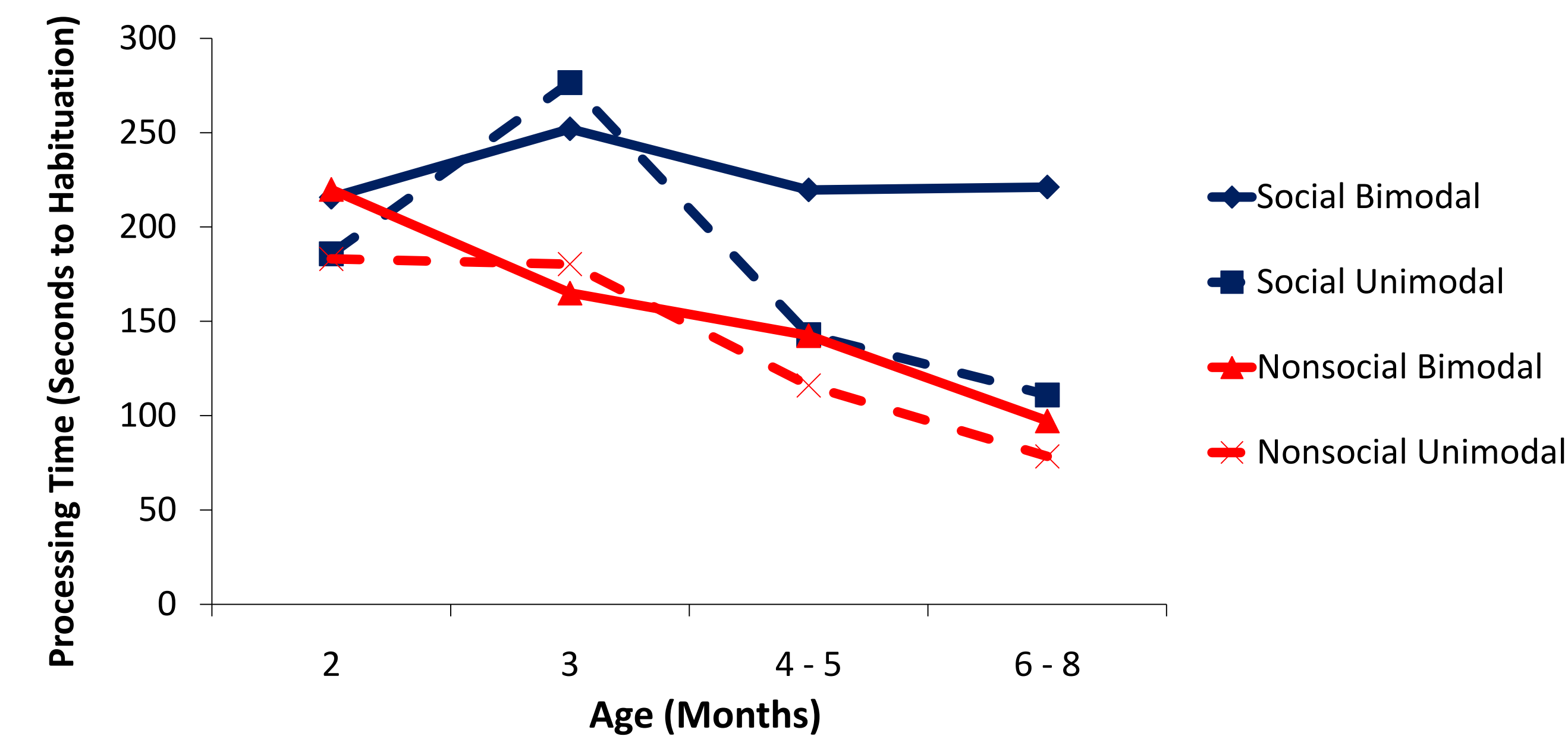


Figure 2. Intersensory processing in ASD.

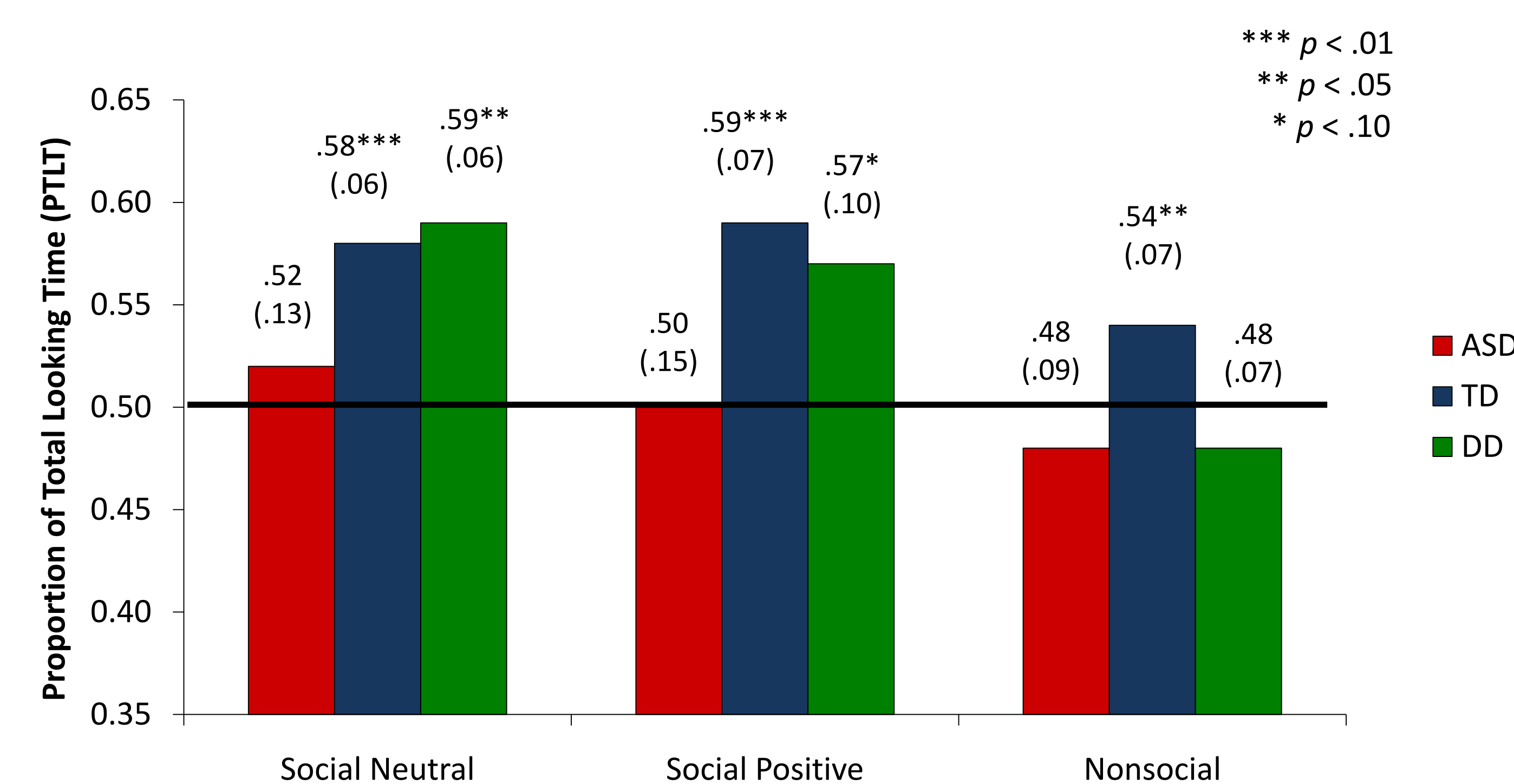


Figure 3. Attention maintenance in ASD

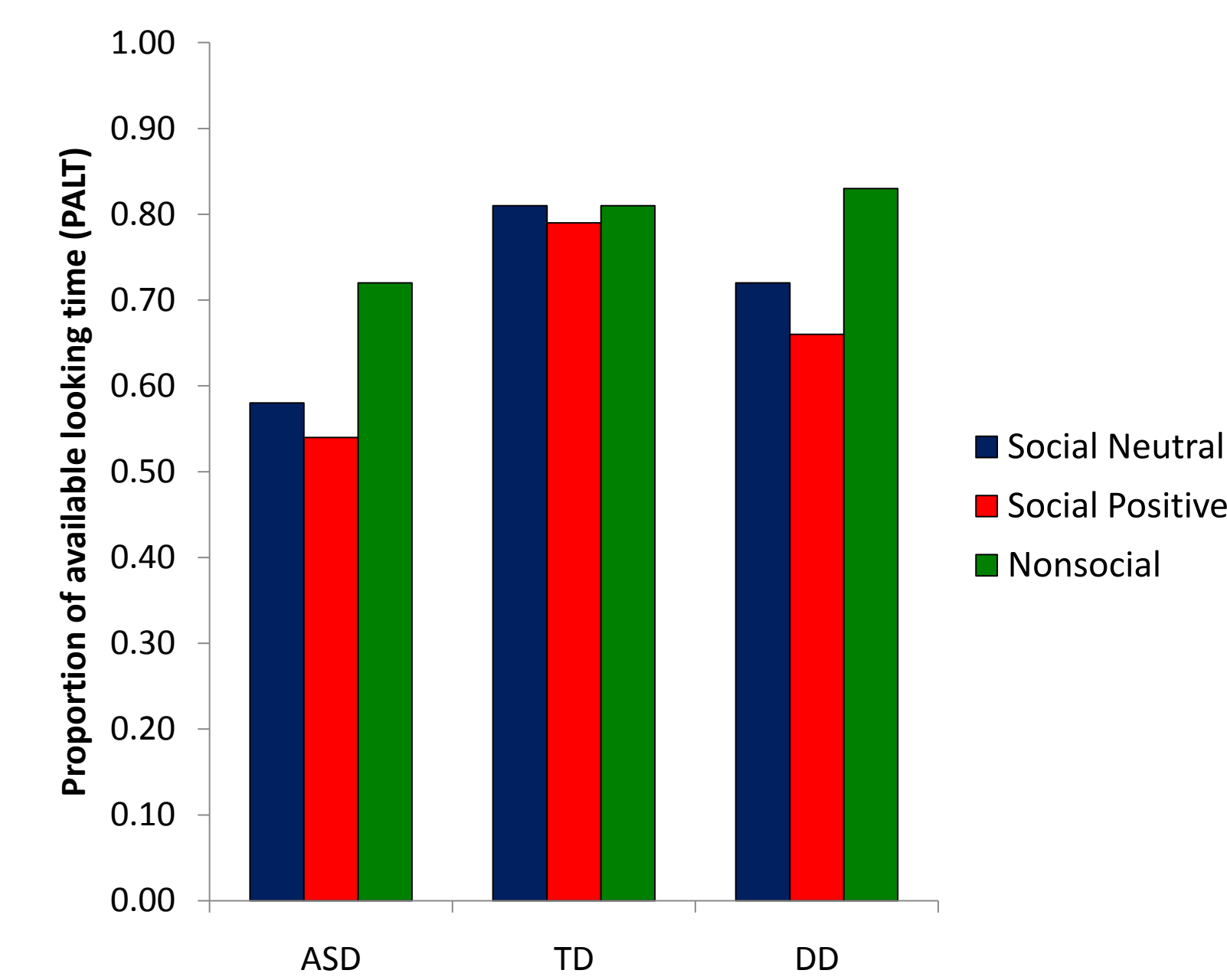
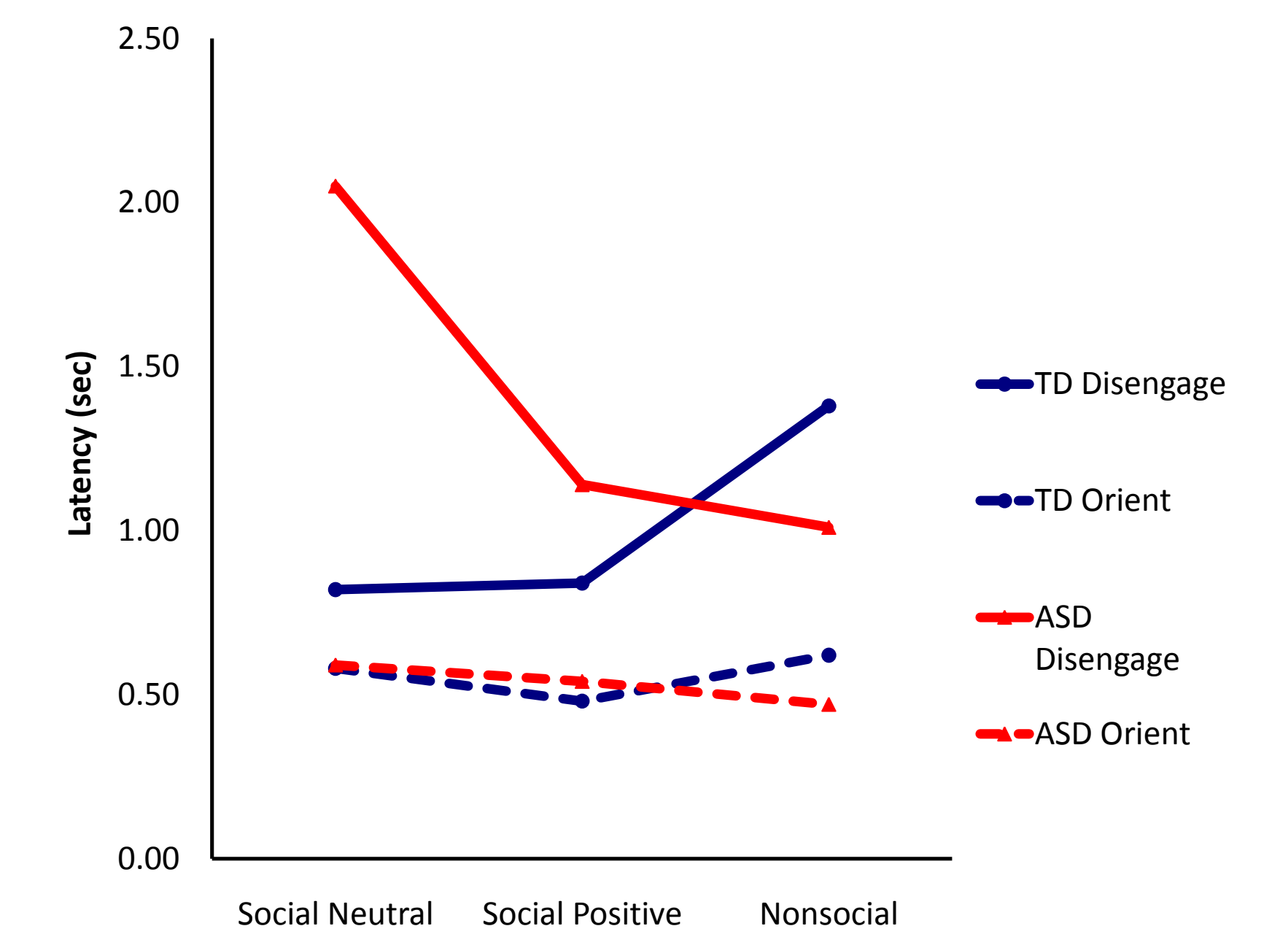


Figure 4. Attention disengagement in ASD



Conclusion:

Collectively, these findings support growing reports of intersensory processing deficits and greater attention impairments for social than nonsocial events in ASD. Our findings also reveal new information indicating that in typical development, social orienting emerges gradually across infancy, likely as a function of intersensory redundancy. Together, these findings are consistent with the view that an intersensory processing disturbance in early infancy could lead to a failure of social events to become selectively salient. This could lead in turn to cascading effects across development including decreased social attention, impaired joint attention, language, and communication, consistent with fundamental impairments in ASD.

References:

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