Infant Attention to Multimodal Synchrony in Social and Nonsocial Stimuli

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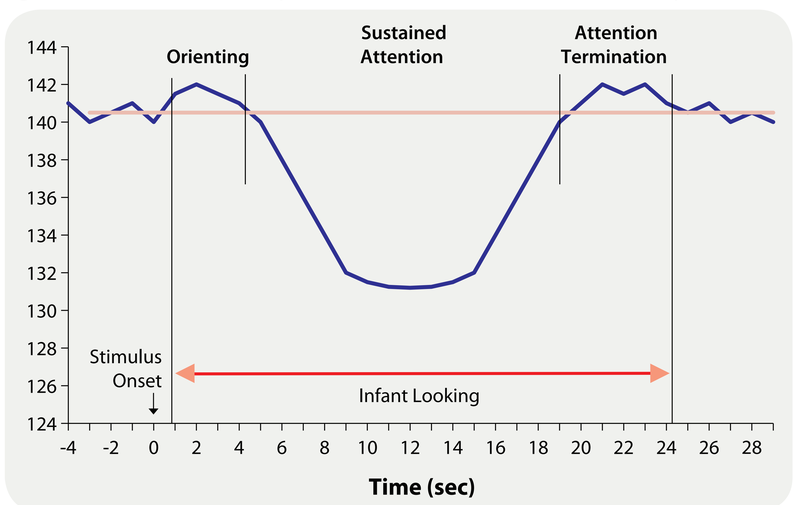
Introduction

Attention is a behavioral state that facilitates learning, and is associated with coordinated neural activity (i.e., neural synchrony). To some degree, infant attention is driven by stimulus-related factors. This tends to be truer of younger infants; in older infants, attention appears to be more voluntary or controlled (Colombo & Cheatham, 2006). Research has shown that synchrony is one factor that elicits infant attention (Bahrick & Lickliter, 2000). In addition, social events, compared to nonsocial events, provide redundant information (across face and voice) that attracts and sustains attention (Bahrick, 2010). The current study sought to determine whether synchronous stimuli more effectively induce attention in infants than stimuli characterized by asynchrony. Synchrony was manipulated within both a social and a nonsocial context. We predicted the synchronous and social stimuli, compared to asynchronous and nonsocial stimuli, would produce longer looking and more time spent in a state of sustained attention, evidenced in deep heart rate decelerations strongly coordinated with looking.

Method

Eighty 4-month old (N = 38; M = 3.9 months) and 8-month old (N = 42; M = 8.1 months) infants were shown 2-minute, multimodal synchronous or asynchronous video clips of social events (a woman speaking in infant-directed speech) or nonsocial events (a toy hammer tapping a rhythm). Looking times and heart rate (HR) were measured during the task. Looking was evaluated using measures of total looking time and peak look duration. HR was evaluated using measures of beats per minute (bpm) and 3 HR-defined phases of attention: Orienting (OR), Sustained Attention (SA) and Attention Termination (AT).

Figure 1: Heart-rate defined phases of attention (after Richards & Casey, 1992)



Results

Age (4 months, 8 months) x Condition (Synchronous, Asynchronous) x Event Type (Social, Nonsocial) ANOVAs were completed for looking and HR measures.

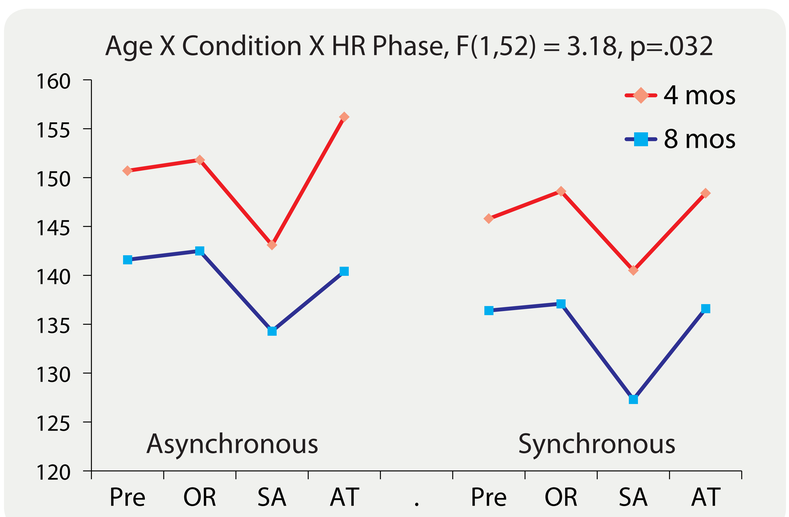
Looking Data

There was a main effect of event type for both total looking time and peak look duration. Infants spent more time looking at social events (101.73 sec) compared to nonsocial events (87.85 sec), $F(1,63) = 4.62$, $p=.03$. In addition, infants had longer peak looks to social events (38.31 sec) compared to nonsocial events (24.52 sec), $F(1,63) = 6.78$, $p=.011$. There were no effects of synchrony condition for measures of looking.

Heart Rate Data

Looking was parsed into HR-defined phases: OR, SA, and AT. Percentage of looking, and HR for each phase were analyzed across the 2-min period. Analyses of HR during Premedian, OR, SA, and AT yielded an expected significant main effect of age ($p < .001$), with older infants having lower HR than younger infants. In addition, HR was lower for the social event (139.9 bpm) compared to the nonsocial event (145.7 bpm), $F(1,54) = 5.29$, $p=.025$. An Age X Condition X HR Phase interaction can be seen in Figure 2. As can be seen in the figure, 4-month-olds had higher HR during AT in the asynchronous condition compared to the synchronous condition.

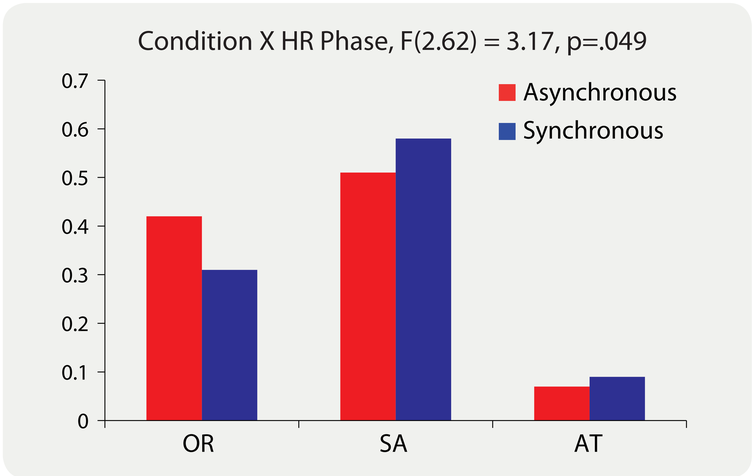
Figure 2: HR (bpm) as a function of each HR-defined phase of attention for 4- and 8-month-olds in the asynchronous and synchronous conditions.



Results (cont.)

Analyses of the percentage time spent in each HR phase (OR, SA, AT) yielded a significant Condition x HR Phase interaction (see Figure 3). As can be seen in the figure, infants spent less time orienting and more time in a state of sustained attention during the synchronous condition compared to the asynchronous condition.

Figure 3: Percentage of looking time as a function of each HR-defined phase of attention for the asynchronous and synchronous conditions.



Conclusions

Evidence for the effects of both synchrony and social stimuli on attention was obtained. As predicted, social stimuli attracted and held attention, eliciting longer looking, higher peak look duration, and lower HR than nonsocial stimuli. Also consistent with our predictions, the synchronous condition produced faster HR decelerations (less OR) and a longer, deeper state of sustained attention than the asynchronous condition. Interestingly, the effects of synchrony and the social nature of stimuli were additive, suggesting separability of their effects.

References

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