

Intersensory Redundancy Facilitates Infant Discrimination of Tempo of Speech

Lorraine E. Bahrick¹, Sheila Krogh-Jespersen², James Torrence Todd¹, Catherine Naclerio¹, Yessenia Lau¹

¹Florida International University, ²University of Chicago

Introduction

Sensitivity to amodal properties of speech such as tempo, rhythm, and intensity underlies basic speech perception skills including detecting prosody, affect, and communicative intent. According to the Intersensory Redundancy Hypothesis (IRH; Bahrick & Lickliter, 2000, 2002), detection of amodal properties is facilitated when they are redundantly specified across multiple sense modalities as compared with when they are detectable through only a single sense modality (intersensory facilitation). Prior studies have shown intersensory facilitation for infant detection of tempo and rhythm in nonsocial object events (Bahrick & Lickliter, 2000, 2004). In particular, discrimination of the tempo and rhythm of a toy hammer tapping was facilitated in audiovisual, synchronous stimulation and attenuated in unimodal visual or auditory stimulation in infants of 3 and 5 months (Bahrick & Lickliter, 2000; Bahrick, Flom, & Lickliter, 2002). The current study assessed whether intersensory facilitation of tempo would also be evident in the domain of audiovisual speech perception. Given that intersensory facilitation is a general principle of early perceptual processing (evident across species), then it should also be evident in the domain of speech perception in early development.

Methods

Infants of 2.5 (N=32) and 5.5 months of age (N=32) were randomly assigned to either a *synchronous, audiovisual* speech condition (providing intersensory redundancy) or a *unimodal visual* speech condition (no intersensory redundancy). Infants were habituated, under their respective conditions, to a woman speaking a nursery rhyme at one tempo (130, 145, 175 or 190 syllables per minute; spm), followed by two test trials in which the same woman's speech was either 45 spm faster or slower than the habituated tempo (145 vs. 190 spm or 130 vs. 175 spm; see Figure 1). We predicted enhanced discrimination of tempo in the synchronous, audiovisual condition as compared with the unimodal visual speech condition, demonstrating intersensory facilitation of tempo of speech.

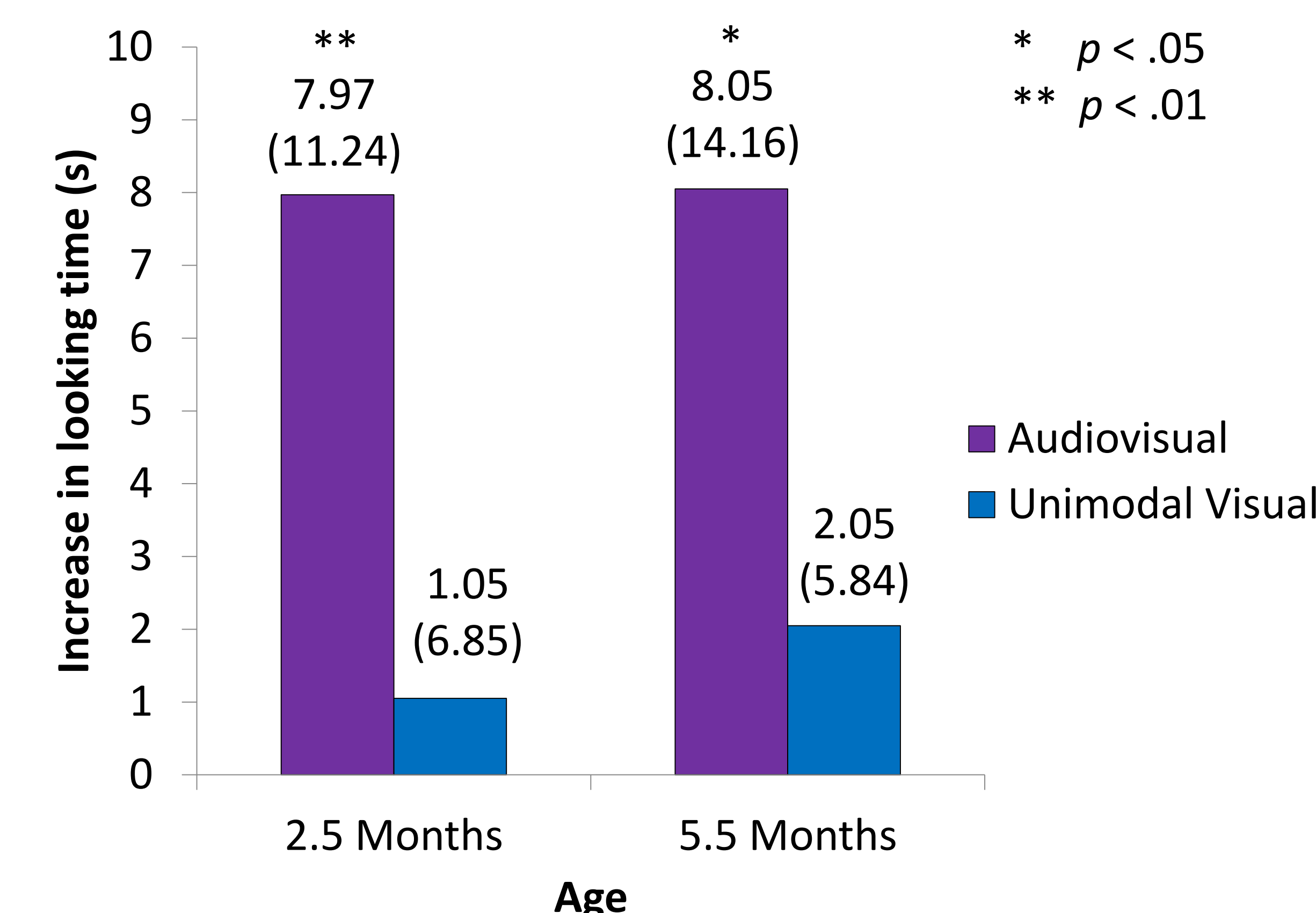
Results

Results (see Figure 2) demonstrated a significant visual recovery (difference in looking during two test trials vs. two no-change, posthabituation trials) in the audiovisual condition at both 2.5- and 5.5-months of age ($t(15)=2.84, p=.01$; $t(15)=2.28, p=.03$, respectively) demonstrating discrimination of tempo. In contrast, neither 2.5- nor 5.5-month-olds showed evidence of discriminating tempo of speech in the unimodal visual condition ($ps > .1$). Further, an age (2.5, 5.5 months) x condition (audiovisual, unimodal visual) ANOVA revealed a significant main effect of condition ($F(1,60)=6.55, p=.01$) indicating that infants showed greater discrimination of the tempo of speech in the audiovisual than unimodal visual condition. No other significant main effects or interactions emerged.

Figure 1. Static images depicting the four actresses presented in the habituation and test phases.



Figure 2. Increase in looking time to test events depicting a change in tempo of speech for 2.5- and 5.5-month-old infants as a function of condition (synchronous audiovisual, unimodal visual).



Conclusions

Infants of 2.5 and 5.5 months of age discriminated changes in the tempo of speech in synchronous audiovisual, but not unimodal visual, stimulation. Consistent with predictions of intersensory facilitation, discrimination of tempo was enhanced in redundant audiovisual as compared with unimodal visual stimulation. These results extend previous findings of intersensory facilitation of tempo from nonsocial object events (Bahrick & Lickliter, 2000; Bahrick et al., 2002) to social speech events. Parallel findings of intersensory facilitation across speech and object events suggest that the same general principles of perceptual development govern perception of amodal properties across social and nonsocial domains.

References

- Bahrick, L. E., Flom, R., & Lickliter, R. (2002). Intersensory redundancy facilitates discrimination of tempo in 3-month-old infants. *Developmental Psychobiology*, 41, 352-363.
- Bahrick, L. E., & Lickliter, R. (2000). Intersensory redundancy guides attentional selectivity and perceptual learning in infancy. *Developmental Psychology*, 36, 190-201.
- Bahrick, L. E., & Lickliter, R. (2002). Intersensory redundancy guides early perceptual and cognitive development. In R. V. Kail (Ed.), *Advances in Child Development and Behavior* (Vol. 30, pp. 153-187). San Diego, CA: Academic Press.
- Bahrick, L. E., & Lickliter, R. (2004). Infants' perception of rhythm and tempo in unimodal and multimodal stimulation: A developmental test of the intersensory redundancy hypothesis. *Cognitive, Affective & Behavioral Neuroscience*, 4, 137-147.