Face Discrimination in Preschool-Aged Children

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Abstract

Newell, Bahrick, and Sternstein (2007) found that 4-year-old children discriminated and recognized faces of unfamiliar women when presented in dynamic, unimodal visual speech. The current study extends this investigation to dynamic audiovisual speech in both synchronous and asynchronous presentations. According to the Intersensory Redundancy Hypothesis (IRH; Bahrick & Lickliter, 2000, 2002), perception of modality specific information (e.g., facial configuration) is facilitated in nonredundant stimulation, but attenuated in multimodal, redundant stimulation such as synchronous audiovisual speech, where redundancy competes for attention. In contrast, asynchronous audiovisual speech provides the same amount and type of stimulation as synchronous audiovisual speech, but eliminates intersensory redundancy. If redundancy interferes with face discrimination, then 4-year-old children should show enhanced face discrimination in the context of asynchronous speech, similar to unimodal visual speech, and attenuated face discrimination in the context of synchronous speech. Results supported our predictions. These findings extend predictions of the IRH regarding facilitation of attention to modality specific properties in nonredundant stimulation, to naturalistic face perception in young children.

Introduction

Infants show discrimination and recognition of faces in unimodal visual stimulation, with enhanced discrimination in dynamic as compared with static presentations (Bushnell, 2001; Bahrick, Moss, & Fadil, 1996; Otsuka, et al., 2009). However, less is known about face discrimination in preschoolers, particularly for naturalistic, dynamic speaking faces. According to the Intersensory Redundancy Hypothesis (IRH), perceptual processing of modality specific information (e.g., color, pattern, facial configuration) is facilitated in unimodal, nonredundant stimulation (unimodal facilitation), but attenuated in bimodal, redundant stimulation where salient intersensory redundancy competes for attention and facilitates processing of amodal properties (e.g., synchrony, rhythm, tempo).

Newell, Bahrick, and Sternstein (2007) found that 4-year-old children recognized briefly presented faces of unfamiliar females in dynamic, unimodal visual (silent speech) displays. The current study extends these findings to synchronous and asynchronous audiovisual speech. Synchronous speech provides intersensory redundancy, which is expected to interfere with face discrimination by focusing attention on redundant properties (rhythm, tempo, synchrony, and intensity changes uniting face and voice). In contrast, asynchronous speech provides the same amount and type of stimulation but eliminates intersensory redundancy. If the presence of intersensory redundancy attenuates face perception, then children should show enhanced face discrimination in unimodal visual and asynchronous audiovisual speech, but attenuated face discrimination in synchronous audiovisual speech.

Method

Forty-eight 3.5- to 4-year-old children participated. Children were randomly assigned to one of three conditions: unimodal visual (silent) speech, bimodal synchronous audiovisual speech, or bimodal asynchronous audiovisual speech (audio track displaced by 3 seconds). Following successful recognition on two practice trials using novel and familiar toys, children were familiarized under their assigned condition, with six dynamic films (5 sec each) of different female actresses speaking a nursery rhyme. The films depicted the face and shoulder areas of females wearing black t-shirts and backwards baseball caps to reduce hair and clothing cues (see Figure 1) and were presented in the context of a story about a birthday party. Children received three consecutive familiarization trials followed by three forced-choice test trials where a familiar and a novel female were presented side by side. The procedure was then repeated for a second block of three familiarization and three test trials with the remaining stimulus events. In each forced-choice test trial, children were asked to point to the female they had previously seen (at the birthday party) and accuracy was recorded.

Figure 1: Stimuli

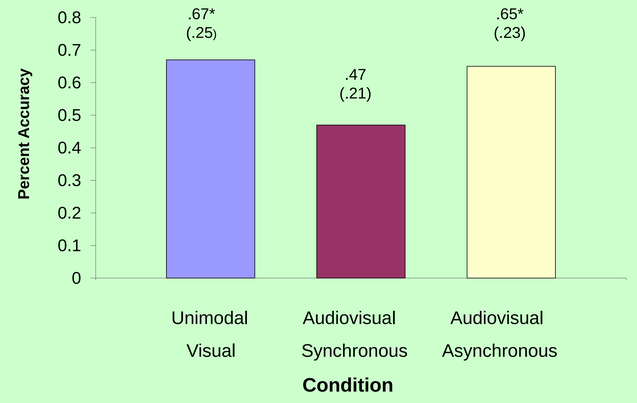
Familiarization Trial

Test Trial

Results

To assess evidence of face recognition, percent accuracy (see Figure 2) was compared against chance (50%) using single sample *t*-tests for each condition. Results indicated significant face recognition in the unimodal visual and bimodal asynchronous speech conditions, $t(15) = 2.62$, $p < .05$; $t(15) = 2.48$, $p < .05$, respectively, but not in the bimodal synchronous speech condition $t(15) = -1.31$, $p > .05$. Further, an ANOVA indicated a main effect of condition, $F(2,36) = 5.71$, $p = .007$, and consistent with our predictions, pairwise comparisons revealed greater recognition accuracy in the unimodal visual and bimodal asynchronous speech conditions than the bimodal synchronous speech condition (ps < .008), but no difference between the unimodal visual and bimodal asynchronous conditions ($p = .80$).

Figure 2: Accuracy of face recognition in the presence of intersensory redundancy (synchronous audiovisual speech) versus the absence of intersensory redundancy (unimodal visual and asynchronous audiovisual speech)



* = p < .05

Conclusions

The present findings demonstrate that 3.5- to 4-year old children discriminate and recognize dynamic displays of novel female faces following a brief familiarization period. Further, consistent with our predictions, under brief exposure conditions, face recognition is evident in unimodal visual and asynchronous audiovisual speech (where no intersensory redundancy is available) but not in synchronous speech (which provides intersensory redundancy). These findings extend predictions of the IRH regarding facilitation of attention and perceptual processing of modality specific information (such as facial configuration) in nonredundant stimulation, to naturalistic face perception in young children. They indicate that intersensory redundancy available in synchronous audiovisual speech interferes with face discrimination in young children, whereas unimodal visual exposure to faces facilitates face discrimination and recognition. Further research will explore when and under what exposure conditions children can recognize faces in audiovisual speech when intersensory redundancy competes for attention.

References

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*, 30 (pp. 153-187). New York: Academic Press.

Bahrick, L.E., Moss, L., & Fadil, C. (1996). The development of visual self- recognition in infancy. *Ecological Psychology, 8*, 189-208.

Bushnell, I. W. R. (2001). Mother's face recognition in newborn infants: Learning and memory. *Infant and Child Development*, *10*, 67–74.

Newell, L. C., Bahrick, L. E., Sternstein, M. L. (2007, March). Face recognition in preschool-aged children. *Society for Research and Child Development,* Boston, MA.

Otsuka, Y., Konishi, Y, Kanazawa, S, Yamaguchi, M.K., Abdi, H, & O'Toole, A.J. (2009). Recognition of moving and static faces by young infants. *Child Development, 80*, 1259-1271.

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