Infant Discrimination of Voices: Predictions from the Intersensory Redundancy Hypothesis

Lorraine E. Bahrick, Robert Lickliter, Melissa A. Shuman, Laura C. Batista, and Claudia Grandez

Florida International University

Abstract

Bahrick & Lickliter (2000) proposed an "intersensory redundancy hypothesis" which holds that, in early development, experiencing an event redundantly across two senses facilitates perception of amodal properties (e.g., synchrony, tempo, rhythm) whereas experiencing an event in one sense modality alone facilitates perception of modality specific aspects of stimulation (e.g., pitch, timbre, color, pattern, configuration). Therefore, discrimination of individual voices (modality specific information) should be enhanced when the voices are presented unimodally, in the absence of intersensory redundancy, and attenuated when they are presented bimodally, in the presence of intersensory redundancy (where amodal properties are attended). Thirty-two 3-month-old infants were habituated to the voice of a woman speaking in the context of intersensory redundancy (along with the synchronously moving face) or no redundancy (with a static face). Test trials played the voice of a novel woman speaking. Results supported our prediction and demonstrated significant discrimination (measured by visual recovery to the novel voice) in the nonredundant, but not the redundant voice condition. These findings converge with those of our prior studies and demonstrate that in early development, infants attend to different properties of events as a function of whether the stimulation is multimodal or unimodal.

Introduction

Most early learning occurs in the context of close face-to-face interactions. Although research demonstrates that young infants are excellent perceivers of faces and voices, we know very little about their perception of naturalistic, dynamic, multimodal person displays. For example, we do not know under what conditions infants attend to information available in the face alone, the voice alone (modality specific information), or to information available in the face and voice together (amodal information). Bahrick and Lickliter (2000, 2002) provided evidence for an "intersensory redundancy hypothesis" which makes predictions about infant perception of amodal and modality specific properties in the context of multimodal versus unimodal stimulation. According to the hypothesis (see Figure 1), in early development, 1) information experienced redundantly across two sensory modalities selectively recruits attention to amodal properties of events (e.g., synchrony, tempo, rhythm) at the expense of modality specific properties, whereas 2) information experienced in one sense modality alone selectively recruits attention to modality-specific aspects of the event (e.g., color, pattern, orientation, pitch, timbre) and facilitates perceptual learning of these properties at the expense of others. Therefore, infants should attend and perceive modality specific properties, such as pitch and timbre of a voice, better when it is experienced unimodally (no intersensory redundancy) than when it is experienced bimodally with the synchronously moving face (intersensory redundancy). In contrast, in bimodal face-voice displays infant attention should be recruited to amodal properties that are redundantly presented (such as rhythm, tempo, and synchrony), at the expense of modality specific properties. The present study tested these predictions by asking whether 3-month-old infants could differentiate between two unfamiliar women's voices better when the voice was experienced with or without the synchronously moving face.

Figure 1

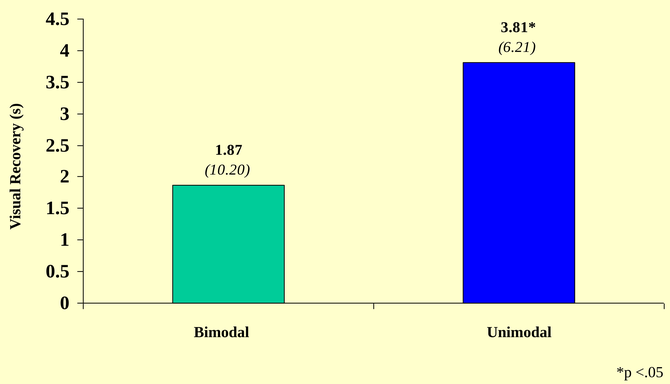
Stimulus Properties

Stimulation Available for Exploration	Amodal (Redundant)	Modality Specific (Non Redundant)
Multimodal (auditory visual)	+	-
Unimodal (auditory or visual)	-	+

Figure 2

Figure 3

Mean visual recovery (and SD) to a change in voice



*p <.05

Method

Thirty-two infants were habituated, in an infant control procedure, to face-voice displays of one of two women speaking a nursery rhyme in the presence versus absence of intersensory redundancy (see Figure 2). Intersensory redundancy was provided by accompanying the speaking voice with the natural, synchronously moving face of the woman speaking (bimodal, redundant condition, N=16). Intersensory redundancy was eliminated by presenting the speaking voice along with a static image of the face of the woman (nonredundant condition, N=16). Following habituation, infants received test trials with the voice of the novel woman speaking the same nursery rhyme, under their respective condition (with no change in the identity of the familiar face). Visual recovery to the change in voice served as the measure of discrimination. It was expected that infants would show visual recovery to the change in voice when it was experienced nonredundantly. However, when the change in voice was experienced bimodally and redundantly with the synchronously moving face, no significant visual recovery should be observed because greater attention would be directed to amodal properties of stimulation.

Results

Results supported our predictions and demonstrated significant visual recovery ($p<.05$) to the new voice under the nonredundant condition but no significant recovery under the bimodal, redundant condition (see Figure 3). Infants of 3-months showed no evidence of discriminating a change in voice when the voice was accompanied by a synchronously moving face, whereas when amodal, redundant information was eliminated by presenting the voice without the moving face, vocal discrimination was evident.

Conclusion

These results demonstrate that in the domain of person perception, infant differentiation between individual voices appears to be facilitated when the voices are heard without seeing the accompanying moving face, and attenuated when the face is visible. These findings support the predictions of the intersensory redundancy hypothesis and suggest that infants attend to different properties of events as a function of whether or not stimulation provides intersensory redundancy. In unimodal stimulation where no redundancy is available, attention to modality specific properties is promoted, whereas in bimodal stimulation where redundancy is evident, attention to amodal properties is promoted. This has important consequences for what is perceived, learned, and remembered in naturalistic events.

References

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Presented at the Society for Research in Child Development Biennial Meeting, April, 2003, Tampa, FL. This research was supported by NIMH grants RO1 MH 62226 and RO1 MH 62225 to the first and second authors, respectively. Requests for reprints should be sent to the first author at bahrick@fiu.edu.