Charles E. Schmidt College of Science

The Role of Voice and Motion Cues in Infants' Shifting Patterns of Selective Attention to Talking Faces

Amy Tift, Nicolas Minar, David Lewkowicz

Psychology; Florida Atlantic University

Previously, we found that 4-month-old infants look more at the eyes of a talking face but that 8- and 10-month-old infants look more at the mouth (Lewkowicz & Hansen-Tift, 2012). Here, we investigated the role of the voice and facial motion in infant selective attention to talking faces at different ages. To do that, we used an eye tracker to measure 4-, 8-, and 10-month-old infants' selective attention to silently talking faces or to still pictures of silent female faces and recorded fixation of the eyes and mouth. We found that infants shifted attention from the eyes at 4 months to the mouth by 10 months when exposed to silently talking faces but that they maintained their attention on the eyes when exposed to silent static faces. The shift to the mouth suggests that when infants first start babbling and begin to acquire speech production capacity they find the mouth to be especially interesting even when no vocalizations can be heard. The failure to shift to the mouth in the absence of motion suggests that older infants normally look at the mouth because of visible motion and/or because the mouth is the source of speech. In other words, the shift of selective attention to the mouth in older infants reflects their emerging interest in speech production. By shifting attention to the mouth, older infants can begin imitating the sounds that their social partners produce and, thus, can improve their speech production skills.

THE ROLE OF VOICE AND MOTION IN THE DEVELOPMENTAL SHIFT IN INFANT ATTENTION TO THE MOUTH OF A TALKING FACE

Amy H. Tift, Nicholas Minar, & David J. Lewkowicz
Florida Atlantic University, Boca Raton, FL, USA

Introduction

Lewkowicz & Hansen-Tift (2012) reported that as infants grow and as they begin to acquire speech production capacity they shift their attention from a talker's eyes to her mouth (see inset graph in Fig. 2). These findings suggest that older infants look at the mouth to gain access to the correlated, redundant, and dynamic audiovisual cues located there to facilitate acquisition of speech and language. Here, we followed up those findings by investigating the contribution that vocalizations and visible motion make to infant response to audiovisual speech across the first year of life.

Methods

Experiment 1

Here we examined response to silently talking faces.

Participants. We tested separate groups of 4-month-old (N=10), 8-month-old (N=19), and 10-month-old (N=11) infants. All were monolingual, English-learning infants.
Stimuli and Procedure. The stimuli were 50 s. movies of one of two female actors who could be seen silently reciting a monologue in the subjects' native or non-native language (English or Spanish) either in an infant-directed or adult-directed manner. Each subject was tested with one of these movies while we tracked their eye gaze with an ASL eye tracker.

Experiment 2

Here we examined response to static images of the same but this time silent faces.

Participants. We tested separate groups of 4-month-old (N=9), 8-month-old (N=11), and 10-month-old (N=9) infants.
Stimuli and Procedure. The stimuli were 10 s. presentations of three female face photographs. Each infant saw all three faces sequentially while we tracked their eye gaze with an ASL eye tracker.

Data Analysis

Data Derivation. To determine where the subjects looked, we defined separate areas-of-interest (AOIs) for the mouth and eye regions (see Fig. 1). Any fixations that fell within these regions were counted as points of gaze directed at the corresponding region.

Data Reduction. We calculated the total amount of time subjects spent gazing at each AOI and then converted these data to proportion-of-total-looking time (PTLT) scores for each AOI by dividing the amount of looking at each AOI, respectively, by the total amount of looking at the video.

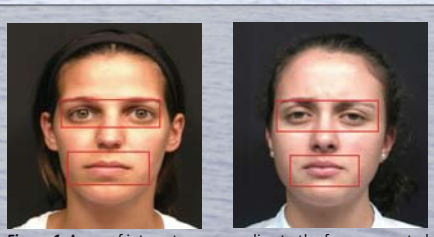

Figure 1. Areas of interest corresponding to the faces presented in Experiment 1. Similar AOIs were used in Experiment 2.

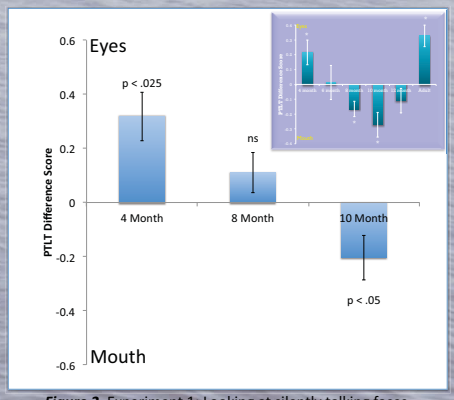

Figure 2. Experiment 1: Looking at silently talking faces

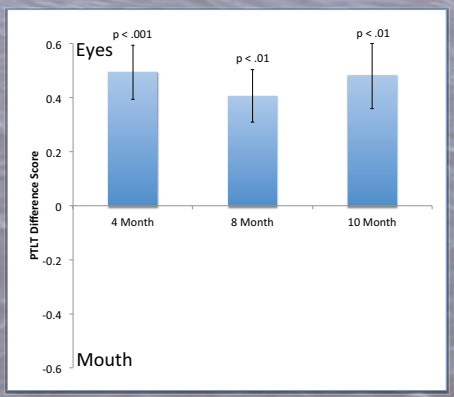

Figure 3. Experiment 2: Looking at silent & static faces

Results

Experiment 1

As can be seen in Fig. 2, when infants watched a silently talking face, their attention shifted from a preference for the eyes at 4 months of age to a preference for the mouth at 10 months of age. This shift was confirmed by a significant AOI x Age interaction, F (2, 37) = 5.43, p < 0.001. In terms of proportion of looking at the eyes, 4-month-olds looked 45% of the time at the eyes, 8-month-olds looked 32% of the time, and 10-month-olds looked 17% of the time. The corresponding proportions for looking at the mouth were 13%, 22%, and 37%, respectively.

Experiment 2

Fig. 3 shows that when infants looked at a static/silent face, they looked longer at the eyes at all three ages, with 4-month-olds looking at the eyes 51% of the time (1% at the mouth), 8-month-olds looking at the eyes 45% of the time (4% at the mouth), and 10-month-olds looking at the eyes 50% of the time (2% at the mouth). This was confirmed by a significant main effect of AOI, F (1, 26) = 56.74, p < 0.001. There were no other effects.

Discussion

Experiment 1 showed that infants shift their attention to the mouth even when a person is talking silently. This suggests that when infants begin to acquire speech-production capacity they find the mouth to be especially interesting and that the eye-to-mouth shift is due to speech-related motion in the mouth area .

Experiment 2 showed that older infants do not focus their attention on the mouth in the absence of vocalizations and the dynamic cues that are normally associated with speech. Instead, they look more at the eyes. This suggests that older infants expect speech to emanate from the mouth only if the person they are observing can be seen and/or heard talking.

Together with the Lewkowicz & Hansen-Tift (2012) findings, the current results provide new insights into the mechanisms underlying the attentional shift from the eyes to the mouth of a talking face. They indicate that the auditory and dynamic visual cues that are normally located in the mouth region of a talking face begin to capture attention by 8 months of age and that dynamic cues alone can capture attention by 10 months of age. This suggests that by 10 months infants begin to expect speech to emanate from the mouth even when it is not heard. This conclusion is reinforced by the results from Experiment 2. They indicate that speech-related auditory and dynamic visual cues located in the mouth region drive the shift to the mouth originally reported by Lewkowicz & Hansen-Tift (2012) because such a shift does not occur when these cues are absent.

References

Lewkowicz DJ and Hansen-Tift AM. (2012). Infants deploy selective attention to the mouth of a talking face when learning speech. *Proc Natl Acad Sci U S A*, 31; 109:1431.