

Audiovisual speech and the discrimination of a native fricative contrast: adult and infant data

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The study of phonetic discrimination in infancy has revealed perceptual changes resulting from exposure to the language in the environment, typically with enhanced discrimination for native contrasts and a gradual decline for non-native ones taking place during the second semester of life [1,2]. Some native contrasts, however, seem to challenge this developmental pattern as they appear to be initially difficult to discriminate and require longer exposure till infants reach the expected performance in discrimination tasks [3]. Fricative contrasts are among those that show a less uniform developmental pattern. Although not extensively explored, evidence from infant's discrimination studies (auditory modality) offers mixed results, especially regarding place of articulation discrimination for voiceless fricatives [4-7]. The present research focuses on a native fricative place of articulation contrast (/f/-/s/) and explores whether discrimination is enhanced when redundant audiovisual cues are provided.

Previous research in our lab failed to find evidence of discrimination in six-month-old infants for this native fricative place of articulation distinction, involving a sibilant and a non-sibilant voiceless pair, using CVC natural speech stimuli (fit vs. sit) produced by six different speakers and an auditory-only presentation of the test material. In a follow up experiment, a new group of infants was tested with a selection of the same material, based on acoustic measures of infant-directed speech properties, assessing whether this cue could enhance discrimination [8]. Again, no positive evidence could be gathered. An AV discrimination experiment was then designed. Beginning around six months of age infants' attention to a talker's mouth gradually increases with the detection of the perceptual equivalence between auditory and visual properties of speech and likely connected to speech processing [9]. Thus it was expected that AV cues could support discrimination of the target contrast. A total of N=33 six-month-old infants from Catalan and Spanish families (/f/ and /s/ are contrastive in both languages) were tested using the habituation-switch procedure. The AV material involved four different speakers producing tokens of either [sit] or [fit] stimuli (half of the sample was habituated to [f] tokens, the other half to [s] tokens). At test, attention to two same and two switch trials was measured, with longer attention to the switch trials indicating discrimination of the contrast. An experiment with adult participants was also planned. Adults (N=29) were undergraduate students from Catalan and Spanish backgrounds who were requested to identify the initial fricative consonant of [fit] and [sit] stimuli, also produced by four different speakers. The experiment involved the three modalities (visual, auditory and AV) for a total of 192 tokens presented in random order.

Infant data yielded no clear indication of discrimination (Fig. 1) with similar looking time measures to same and switch test trials ($F < 1$). Adults' accuracy scores (Fig. 2), as expected, revealed no difficulties in the task, but a highly significant effect of modality ($p < 0.0001$), with a lower performance in the visual-only modality, and a significant interaction of modality x consonant ($p = 0.02$), with a small advantage for [s] tokens in the AV condition. Contrary to our expectation, successful categorization and discrimination of this contrast could not be confirmed in six-month-old infants, even with AV speech material. Adult data confirmed that AV cues are useful in discrimination, although no clear advantage over the auditory condition was found due to the high level of performance in both conditions. A follow up study with older infants has been planned to establish the age at which discrimination is finally attained and to explore the role played by phonetic context ([fat]-[sat] stimuli) in the discrimination.

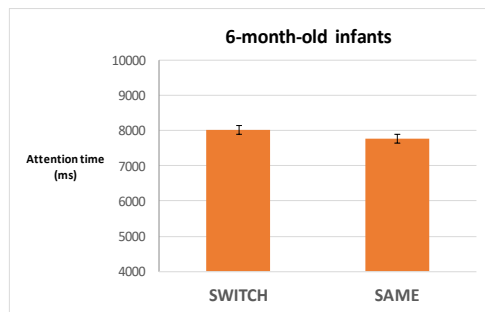


Figure 1. Mean attention time to switch and same test trials after habituation to [sit] or [fit] AV stimuli

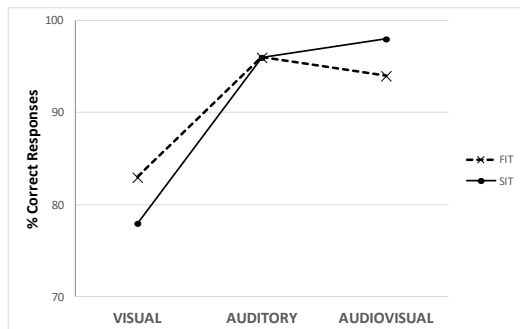


Figure 2. Accuracy in [s]-[f] identification by adult participants in three different presentation modalities.

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