Infants prefer vowels with infant vocal resonances: Evidence for an “articulatory filter” bias

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Understanding the nature and development of speech production-perception relations is a central issue for phonetic theories. It has been suggested that, early in development infants’ own emerging production abilities strongly influence speech perception. For example, Vihman’s (1993) “articulatory filter” hypothesis holds that an infant is sensitive to ambient speech elements that align with their own vocal patterns. That is to say, an infant’s familiarity with and interest in their own emerging production patterns make segments in the input speech that resemble those patterns more perceptually salient. Evidence supporting this hypothesis is provided by recent findings that pre-babbling infants (at 4-6 months) preferentially attend to infant vowel sounds over adult vowel sounds (Masapollo et al., 2015). Infants begin to produce vowel-like sounds at 3-4 months. Perceptual attunement to their own early vocal output might therefore enhance infants’ attention to infant vowel signals.

However, this “infant vowel” bias could be given an alternative explanation. Infants’ preference for infant vowels could just as well derive from their higher voice pitch (f0). A preference for the higher f0 of infant vowels would not be surprising given that infants prefer listening to infant-directed speech with this same vocal property. However, if infants prefer both the f0 and vocal resonances of infant vowels, then that would provide support for the articulatory filter hypothesis, since both of those vocal properties jointly form infant speech signals.

Consistent with an articulatory filter account, Masapollo et al. (2015) found that infant vocal resonances were sufficient to elicit a vowel preference. More precisely, 4- to 6-month-olds preferred to listen to /i/ vowels with infant formants over /i/ vowels with adults formants when both vowel types had f0 values typical of adult female speech (210 or 240 Hz). However, a non-significant trend (favoring the infant formants) was observed in another experiment in which both vowel types had higher f0 values (315 or 360 Hz) that fall within the range observed in infant-directed speech produced by an adult female. This latter result suggests that infant preference is also influenced by f0.

In the present research, we synthesized a set of vowel stimuli, using the Variable Linear Articulatory Model (Ménard et al., 2004), to further investigate infants’ listening preference for infant over adult vocal resonances. Across three experiments, infants were tested in a sequential preferential listening procedure. In this procedure, infants were seated on their caregiver’s lap and shown a static checkerboard pattern to look at while listening to the vowel stimuli. Infants were presented with the infant vowels and adult vowels on alternating trials. Trial length was infant-controlled, i.e., trials were initiated by infant fixation on the checkerboard pattern, and ended when infants looked away for more than 2 seconds. In each experiment, we collected 12 trials, 6 for each vowel type, and then calculated whether infants choose to listen longer to one type of vowel over another. The type of vowel that infants heard first was counterbalanced in each experiment.

In Experiment 1, we assessed preference for adult versus infant formants when the f0 of both vowel types were the same (315 or 360 Hz). We tested 5- to 7-month-old infants (mean age = 7:11); this group was slightly older than the 4- to 6-month-olds (mean age = 5:19) tested in Masapollo et al. (2015) who failed to show a significant listening preference when presented these same vowels. In this older sample a robust preference for vowels with infant resonances was observed [t(23) = 3.143, p = .005, r² = .542], suggesting that infants’ preference for infant vocal resonances increases with age during the developmental period when vocal production skills are emerging.

The next two experiments were designed to further assess infant listening preferences in the older
age range (5-7 months) when f0 values are modulated. If infants are more attentive to vowels with infant vocal resonance properties when f0 values are varied, this would support the articulatory filter hypothesis by showing that they are listening selectively to vowels that resemble the output of their own vocal apparatus. In Experiment 2, infants’ looking times were measured while they heard /i/ vowels with infant formants and relatively high f0 (400 or 450 Hz) versus vowels with adult female formants and relatively low f0 (315 or 360 Hz). In Experiment 3, looking times from another group of infants were measured while they listened to /i/ vowels with infant formants and relatively low f0 (316 or 360 Hz) versus vowels with adult female formants and relatively high f0 (400 or 450 Hz). The mean looking times are shown in Figure 1. An analysis of variance – vowel type (infant formants vs. adult formants) X experiment (1 vs. 2), performed on the mean looking times – revealed a significant main effect of vowel type \([F(1,34) = 4.756, p=.036, \eta^2_p=.123]\), such that infants listened longer to the vowels with infant formants, compared to the vowels with adult formants. There was no significant main effect of experiment \([F(1,34) = .023, p = .879]\), or two-way interaction \([F(1,34) = .906, p = .348]\). These results confirm that the infant vowel bias does not derive solely from higher f0, and provides strong support for the articulatory filter account that invokes young infants’ attention to speech signals that resemble their own productions. Taken together, these findings support the view that infant vowel listening preferences reflect an articulatory filter bias that is shaped by infant vocal behavior.

![Figure 1](image_url)

**Figure 1:** Mean looking times (in seconds) to the different vowel types presented in Experiments 1-3. Error bars indicate standard errors.

**References**

