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Narrowing in face and speech perception in infancy: Developmental change in the relations between domains



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ABSTRACT

Although prior research has established that perceptual narrowing reflects the influence of experience on the development of face and speech processing, it is unclear whether narrowing in the two domains is related. A within-participant design ($N = 72$) was used to investigate discrimination of own- and other-race faces and native and non-native speech sounds in 3-, 6-, 9-, and 12-month-old infants. For face and speech discrimination, whereas 3-month-olds discriminated own-race faces and native speech sounds as well as other-race faces and non-native speech sounds, older infants discriminated only own-race faces and native speech sounds. Narrowing in face and narrowing in speech were not correlated at 6 months, negatively correlated at 9 months, and positively correlated at 12 months. The findings reveal dynamic developmental changes in the relation between modalities during the first year of life.

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Introduction

Experience exerts strong influence on the development of perception in infancy. Such influence can be observed in an apparently regressive age-related change in infant discrimination of familiar and unfamiliar stimuli. Young infants initially can discriminate differences among stimuli from both familiar and unfamiliar categories. However, with increased age, due to continued processing experience with familiar categories and lack of processing experience with unfamiliar categories, infants maintain the ability to discriminate differences among stimuli from the former but begin to experience difficulty in differentiating among stimuli from the latter (Kelly et al., 2007; Kuhl, Tsao, & Liu, 2003; Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992; Le Grand, Mondloch, Maurer, & Brent, 2001; Macchi Cassia, Bulf, Quadrelli, & Proietti, 2013; Pascalis et al., 2005; Pascalis, de Haan, & Nelson, 2002; Pons, Lewkowicz, Soto-Faraco, & Sebastián-Gallés, 2009; Werker & Tees, 1984). This experience-related developmental pattern in infancy is referred to broadly as perceptual narrowing (for a review, see Maurer & Werker, 2014).

Narrowing has been observed in various domains, such as face, speech, music, and intermodal perception, with a consistent emergence in the second half of the first year of life. The similarity in timing of narrowing among different perceptual domains is consistent with the idea that narrowing may be driven by domain-general mechanisms that are not specific to a particular perceptual domain (Pascalis et al., 2014; Scott, Pascalis, & Nelson, 2007). However, because nearly all prior investigations have studied narrowing in only a single domain, there is little work that bears on this possibility. Therefore, it is entirely unknown whether narrowing in one domain is related to that in another domain. To bridge this significant gap in the literature, the current study investigated the relations between narrowing in face and speech perception in infants at 3, 6, 9, and 12 months of age with a within-subject design.

For the domain of faces, face race is perhaps the most well-studied category to illustrate the influence of experience on the development of face perception (Kelly et al., 2007, 2009; see Sugden & Marquis, 2017, for a recent review). In the first year of life, infants are mostly exposed to faces from their own race while having limited access to other-race faces (Liu et al., 2015; Rennels & Davis, 2008; Sugden, Mohamed-Ali, & Moulson, 2014). As a result of this asymmetrical face race experience, perceptual narrowing occurs in the processing of own- and other-race faces (Kelly et al., 2007, 2009; Liu et al., 2011; Quinn, Lee, Pascalis, & Tanaka, 2016; Tham, Bremner, & Hay, 2015; Wheeler et al., 2011; but see Chien, Wang, & Huang, 2016). For example, Kelly et al. (2007) found that 3-month-old Caucasian infants could discriminate among own-race faces and also among other-race faces. By contrast, 9-month-old Caucasian infants were able to discriminate only among own-race Caucasian faces but not within other-race face classes such as Asian and African faces. This developmental pattern of responding to own-race versus other-race faces was later replicated with Asian infants (Kelly et al., 2009). Moreover, consistent with the experiential account of narrowing, experimentally exposing infants to other-race faces was found to prevent and even reverse narrowing for other-race faces (Anzures et al., 2012; Heron-Delaney et al., 2011). Similar perceptual narrowing patterns have been found in processing other aspects of facial information such as species and age (Kobayashi, Macchi Cassia, Kanazawa, Yamaguchi, & Kakigi, 2016; Macchi Cassia et al., 2013; Pascalis et al., 2002; Scott & Monesson, 2009). Thus, it is now well established that narrowing in face perception is a common phenomenon in infancy that reflects the experience-based tuning of the perceptual system to optimally process faces of the most frequently encountered categories in the visual environment of infants.

Similar to their experience with faces, infants also have asymmetrical experience with native speech versus non-native speech. They typically have far greater exposure to native speech than to non-native speech. This asymmetrical experience with speech is known to shape the early development of speech perception, also through a narrowing process. In the now classic study by Werker and Tees (1984), English-learning infants at 6–8 months of age were able to discriminate two syllables from either Hindi or English (see also Werker, Gilbert, Humphrey, & Tees, 1981). However, unlike the younger infants, older infants maintained discrimination of the English syllables but failed to discriminate the Hindi syllables. This finding has been replicated with infants from many linguistic environments in terms of various aspects of speech processing. For example, infants learning a tonal

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