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Attention to lexical stress and early vocabulary growth in 5-month-olds at risk for autism spectrum disorder



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ABSTRACT

Typically developing infants differentiate strong–weak (trochaic) and weak–strong (iambic) stress patterns by 2 months of age. The ability to discriminate rhythmical patterns, such as lexical stress, has been argued to facilitate language development, suggesting that a difficulty in discriminating stress might affect early word learning as reflected in vocabulary size. Children with autism spectrum disorder (ASD) often have difficulty in correctly producing lexical stress, yet little is known about how they perceive it. The current study tested 5-month-old infants with typically developing older siblings (SIBS-TD) and infants with an older sibling diagnosed with ASD (SIBS-A) on their ability to differentiate the trochaic and iambic stress patterns of the word form *gaba*. SIBS-TD infants showed an increased interest in attention to the trochaic stress pattern, which was also positively correlated with vocabulary comprehension at 12 months of age. In contrast, SIBS-A infants attended equally to these stress patterns, although this was unrelated to later vocabulary size.

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Introduction

Before producing their first words, infants are learning the sounds and patterns of their language as they build and refine their lexicons. From birth, infants are faced with the daunting task of deciphering the speech signal through their discovery of statistical regularities and properties of speech that will help them to identify and learn new words (Jusczyk, 1997). Prosody (i.e., intonation, lexical stress, and

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rhythm of a language) is one such property of speech to which infants are highly sensitive. Indeed, infants can discriminate their native language from those of others within days after birth based simply on the rhythmical class of those languages (Mehler et al., 1988). This attentional sensitivity to rhythm in speech has also been shown to be positively associated with later vocabulary growth (e.g., Weber, Hahne, Friedrich, & Friederici, 2005), suggesting that atypical attention to prosody during infancy may, at the very least, be associated with delays in language development.

Typically developing (TD) infants demonstrate an attentional bias for human speech over non-speech sounds early in development (Vouloumanos & Werker, 2004, 2007), which remains specific to speech and not just any sound produced by humans such as laughing, coughing, or sneezing (Shultz & Vouloumanos, 2010). Infants also prefer infant-directed speech to adult-directed speech within the first month of life (Cooper & Aslin, 1990; Fernald, 1985). Researchers have argued that these early preferences are likely to play an important role in infants' linguistic and socioemotional development (Droucker, Curtin, & Vouloumanos, 2013; Shultz & Vouloumanos, 2010). In a more general way, the heightened prosodic structure of infant-directed speech may assist infants in their ability to segment speech (Thiessen, Hill, & Saffran, 2005) and learn new words (Graf Estes, 2008). However, there may be even more specific links between early speech processing and language development. For instance, Vouloumanos and Curtin (accepted for publication) found that TD infants' longer looking to speech trials at 12 months of age positively correlates with vocabulary size at 18 months. Tsao, Liu, and Kuhl (2004) found that 6-month-olds who could discriminate various phonemes (e.g., /u/ and /i/) had superior language competence when they turned 13, 16, and 24 months of age compared with 6-month-olds who could not discriminate them. Furthermore, Bernhardt, Kemp, and Werker (2007) found that infants who successfully mapped word forms to objects at 17 and 20 months of age also demonstrated stronger vocabulary production skills up to 2½ years later. Taken together, these studies suggest a link between early speech perception skills and later vocabulary competence.

TD infants are also highly sensitive to the prosodic properties of speech such as the intonation, lexical stress, and rhythm of a language. Lexical stress, which was the main focus of the current study, refers to prominence of a syllable within a word that is characterized by duration, intensity, and pitch (Hayes, 1995). In English, the stress pattern of most words is trochaic (strong–weak [Sw] as in DOCTOR, with stress denoted by uppercase letters, often found in nouns) and fewer words are iambic (weak–strong [wS] as in RECORD, often found in verbs). Indeed, for English listeners, the likelihood of encountering a content word with a strong syllable at the beginning is three to one (Cutler & Carter, 1987). English-learning infants are highly attuned to trochaic and iambic stress and can discriminate between these patterns as early as 2 months of age (Jusczyk & Thompson, 1978). Furthermore, 9-month-old English-learning infants reliably demonstrate a preference for trochaic stress (Echols, Crowhurst, & Childers, 1997; Jusczyk, Cutler, & Redanz, 1993). By 12 months of age, infants can map labels to objects when those labels differ solely in stress (initial [Sww] vs. medial [wSw] stress; Curtin, 2009), demonstrating a potential recognition that words minimally differing in their stress can also have different meanings. At 16 months of age, infants will map an iambic pattern to path actions but will not map forms with trochaic stress (Curtin, Campbell, & Hufnagle, 2012), suggesting that they have a rudimentary understanding of which stress pattern accompanies actions versus objects. Given the prominence of trochaic words in English, it is perhaps not surprising that English-learning infants use this information to detect and learn new words in the speech signal.

In prior research, investigators have explored the linguistic purpose of this perceptual sensitivity to stress in speech during infancy. For instance, Herold, Hohle, Walch, Weber, and Obladen (2008) tested whether preterm infants at the corrected age of 4 to 6 months could discriminate between trochaic and iambic stress because this population tends to experience delays in language acquisition. They found that whereas TD infants at 4 to 6 months attended longer to trochaic stress, preterm infants did not differentially attend to either. Similarly, Weber and colleagues (2005) investigated whether infants' impaired perception of word stress at 5 months of age could be used as a marker for specific language impairment (SLI). Indeed, they found that the infants who did not successfully discriminate between the stress patterns at 5 months also had word production scores in a range suggestive of a future SLI diagnosis at both 12 and 24 months. Taken together, these studies suggest that attention to lexical stress in speech early on in development could serve as a marker for future language difficulties as early as 12 months of age. Here, we examined whether infants at risk for autism spectrum

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