

Musical Intervals in Baby Sounds

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ABSTRACT

Background

Perception and memorizing of salient, regularly occurring sounds start in the womb at about the third trimester of gestation. Fetuses are particularly sensitive to ‘musical’ elements of their mother’s voice and speech sounds, based on prosodic elements such as melody, rhythm, tempo and pitch. The auditory stimulation experienced in the womb was found to imprint and shape postnatal auditory development and musical preferences (Ullal-Gupta, 2013). Young babies are able to communicate by vocal sounds long before vocabulary and grammar is established, and they do so by making extensive use of melody (f_0 contour) (Wermke & Mende, 2011). They are also well-equipped with surprising musical perceptual capabilities (Trehub, 2003). In two previous pilot studies, we identified and analyzed f_0 ratios in infant cry melody and observed a stable pattern of several musical intervals (Wermke & Mende, 2009; Dobnig et al., 2017).

Aims

The aim of this study was to quantitatively characterize musical interval-like substructures of the melody (f_0 contour) of pre-speech sounds of babies during their first three months of life.

Method

Spontaneously uttered sounds of 12 healthy German babies were recorded in weekly intervals over the first three months. Frequency spectrograms and melodies of 6,059 vocalizations were analyzed by using the open-source software Praat 6.0.26. After low-pass filtering (40 Hz Gaussian Filter), intervals were identified and quantitatively analysed. The applied interval model was defined as plateau-transition-plateau structure in the melody, with each plateau lasting ≥ 50 ms, containing a f_0 variation smaller than \pm a quarter tone (according to perceptual entities) and creating a relative reference tone. Here, each measured interval was auditory re-evaluated by the first author using a special Praat routine. Results are reported for (1) frequency of occurrence of melodies containing intervals and (2) distribution of all identified frequency ratios displayed in a cent scale (organized around musical intervals from the prime to the octave and above).

Results

Over the three months, a number of 3,587 (59%) vocalizations exhibited intervals in their melody (1st month: 55%; 2nd months: 62%; 3rd month: 63%). Interval (f_0 ratio) distributions were very similar over the three months with the minor second (semitone) being the most prominent interval (Figure 1). Moreover, a remarkably monotonous decline from semitone to larger intervals was found (Figure 1).

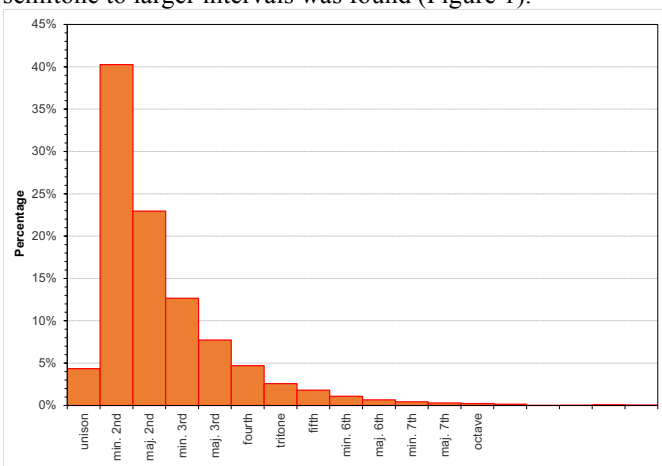


Figure 1. Distribution of identified intervals (frequency ratios) over the first three months (bin range = 100 cent, start bin -50 to +50).

Conclusions

In agreement with our previous findings, frequency ratios (intervals) along the full scale of musical intervals from prime to octave and beyond were identified. Melody intervals are a regular phenomenon of pre-speech sounds, forming an organic phenomenon - productive unity. Whether the robust ‘semitone-phenomenon’ reflects a relationship to the ‘semitone as perceptual boundary’ in adults (Zarate, Ritson & Poeppel, 2012), needs to be investigated. Subsequent studies are warranted to investigate a potential influence of exposure to music or ambient language on the observed interval distribution in baby sounds.

Keywords

melody; infant; musical interval; semitone; pre-speech development

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