

The development of early infant vowel productions in a phonetical perspective

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Abstract

So far there are only a few longitudinal studies in the German language area that deal with early infant speech development and focus particularly on phonetical aspects.

For a long time consonantal development has been observed in a much stronger way than vowel development (Piske, 2001; Reinicke & Sendlmeier, 2002). A phonetical approach facilitates a specific description of acoustically perceivable shifting in early infant speech productions. The combination of phonetical and psychological aspects of early infant vocal and cognitive development results in a detailed overall view of infant speech development.

This longitudinal study focuses on the first and second vowel formants of the German open and half-open front vowels ([a], [ɛ:] and [ɛ]) produced by infants during their first eighteen months. Vowel productions of eleven infants aged between four and eighteen months were analysed using specific software for speech analysis.

The values for vowel formants of infant voices have to be specified for age and body height. Because of the reversed proportionality between the formant frequencies and the length of the vocal tract, infant formants should turn out to be double as high as those of a male adult; the infant vocal tract is about half as long as the adult vocal tract. Especially during the first year of life the infant formant values display a broad bandwidth and a high amount of variability (Neppert, 1999; Reinicke & Sendlmeier, 2002).

Until now there are no explicit infant formant specifications for the German language to be found in literature for the whole developmental period between birth and adolescence with its beginning vocal changes. Therefore no coherent data exists for the time period of the first eighteen months, which show serious physical modifications.

The purpose of this study is to manifest in which way the infant vowel quality changes, to which extent and in which time period phonetical parameters like vowel formants get modified and which connection can be found between these aspects and a possible successive adaptation to the parameters of the surrounding native language. For keeping coarticulatory influences on a marginal level this study used only isolated produced vowels without any kind of consonantal context.

After monthly recording vocalisations of eleven monolingual German growing up infants (five girls, six boys) for at least twenty minutes in their homes over a period of fifteen months this material was digitalised (44 kHz, 16 bit). In a next step all isolated produced open and half open front vowels were screened out using the special speech analysing software PRAAT. Infants articulate those three vowels very often especially during the first months in their life, so a sufficient amount of vowels was available. Parents were asked before recording not to evoke any utterances from their children, but to keep their usual behaviour. No child displayed any kind of developmental retardation during the investigation; nothing is known about an atypical development up until now.

For every vowel four values were collected using PRAAT: the first two vowel formants, the fundamental frequency and the duration of the vowel segment. Only completely collected data sets with four values per vowel were included in the analysis. Some system inherent adjustments of PRAAT had to be modified for infant speech, no automatic acquisition was used.

Comparative values for German adult formant values were collected with male and female native German students (Sendlmeier & Paeschke, 2004). Usually only male formant values are used as reference values in literature. Because of the mothers being the primary attachment figures, at least during data collection, female formant values were also included. During the analysis the infant formants were related to the adult male or female formants.

In addition to rendering a description of a regular development of vowel production during the first eighteen months, it can be shown that the development of the infant vowel formants indicates a strong tendency towards the native German adult formants of the same vowels. In spite of significant anatomical restrictions even infants aged only a few months do not produce doubled vowel formant values as would be expected considering the fact that the vocal tract is only half as long as an average adult vocal tract. The data allows to conclude that the infants actively adapt their vocal tracts in producing the vowels in question.

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