Utterance-final lengthening in infant-directed speech

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Infant-directed speech (IDS) is among the most commonly investigated types of speech entrainment. It is well known that caregivers speak to their children differently than to adults. Previous research has revealed that higher fundamental frequency, shorter utterances, expanded vowel space, and slower speech rate are typical for infant-directed speech (IDS) compared to adult-directed speech (ADS) [1]. Whether final lengthening is more disproportionally exaggerated in IDS than in ADS relative to the global speech rate still remains a controversial issue. [1-4]. Utterance-final syllables were found to be longer in IDS than in ADS [1, 2]. While some studies have reported significant differences between IDS and ADS in terms of the duration of the phrase-internal syllables or vowels [2, 3], others have not [1, 4]. These results raise the question whether the overall articulation rate differs in the two registers, if the utterance-final syllable or syllables are not taken into account. One study has reported significant differences [2] while another has not [4]. There is rather sparse data available on the temporal features of IDS for Hungarian. A recent study has found no evidence to support the hypothesis that mothers tend to speak slower to their newborn babies [5]. The present study aims to investigate the temporal characteristics of Hungarian infant-directed speech. It is to be tested whether mothers tend to speak slower in general, and whether they lengthen utterance-final syllables even more intensely in IDS than in ADS.

To investigate the features of IDS, recordings of 17 native Hungarian speakers were chosen. Every mother told a story to the experimenter (ADS), then to her 4-month old baby (IDS) using the same story book. The mothers had to improvise a story based on the pictures, but they had to incorporate prescribed utterances word by word. The procedure was repeated when the baby reached the age of 8 months. Utterance boundaries and the last three syllables were annotated in the recordings manually in the Praat 6.0 software [6]. Statistical analysis was carried out in R. We built linear mixed-effect models with directedness (adult vs. infant), and age of infant as fixed effects, and participants and sentences as random effects.

Based on our results, the mothers spoke slower in IDS than in ADS ($p < 0.001$). The last, the penultimate, and the antepenultimate syllable duration of read sentences in IDS differed significantly from that in ADS ($p < 0.01$). Disregarding the last syllable, the speech rate of IDS was markedly slower than that of ADS. The same tendency was found if the last two and even if the last three syllables were excluded from the analysis ($p < 0.01$). Quantifying the lengthening, the duration of the last syllable was found to be around 1.5 times longer than the average duration of all other syllables in the utterance both in IDS and in ADS. The duration ratios of the last two or three syllables compared to the rest of the utterance also appeared to be independent of directedness.

To conclude, IDS is characterized by an overall lower articulation rate compared to ADS, but contrarily to some earlier findings, the final syllables did not extend disproportionally compared to the rest of the utterances in IDS, their boundary marking role was not exaggerated by the mothers. The syllable durations in the utterances were longer in IDS than in ADS, but the timing structure remained the same in terms of duration ratios. Based on earlier experiments [7], it appears that it is the ratio-preserving property of speech that plays a dominant role in the perception of infants, and not the absolute temporal differences. However, the slower speech rate may provide a certain word recognition advantage for the infants when listening to IDS [8]. This study highlights the complexity of the temporal structure in IDS, which can lead to a better understanding of the functions of IDS in language acquisition.

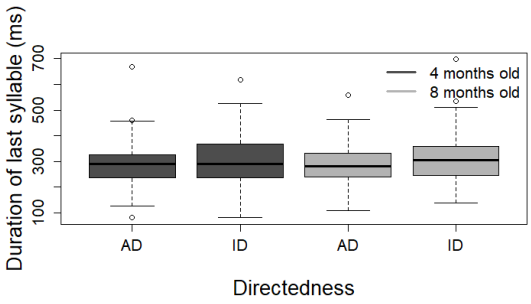

Figure 1. *The last syllable duration in ADS and in IDS at 4 and 8 months of the infant's age*

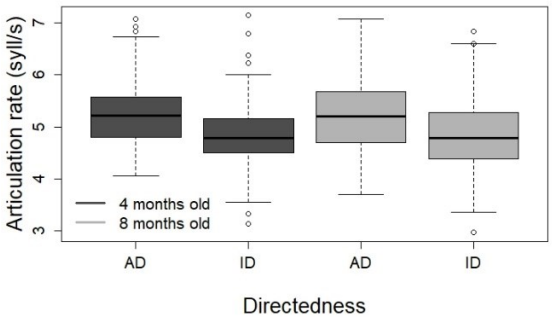

Figure 2. *The articulation rate in ADS and in IDS at 4 and 8 months of the infant's age disregarding the last syllable.*

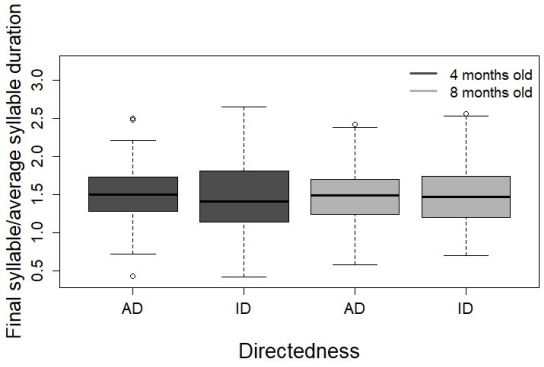

Figure 3. *The last syllable duration divided by the average syllable duration in the rest of the utterance for ADS and IDS at 4 and 8 months of the infant's age.*

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