Children's imitation of coarticulatory patterns in different prosodic contexts

Felicitas Kleber, Sandra Peters

Institute of Phonetics and Speech Processing, Ludwig-Maximilians-University, Munich, Germany

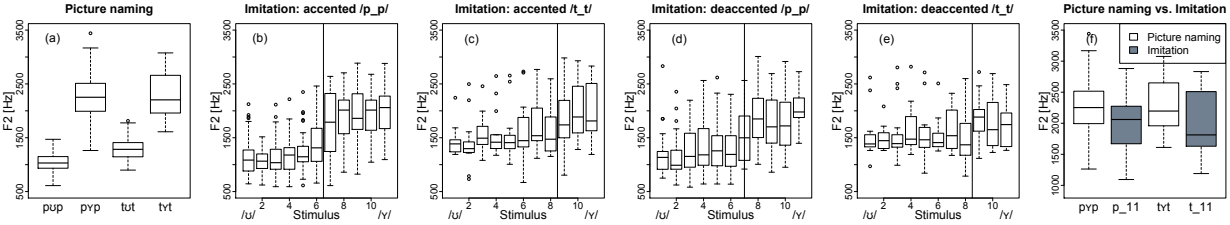
{kleber|sandra}@phonetik.uni-muenchen.de

Acoustic speech signals show a great amount of synchronic variation that comes about through coarticulation, hypoarticulated speech – which is often observed in prosodically weak contexts (e.g. deaccented words) –, and other connected speech processes. Adult listeners usually compensate for coarticulation (Mann & Repp, 1980), but children have yet to learn to attribute acoustic modifications to the source that causes this synchronic variation. Nittrouer and Studdert-Kennedy (1987) showed that children compensated less for coarticulatory effects than adults; however, other studies reported that children overgeneralize adult forms (cf. Vihman, 1996). The aim of the present study was to investigate in an adult-child-interaction setting whether or not preschool children compensate for consonant-on-vowel coarticulation in prosodically weak and strong contexts. The overall aim is to relate these findings to Ohala's (1993) theory of sound change that sees unexperienced language users such as children as candidates for undercompensating for coarticulation and thus potentially initializing sound change.

In a picture naming task, 13 L1-German children aged 4;11 to 6;3 produced the names of puppets called /pʊp/, /pʏp/, /tʊt/, and /tʏt/ (five times each and always accented). While labial consonants have a retracting influence on vowels, alveolars have a fronting effect. The same children then imitated three times each 44 versions of the sentence *Maria hat* <target word> *gesagt* (*Maria said* <target word>) produced by a male adult speaker. The target word contained vowels from an 11-step continuum from /ʊ/ to /ʏ/ that was spliced into either a symmetric labial /p_p/ or an alveolar /t_t/ context. The only pitch accent was either on the target word (accented condition) or on *Maria* (deaccented condition). F2 was measured at the vowel's temporal midpoint of all target word productions and imitations. The analysis included only CVC tokens in which the children pronounced the consonantal context and prosody correctly.

An RM-ANOVA with F2 from the picture naming task as the dependent variable revealed a significant interaction effect for Context*Vowel ($F[1,2] = 13.4$, $p < 0.01$) showing coarticulatory effects in children's /tʊt/ productions ($t = -5.9$, $p < 0.001$) but not in /pʏp/ productions (cf. Fig. 1a). Comparatively high F2 values can also be seen in the imitations of stimuli 1–5 in the /t_t/-continua (cf. Fig. 1c+e). Irrespective of accentuation, children's imitations showed a steeper and earlier shift (indicated by the vertical lines in Figs. 1b–e) from back to front vowel realizations in /p_p/ than in /t_t/, suggesting that children attributed higher F2 values to the alveolar context and perceived and imitated more /ʊ/-like sounds in this context, i.e. they tended to compensate for coarticulation. Moreover, although /ʏ/ was realized with a high F2 and similar amount of variation in both contexts in production (median: /pʏp/ = 2253 Hz, /tʏt/ = 2197 Hz), the imitations of stimulus 11 from the accented alveolar continuum (i.e. an unambiguous /tʏt/ for adult listeners) showed vastly more variation in F2 and a significantly lower median (1813 Hz) than the /tʏt/ tokens from the picture naming task ($W = 846$, $p < 0.05$) as well as the labial stimulus 11 (2061 Hz; cf. Fig 1f which only contains accented tokens). The low F2 values for imitations of accented /t_t/ stimuli at the /ʏ/-end of the continuum imply that children tended to overcompensate for the contextual effect. In the deaccented condition, on the other hand, the shift from front to back vowels was more gradual (cf. Fig. 1d–e), i.e. children were less confident of the vowel categories leading to diminished compensation effects.

Figure 1 (a–f): F2 at the vowel's temporal midpoint separately for labial and alveolar, accented and deaccented conditions.



Children are sensitive to coarticulatory effects, but have yet to learn to compensate properly for these effects. Coarticulated sounds – particularly in prosodically weak position – are less stable in children's perception and may thus be more prone to undergo diachronic changes. Such changes are not necessarily due to undercompensation (Ohala, 1993): they may also come about due to overcompensation.

References

Mann, V.A., Repp, B.H. 1980. Influence of vocalic context on perception of the [ʃ]-[s] distinction. *Perception & Psychophysics* 28, 213-228. / Nittrouer, S., Studdert-Kennedy, M. 1987. The role of coarticulatory effects on the perception of fricatives by children and adults. *J. Speech and Hearing Research* 30, 319-329. / Ohala, J.J. 1993. The phonetics of sound change. In: Jones, C. (ed.): Historical Linguistics: Problems and Perspectives. London: Blackwell, 237-278. / Vihman, M. 1996. *Phonological Development*. Oxford: Blackwell.