

## **Acoustic characterization of coarticulation in stop-vowel sequences by French speaking adults vs. children: a preliminary study**

Locus equation (LE) has been described and used in several acoustic studies as an indicator of place of articulation and as an index of coarticulation (among others [1]): LE in CV-sequences is a linear regression with second formant (F2) values measured at the onset of the vowel (y-axis) and at the mid-point of the vowel (x-axis). The slope of the regression line gives information about place of consonant articulation and degree of coarticulation.

Acoustic and articulatory studies of child speech have used LE to describe the realization of stop-vowel sequences during the L1 acquisition process, for children under 5 years of age. They have varying methodologies and varying results, either consistent with (e.g. [5]) or differing from ([2]) the adult order of slope values, and evolving with age (e.g. [2] and [5]). No data however is available for older children, particularly in French.

In this paper, we present the preliminary results of a study on coarticulation in French speaking children from 5 to 10 compared to adults, using LE as an acoustic criterion of speech production development. Since it has been argued that production and perception of speech has not fully stabilized until teenage years [3], we hypothesize that the realization of stops is still influenced by age at that developmental stage.

Participants were native speakers of French: 8 adults and 10 children (5;9 to 9;8 years). The experiment was a picture-naming task under two conditions: (1) repetition with audio model and (2) production without audio model. The stimuli were 15 words with a word-initial CV sequence: voiced bilabial /b/, alveolar /d/ and velar /g/ stops followed by five vowels /i, e, a, o, u/. Two tokens of each word were recorded in each condition.

Second formant (F2) values were extracted at mid-point of the vowel, and at vowel onset (on the 1<sup>st</sup> glottal pulse after burst). All F2 values were then normalized with Lobanov z-scores [4].

Statistic analyses (linear mixed effects models) show a significant difference in slope values between the three places of articulation. For both groups, alveolar stops have the shallowest slope, followed by bilabial and velar stops, which is consistent with the literature on locus equations in adults. Alveolar stops are the only place of articulation with a significant difference between groups: higher slope for children.

These results indicate that children have already acquired adult-like coarticulation patterns for bilabial and velar stops, but they still have higher LE slopes than adults for alveolar stops, indicating a higher degree of coarticulation, i.e. a greater vowel influence on consonant place of articulation. Further analyses suggest that the extreme front and back vowels [i] and [u] are responsible for this variability in child speech.

This ongoing study points to different coarticulation in adult and child speech. Further data is being analyzed from 10 additional children aged 5 to 11, which will allow us to characterize the chronology in the acquisition of CV-coarticulation and production of stops in French.

References:

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