

Speech stability, coarticulation, and speech errors in a large number of talkers

Stefan A. Frisch, Alissa J. Belmont, Karen Reddick, Nathan D. Maxfield

Department of Communication Sciences and Disorders, University of South Florida

Introduction

This study uses ultrasound to image onset lingual stop consonant articulation in words. In one set of stimuli, velar stop consonants are produced in variety of vowel contexts. Anticipatory coarticulation can be interpreted as a quantitative measure indicating the maturity of the speech motor system and its planning abilities (Zharkova, Hewlett, & Hardcastle, 2011, *Motor Control*, 15, 118-140). Part of the method for measuring anticipatory coarticulation in Zharkova et al (2011) involves measuring multiple repetitions of the same item. Variation in these repetitions is taken to be an index of motor speech stability. Speech motor stability can also be examined through challenging speech production tasks such as tongue twisters. The present study examines coarticulation and speech stability in typical speakers and people who stutter across three lifespan age groups.

Methods

One hundred twenty two (n = 122) participants were recruited in three age groups over the lifespan (8-12yo; 18-30yo; 55-65yo) who were either typically developing speakers (n = 73) or people who stutter (n = 49). Individual age and talker group combinations varied in size from 11 to 29 talkers. Articulate Assistant Advanced 2.0 software was used to semi-automatically generate midsagittal tongue contours at the point of maximum stop closure and was used to fit each contour to a curved spline. Three measures of articulatory ability are being examined based on curve-to-curve distance (Zharkova et al 2011). Token-to-token variability is examined from multiple velar vowel productions within the same vowel context, describing the accuracy of control, or stability, of velar closure gestures. Variability in production between vowel contexts is an index of coarticulation as in Zharkova et al (2011). Participants produced 18 target words in a frame sentence for the coarticulation part of the study (e.g. *Say a key again*). Participants also produced 16 four-word tongue twisters varying in alveolar and velar stop onset with low vowels (e.g. *top cap cop tab*). The use of curve-to-curve distance has been extended in this study to cases of tongue twisters as a measure of similarity of the production to typical targets for both the intended and error category following Reddick & Frisch (ICPhS poster, August 2015).

Results

Completed results indicate an overall age effect, interpreted as refinement of speech motor production, with increased speech stability and progressively more segmental (less coarticulated) productions across the lifespan (Figure 1). Anticipatory coarticulation can be interpreted as a quantitative measure indicating the maturity of the speech motor system and its planning abilities (Zharkova et al 2011). A tendency toward decreased stability was found for younger people who stutter, but this difference was small and absent among older adults (Belmont, unpublished MS thesis, June 2015). Classification of speech errors is still ongoing, but partial data analysis finds a correlation between speech motor stability and the rate of production of both gradient and perceived speech errors in tongue twisters replicating Reddick & Frisch (2015).

Figure 1: Speech stability (left, within context distance) and coarticulation (right, between context distance) for Children, Young Adults, and Older Adults with (PWS) and without (TFS) stuttering.

