EVALUATING ASPECTS OF SPEECH MOTOR STABILITY IN DYSARTHRIA

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Dysarthria may manifest in respiratory, phonatory, resonatory, articulatory and prosodic levels of speech production. One way to assess motor control in these areas is to estimate the stability of movement patterns. Previous research has demonstrated changes in motor variability in disordered speakers based on kinematic measures. Our lab has furthermore shown that acoustically based variability measures also have the capability to distinguish between speaker groups, and correlate with clinical assessments (van Brenk & Lowit, 2012).

The aim of this study was to further investigate the potential of acoustic measures to characterize aspects of speech motor stability in dysarthria. A range of speaking conditions and acoustic parameters were evaluated in order to provide a better understanding of the neuromotor factors affecting performance in dysarthria, and to evaluate to what degree the variability estimators hold their promise in being valuable for clinical research.

Participants were 23 speakers with hypokinetic dysarthria, 8 speakers with ataxic dysarthria, and 27 age-matched control speakers. The phrase "Tony knew you were lying in bed" was repeated around twenty times in six speaking conditions varying in rate, complexity and motor load. Contours of sound pressure level, fundamental frequency, and first and second formants were extracted from the acoustic signal, and subjected to functional data analysis (Ramsay et al., 1996) to obtain measures of spatial and temporal variability. The spatiotemporal index was calculated as an additional measure. Furthermore, standardized clinically based measures of speech motor performance and quantifiable details of treatment history were obtained.

We report on the potential of using acoustic variability measures in the assessment of dysarthria, guided by two data treatment procedures. The interplay between all obtained measures was explored by means of a factor analysis used as a data reduction method to detect possible relations. In addition, a logistic regression analysis was performed in which the various measurements were used as predictors and the presence of dysarthria as outcome measure. Based on the results of these analyses we aim to provide guidelines on the optimal selection of speech tasks and acoustic parameters.

References

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