What does supraglottic articulatory global speed tell us about disfluencies?

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Introduction

- Developmental stuttering: a speech disorder that affects 1% of the world's population
- Genetic (Domingues & Drayna, 2015) and neurological causes (see Etchell, 2018)
- Presence of disfluencies in stuttering speech which generally take the form of sound prolongations, silent blocks, and/or repetitions of sounds, syllables, or words
- Few studies have focused on the articulatory movements present during these disfluencies

Why working on the speed of movement of the articulators

- In previous studies (Hirsch, 2020; Didirkova et al., 2019), we observed that articulators covered a distance that was more important during stuttering-like disfluencies (SLD)
- This should be seen in conjunction with the fact that SLD are generally longer than other disfluencies
- Studying the speed of movement of the articulators could make it possible to know whether the distance covered by the articulators is indeed longer during SLD, taking into account the duration of the disfluency

Aim & Hypothesis

- *Aim:* assessing the speed of movement of speech articulators during disfluencies
- *Hypothesis:* the speed of movement of the articulators makes it possible to differentiate Stuttering-like disfluencies and other disfluencies

Method

- Articulatory data acquired using EMA (Carstens; AG501 3D)
  - 10 coils to track movements of the upper and lower lips, tongue (3 sensors) and mandible
  - 4 persons who stutter (2 males & 2 females) and 4 age- and gender-matched control subjects in spontaneous speech
- Audio recording (44.1 kHz, 16 bits, .wav), synchronized to the EMA data
- Transcription and segmentation of the articulatory and audio data (orthographically and phonetically) in Praat (Boersma & Weenink, 2022)
- Extraction of the position of each coil using Visartico software (Ouni et al., 2012)
- Calculation of the speed of the upper and lower lips, the mandible, the tongue tip, and the tongue body's vertical movements in SLD and other disfluencies produced by Persons Who Stutter and Control Speakers
- Statistical analyses were conducted using RStudio (RStudioTeam, 2020). Non-parametric tests for mean comparisons were used, with Bonferroni correction for multiple comparisons
- A total of 1,291 disfluencies were considered

Results

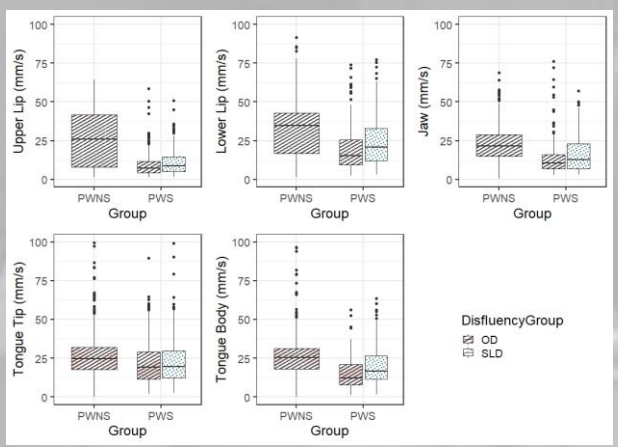

Figure 1. Supraglottic articulatory speed in Other disfluencies ("OD," red stripes) and Stuttering-Like Disfluencies ("SLD," blue dots). On the x-axis, nonstuttering speakers are on the left and stuttering speakers on the right-hand side. On the y-axis, speed is in millimetres per second.

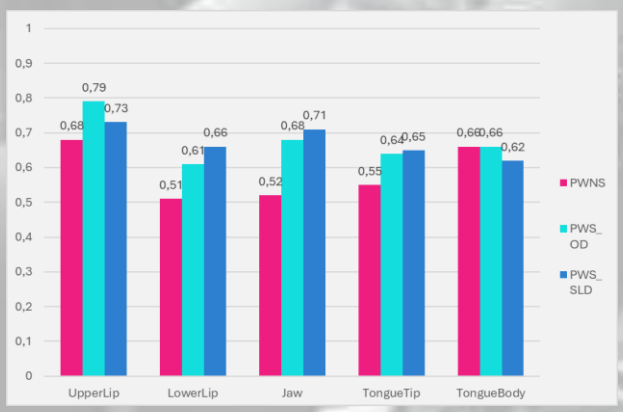

Figure 2. Coefficient of variation per articulator and group. In red, PWNS. In green blue, other disfluencies produced by PWS. In blue, SLD produced by PWS.

Discussion

- Overall reduction in the speed of movement of articulators during disfluencies produced by people who stutter compared with control speakers
  - We suggest increased instability could lead to more complicated management of the normally fine-grained balance between sequential and overlapping muscle movements during speech production. This complication in accurate motor timing could decrease speech rate as a natural compensatory strategy to preserve fluency
- More variability in articulator movement speed in persons who stutter than in control speakers