

Aspects of Prosodic Phrasing in Motor Speech Disorders

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Skilled speech interactions in adulthood can be compromised by neurological breakdowns which can affect the planning, programming and/or execution of speech production. While the consequences of these Motor Speech Disorders (MSD) on voice or segmental features are pretty well described, there is comparatively little or unprecise impressionistic descriptions of their suprasegmental features [1, 2, 3]. In this study, our goal is to better characterize abnormal prosodic phrasing, with the idea that atypical prosodic organization may reflect specific prosodic impairments, but also strategic reorganization of the speech flow to overcome other impairments affecting articulation, voicing or breathing.

We focus here on prosodic phrasing, i.e. how speakers make use of breaks and prominences to organize their utterances into structured and meaningful chunks of articulated content [4, 5]. Fifty-five speakers with MSD of various origin (18 individuals diagnosed with apraxia of speech (AoS), 37 individuals presenting dysarthria associated with Parkinson's disease (PD, N = 18) or spinocerebellar ataxia (SCA, N = 19)) as well as 30 neurotypical control speakers (CTRL) were recorded with the MonPaGe protocol [6]. For each speaker, 10 sentences of a text reading task were prosodically annotated by two expert prosodists following adaptations of F_ToBI [7] and RaP [8]: a break was annotated whenever a rupture was felt between two words or two syllables within a word; a rhythmic prominence was annotated on perceptually salient beat syllables. Four degrees of break (1: weak, Wd-like, to 4: very strong, IP-like) and two degrees of prominence (weak/strong) were defined based on perceptual indices.

Prosodic phrasing is found to differ from that of CTRL in the three MSD groups in terms of (a) the presence/absence of prosodic events (breaks or prominences), (b) the type/degree of the events, (c) the size (in duration and/or number of syllables) of the chunks delimited by prosodic events, as illustrated in **Fig. 1., 2., 3., 4.** and described below.

AoS's speech is characterized by an excess of prosodic events (breaks and prominences) compared to CTRL, contributing to the impression of 'segmented speech' [9], and, strikingly, produce atypical breaks within words. Speakers with AoS have difficulties at the motor planning of speech goals, that is reflected here at the phrase-level with smaller prosodic plans. If the big prosodic groups (break 4 – IP-like) are globally longer than those of CTRL with slowly articulated speech, utterances of the AoS group are marked by many prosodic chunks containing little linguistic content (i.e. fewer syllables between breaks or prominences).

Dysarthric speakers on the other hand, do not differ from CTRL in the quantity of prosodic events (break/prominence) but in the type of events used. Both PD and SCA groups produce a larger proportion of break 4 (IP-like) compared to CTRL, that could reflect their difficulty to initiate speech (i.e., breaks may be longer and may be felt stronger if speech starts with effort) or a breathing limitation leading to more air intake. PD and SCA groups differ in the size of the intervals separated by prosodic events (breaks or accents). Speakers with PD realize longer (in s.) intervals than CTRL which contains many syllables – this corresponds to the 'rushes of speech' described in the literature [9], while these intervals are long but filled with fewer slowly articulated syllables for the SCA group. Regarding rhythmic prominences distribution, PD speakers do not differ from CTRL, while speakers with SCA produce long sequences of speech without rhythmic prominences. Follow-up work will focus on the development of a screening tool dedicated to the assessment of prosody, given the crucial role that prosody can play to preserve communication in the case of poor segmental content.

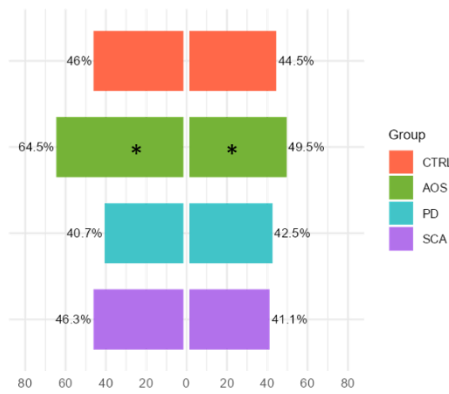


Fig. 1. Occurrences of breaks (left) and prominences (right) according to group (expressed as a % over the total of words in the text). ‘*’ = significantly different from CTRL.

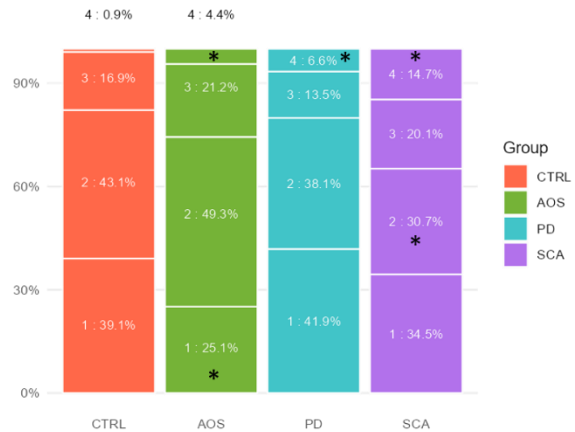


Fig. 2. Distribution of boundaries according to break degree (1 Wd-like to 4 IP-like) for each group. ‘*’ = significantly different from CTRL.

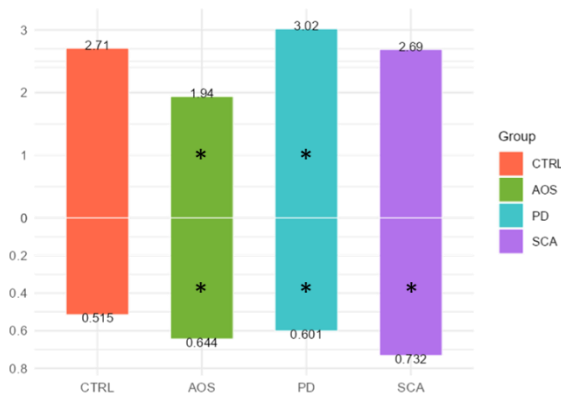


Fig. 3. Size of the intervals between breaks in seconds (bottom) and number of syllables (top) according to groups (mean values). ‘*’ = significantly different from CTRL.

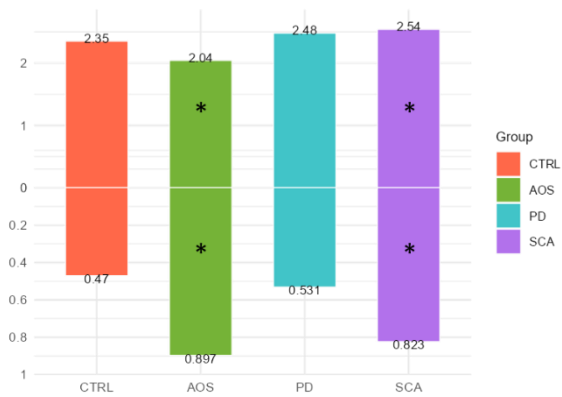


Fig. 4. Size of the intervals between prominences in seconds (bottom) and number of syllables (top) according to groups (mean values). ‘*’ = significantly different from CTRL.

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