When how means what: (Dys)prosody in Parkinson's Disease

Pedro Oliveira[1,2], Marisa Cruz[2], Marina Vigário[2], Selene Vicente[3], Rita Cardoso[1,4], Isabel Guimarães[1], Joaquim J. Ferreira[1,4], Serge Pinto[5] & Sónia Frota[1]

[1]Universidade de Lisboa, Faculdade de Medicina, [2]Universidade de Lisboa, Faculdade de Letras, [3]Universidade do Porto, Faculdade de Psicologia e de Ciências da Educação, [4]CNS - Campus Neurológico Sénior, [5]Aix-Marseille Université

p.oliveira@campus.ul.pt, sonia.frota@mail.telepac.pt

Establishing sentence modality and chunking the speech stream into units are two of prosody's main functions. Both functions affect phrase-level meanings, playing a crucial role in communication. Portuguese uses contrasting nuclear contours to express modality, and intonational breaks for chunking (Frota, 2014). This study examines the impact of Parkinson's disease (PD) on these functions considering time from diagnosis (G1: 1-5 years; G2: ≥10 years) and medication (OFF vs. ON state).

Previous studies of (dys)prosody in PD have focused on a simple acoustic analysis of prosodic parameters (e.g., measures of mean F0, F0 variability, duration, speech or articulatory rate) to describe overall trends (Skodda et al. 2008, 2011; Tykalova et al. 2014), or on professional listeners' judgments of prosodic communicative efficiency (Martens et al. 2011). In either case, the structural properties of prosody, i.e., presence/absence and type of pitch accent and boundary tone, and presence/absence and cues for intonational breaks have not been examined. The current study focuses on these properties. We investigated how nuclear contours were produced to express various sentence types and pragmatic meanings (broad and narrow focus statements, requests, commands, yes-no questions, vocatives), and how prosodic phrasing was accomplished in utterances containing several phrases (as in the case of parentheticals, topics, and enumeration).

Twenty sentences uttered by 10 controls and 20 PD patients (10 in G1; 10 in G2) in OFF and ON were analyzed for nuclear contours and phrasing breaks. The recordings were obtained during a session with a speech therapist in which the participant completed a series of speaking tasks as part of a larger protocol. The sentences were read in response to a previously presented context. PD participants did the task first in OFF state, and then in ON state (1 hour after a dopaminomimetic drug intake). The OFF and ON sentence sets have slight differences in the lexicon used, while keeping the syntactic and prosodic structures unchanged. For the recordings, a headset microphone and a Marantz PMD recorder were used. Prosodic analysis was done with PRAAT, using the P-ToBI system (Frota et al. 2015). For nuclear contour type and phrasing breaks a deviance scale from '1' to '-1' was computed taking the performance of controls as '1' (reference) and positioning PD patients relative to controls. Group performance was examined by means of a One-Way ANOVA (Controls, G1, G2). A mixed ANOVA assessed the effects of OFF/ON state (within subject factor) across the two groups of PD (G1, G2).

Results indicate that nuclear contour type (Fig. 1) distinguishes between groups ($F(2,47)=7.92$, $p=.001$, $\omega=.47$), with patients performing worse than controls, but no effect of time from diagnosis (G1, G2). By contrast, ON state significantly improves the expression of modality ($F(1,18)=5.29$, $p<.05$, $r=.48$). Presence/absence of expected phrasing breaks (Fig. 2), however, does not differentiate the groups ($F(2,47)=1.86$, $p=.17$). Although a main effect of ON/OFF state was not found, there was a significant interaction between medication and PD group ($F(1,18)=4.70$, $p<.05$, $r=.46$), with G1 phrasing improving in ON state (as illustrated in Fig.3), unlike G2 phrasing. Phrasing breaks were mostly realized by rising pitch by both controls and PD (Fig.4). However, the interaction between medication and PD group approached significance ($F(1,18)=3.45$, $p=.08$), with G1, again, performing better in ON state than G2. Overall, medication had a strong effect on modality, but it didn't help with dysprosodic phrasing, which evolves differently suggesting that the underlying

mechanism of the latter is less dependent on dopaminergic deficits, with implications for PD neurophysiology and therapy.

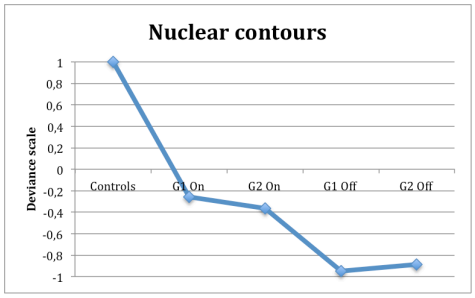

Fig.1. Nuclear contours in PD compared with controls (data for all sentence types)

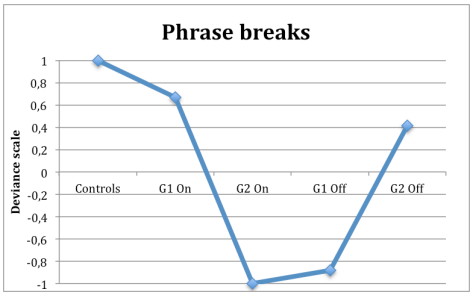

Fig.2. Correctness of expected phrase breaks (intonational breaks) in PD compared with controls

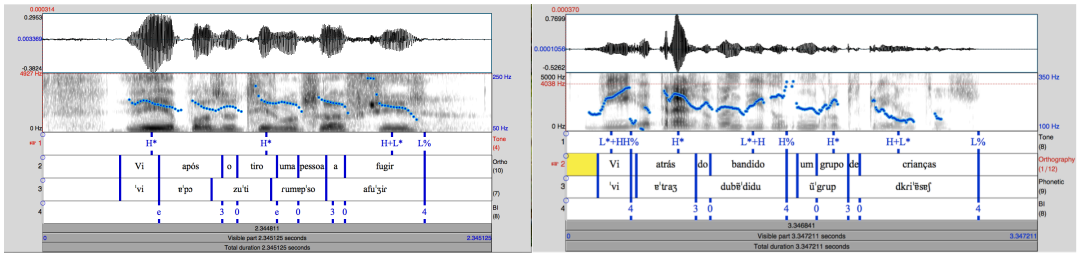

Fig.3. Presence/absence and correctness of intonational breaks (IP, level 4): utterance with a parenthetical produced by a G1 patient in OFF (left) and ON (right) state. 'e' marks phrasing deviations from the expected pattern.

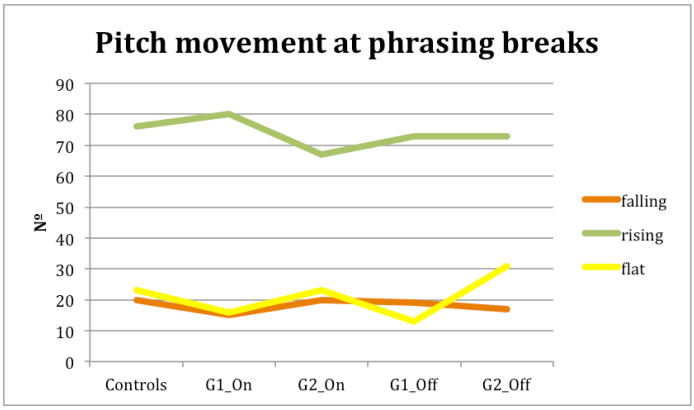

Fig.4. Type of pitch movement at phrasing breaks in controls and PD

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