

Phonological and sociophonetic information in parkinsonian dysarthric speech: The analysis of two varieties of Italian

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Hypokinetic dysarthria often accompanies Parkinson's Disease, resulting in reduced range and accuracy in movements [1], including those of speech articulators. Such reduction affects the production of segments and prosody [2,3,4,5], inducing variability in speech. However, such variability goes along with typical patterns of variability that correspond to socio-phonetic variation, and a question arises as to the relation between the disease-related variability and the specific socio-phonetic characteristics. The varieties of Italian spoken in Bari and Lecce (Southern Italy), for instance, belong to different dialectal isoglosses (South vs. Extreme South; [6]) and are characterized by different sociophonetic markers, such as a) unvoiced plosive aspiration only in Lecce, and b) vowel reduction or deletion in pre- or post-tonic position in Bari [7,8]. Some of the characteristics variably distributed in the two varieties go in the direction expected in dysarthric speech, that are changes in the phasing of laryngeal and supralaryngeal gestures [9,10], such as in a) in the Lecce variety, and the tendency to reduce vowels, such as in b) for Bari Italian.

The main goal of the paper is analyzing speech produced by dysarthric parkinsonian and healthy control speakers from Bari and Lecce to verify if the disease-related variability has a different impact on dysarthric speech characteristics, possibly depending on the variety-specific phonological and phonetic features. In this work, a set of phonetic and phonological features is considered 1) to confirm the differences between dysarthric and control speech, observing vowel space areas and stop production accuracy, and 2) to analyze the dysarthric speech characteristics in the two varieties taking into account the phonological and phonetic references as found in control speakers. We hypothesize that a) measures regarding the set of features differentiate dysarthric and control subjects, but b) characteristics of dysarthric and control's speech differ more where the reference, varietal feature is already shifted in the direction of reduction in range or accuracy, as if the reference system would somehow admit more variability in that expected direction (with less need for compensation-strategies that are often observed).

Twenty Parkinsonian subjects with mild hypokinetic dysarthria (PDs, 10 from Bari; 10 Lecce – M, F balanced; DYS-TOM 3-4), and 5 control speakers for each variety (CTRs) participated in the study. They were not cognitively impaired (MoCA \geq 24), were from/lived in the Bari/Lecce, were age matched as much as possible (mean age: PDs 63 y.o., CTRs 59 y.o.) and presented a similar amount of everyday use of the local dialect. Subjects read 3 short passages (54+54+57 words=165), and 3 repetitions of sentences (40 words) and words (16) in isolation (Tot=333 wordsXsubj). We measured Vowel phonetic space (/i/-/a/-/u/) and post-tonic Vowel reduction: F1xF2 values and Vowel Articulation Index [11,12,13]; Accuracy in stop production: percentage of accurate closure and presence of burst; Aspiration: percentage and VOT duration. Only descriptive statistics are applied as the study is exploratory (for a similar approach, [14]).

Preliminary results showed no relevant phonatory deficit and, as for goal 1), consistently with the literature the vowel space is reduced (Fig.1) and accuracy in stop production is diminished (Tab.1) in PDs in comparison to CTRs. However, as for 2), although the vowel space in PDs from Bari shows a greater reduction along the vertical dimension, possibly in line with the presence of [ə] in the unstressed vowel system, the coefficient of variation shows that variability is observed in both varieties on the horizontal dimension. As for aspiration in stops, PDs from Lecce seem to show more cases of aspiration than PDs from Bari and CTRs (Tab.1). However, the VOT duration calculated as a percentage of the whole consonant duration is similar in PDs from Lecce and from Bari, and the coefficient of variation does not change in one variety only. These observations do not support the hypothesis that more variation in PD speech may be found in case the reference system already presents features that go in the direction expected in dysarthric speech, here in the direction of a reduction (Vs in Bari) or a change in the phasing of laryngeal and supralaryngeal gestures (C aspiration in Lecce). However, as the results are preliminary and the study is exploratory, a larger investigation is required in order to confirm the observations mentioned above and to give a robust answer to the research questions.

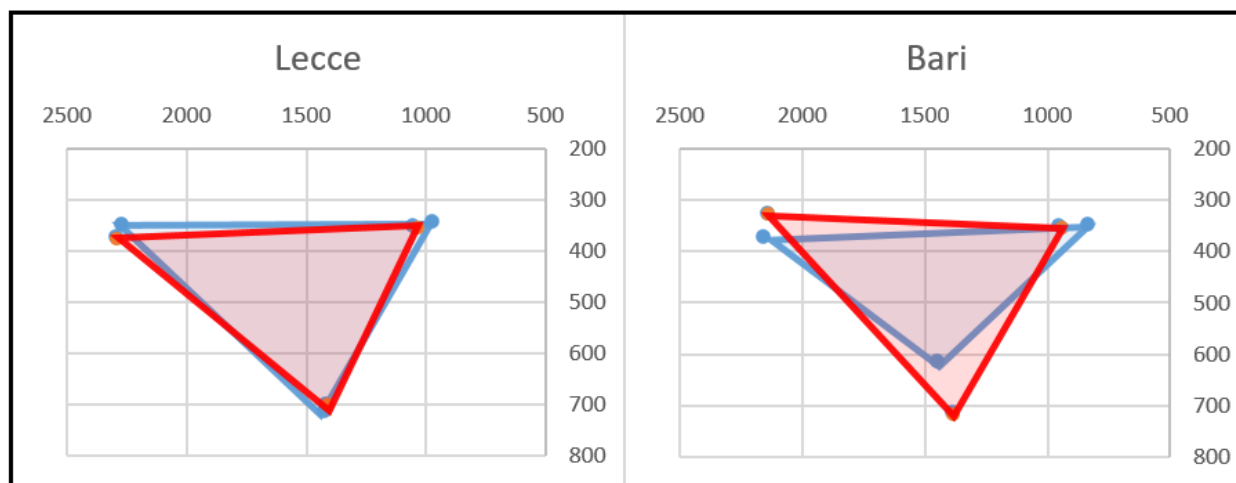


Fig. 1. Acoustic vowel space showed with reference to F1 and F2 vowel formants for /i/-/a/-/u/ in stressed syllables. Data regard PD-dysarthric (blue) speakers and matched controls (red) from Lecce (left) and Bari (right). Vowel formant values were averaged across productions.

Table 1. Percentages of accuracy in stop closure and VOT (aspiration) realization.

SPK	/t/		/tt/		/p/		/k/	
	Accuracy	Aspiration	Accuracy	Aspiration	Accuracy	Aspiration	Accuracy	Aspiration
PD_LE	24/24 100%	24/24 100%	41/41 100%	41/41 100%	46/46 100%	2/46 4.34%	14/23 60,86%	2/23 8.69%
CTR_LE	17/17 100%	12/17 70.58%	34/34 100%	28/34 82.35%	32/32 100%	0/32 0%	13/17 76.47%	0/17 0%
PD_BA	20/20 100%	0/20 0%	39/39 100%	1/39 2.56%	38/42 90.48%	0/42 0%	5/20 25%	0/20 100%
CTR_BA	14/14 100%	0/14 0%	26/26 100%	4/26 15.38%	28/28 100%	0/28 100%	6/14 42.85%	0/14 0%

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