Emotional Speech of Chinese Patients with Parkinson's Disease : A Prosodic Point of View

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Introduction

Approximately 70%- 90% of patients diagnosed with Parkinson's disease (PD) have some form of vocal disorder, showing

– Noticeable impairment in phonation, articulation and prosody (Rusz et al., 2011).

– A decreasing pitch range, smaller intensity variations, and various changes in speech rate (Canter, 1963; Rusz et al., 2011; Pettorino et al., 2016).

Consequences of dyprosody in PD speakers

– Affected ability to convey specific affective or linguistic meanings in their speech brought impairment in social and affective interactions (McNamara & Durso, 2003).

– Emotional speech were poorly sounded from listeners' perspective (Cheang & Pell 2006).

Studies on prosodic features of Chinese PD speakers

– More complicated compared to those on American and European speakers for Chinese is a tonal language.

Previous findings

– Decreases in pitch range and higher speech rates (Fan, 2017).

– Having problems producing questioning intonations (Jian, 2019).

Research Aim

The current study collects the proverbial sound of Chinese PD speakers in different emotional contexts.

By comparing with healthy speakers, we take a closer look on the prosodic features of the speech of Chinese PD speakers.

– This might be indicated through different pitch range or varied speech rate (time duration of length-controlled speech).

Methods

Participants

– 15 native Chinese-speaking adults diagnosed with PD and 6 healthy control subjects.

– All participants speak a dialect of Mandarin Chinese (Dalian dialect).

• The PD speakers were marked an above-zero score in the 3.1 section of UPDRS scale.

• They have not undergone any kind of language therapy and have not been notified with cognition impairment.

• The HC group consisted of 3 male and 3 female speakers that do not have articulation disorder.

Materials

– Scene inducing tasks (Zhang & Gu, 2011)

• This study designed three dialogues for each of the six target sentences with 4 distinct affective tones: "angry", "happy", and "sad" ("natural" was presented by simply showing the target sentence alone).

Item	Target Sentence	Gloss
1	你把风扇往上抬。	Raise the fan upwards.
2	明天可能要下雨。	It might rain tomorrow.
3	过些日子再说吧。	Let's put this topic for another day.
4	早上没喝小米粥。	I didn't have the porridge this morning.
5	他把菜全都吃了。	He ate up the food.
6	爬了三回上坡道。	I climbed up the ramp three times.

Table 1 Target sentences

Recording procedure

– A Zoom H5 recorder (44.1Khz, 16bit, stereo) was used for the recording sessions.

– Prerecorded parts were played through a smartphone, engaging a role-play format between participants and the recordings. Each dialogue was repeated 2-3 times.

•Acoustic Measurements

– Six measurements were made. Minimal F0, Maximum F0 ,Mean F0, F0 Range, Standard Deviation of F0, and Duration.

– Acoustic analysis was done in Praat (Boersma & Weenink, 2017) using the 'prosodypro' script (Xu, 2013).

Results

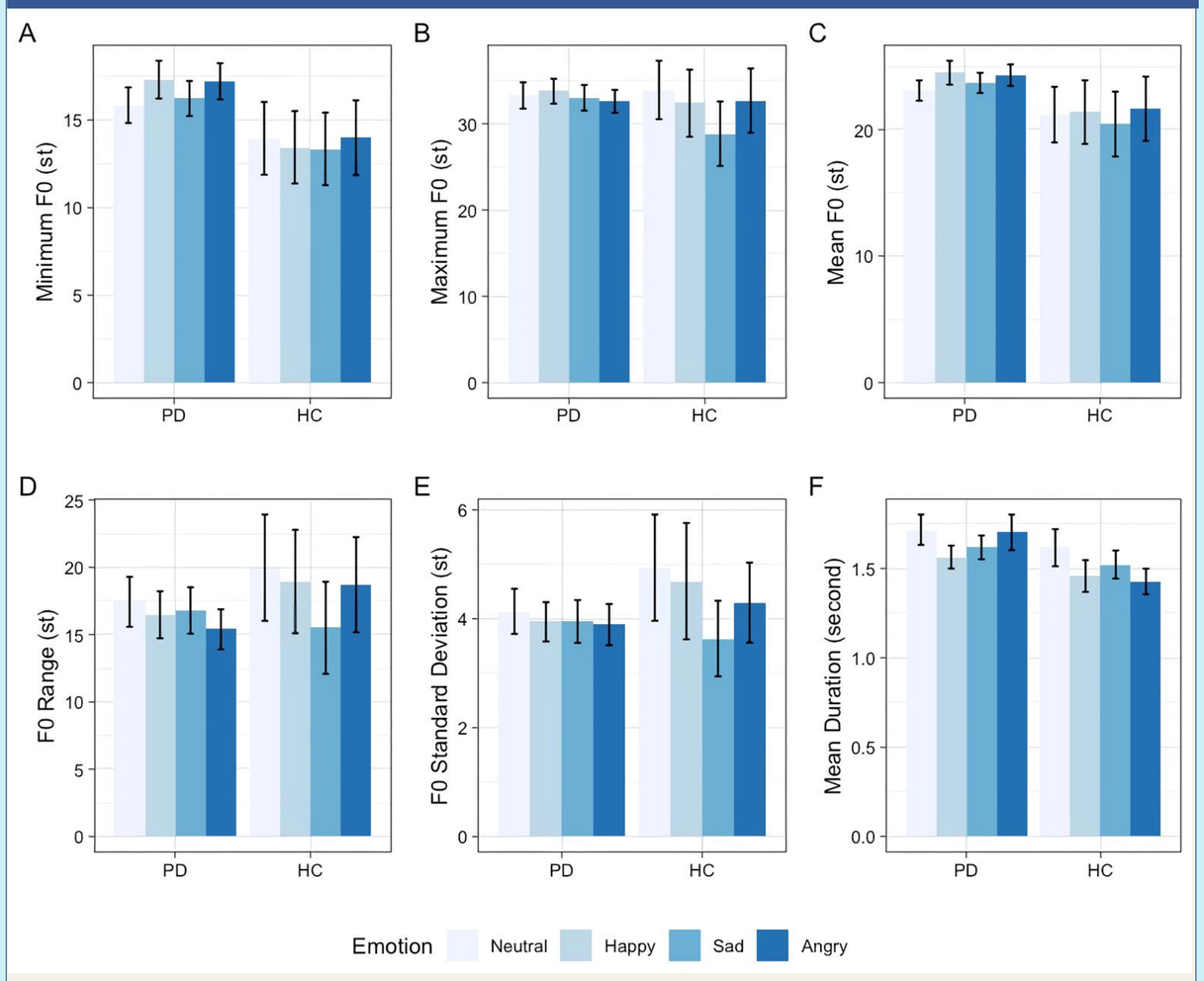

Fig. 1 The minimum F0, maximum F0, mean F0, F0 range, standard deviation of F0 within utterances by emotion condition and participant group.

The overall analysis shows no significant difference between PD and HC speakers in all six acoustics features measured.

– An effect of emotion on Mean F0 (p=.002) and Standard deviation of F0 (p = 0.055) across groups, where standard deviation of F0 was significantly smaller in the Sad emotion than in the Neural.

An effect of Emotion was found in the aspect of duration (p<.001) and a significant interaction between Group and Emotion was also observed, where utterances in angry emotion produced by PD speakers are longer than that of HC speakers.

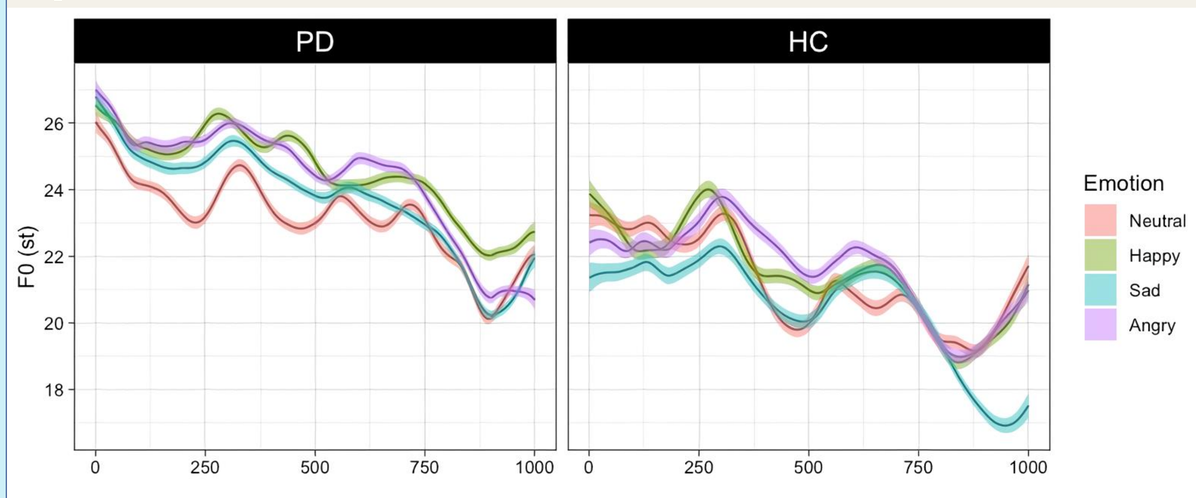

Fig. 2 SSANOVA predicted F0 contours by equidistant time points, emotion condition, and participant group. The shaded polygons give 95% Bayesian confidence intervals around the predictions.

Fig. 2 tells an obvious downdrift towards the end of the utterances was observed for the Sad condition in HC group, but it is not found in PD group.

In PD group, utterances in all emotions except the neutral condition displayed a relatively higher F0 contours in the first half of the utterances. This is not observed in the HC group.

Conclusion

We found evidence in both **pitch contour** and **speech rate** showing PD patients do have different emotional prosodic features compared to HC speakers.

Such features might have been the cause for communicative impairments for the PD patients, and can also serve as a kind of evidence in diagnosing the disease from an acoustic perspective.

Studies on much bigger scales are needed in order to get more clear and accurate evidence.

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The author is looking for a postgraduate programme starting next year.
For a full list of references and an oral-presented version of this research, please visit bm-zhang.github.io.