The Expression of Prosodic Prominence in Parkinsonian Speech

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Patients with idiopathic Parkinson disease (PD) suffer from a neurodegenerative disorder of the extrapyramidal motor system which is released by a progressive loss of dopamine neurons in the substantia nigra. This area of the brain is responsible for motoric activity, cognition and the limbic systems. The major symptoms of this disorder are bradykinesia, resting tremor, rigidity, hypokinesia [1] and dysarthria. The latter one includes monoloudness, monopitch, reduced stress, imprecise articulation, variability of speech rate, disfluencies and voice tremor [2, 3]. Therefore, PD affects communication as well as other related functions such as cognition, but complex prosodic aspects such as prominence marking are less well studied.

Prominence marking in German requires changes in intonation and articulation [4]. In prominent positions (e.g. under accent), speakers use a more distinct articulation of prosodic units such as syllables involving larger, longer and faster movements of the articulators. When the level of prominence decreases speakers adapt to the requirements of localized reduced speech, constantly mediating between linguistic structure and the physical control system. Speakers use multiple cues in the phonetic domain to regulate prosodic marking [5]. In the present study, we are analyzing the prosodic marking strategies of PD patients and compare them to the productions of neurotypical speakers. Therefore, we investigate the production of target words in divergent focus structures.

We recorded 40 German speakers: 20 PD patients in medication ON condition and 20 healthy controls. As speech material, we used a question-answer scenario to manipulate focal structure by means of contextualizing target utterances. Nine target words were placed in either contrastive focus (with a potentially high degree of prominence) or background position (which is likely produced without any prominence) in sentences such as <Die Fliege hat die grüne **WAde** berührt.> *("The fly has touched the green calf*.") related to pictures on a computer screen [cf. fig.1]. Target words were always disyllabic (CV.CV structure). In total, we recorded 1440 tokens (9 target words x 40 speakers x 2 focus structures x 2 adjectives). For acoustic measurements, we analyzed supralaryngeal and laryngeal parameters: syllable duration, intensity, formants of target syllables, (relative) pitch height and F0-contours.

Preliminary results show that, in line with [6], patients can express prosodic prominence by increasing pitch, intensity and duration [cf. fig.2] but to a lesser extent as the healthy controls do [3, 6] and with a higher degree of variability. This reflects abnormalities in the regulation mechanism of speech. Figure 2 shows two different productions of the target word <Wade> /va:d@/ in prominent position spoken by the same speaker. In the left example, the supralaryngeal adjustments lead to a strong increase in loudness in the target syllable, making the utterance sound unnatural and a very steep pitch excursion. In contrast, the example on the right shows a more balanced production of loudness but a distinct flatter pitch contour. For the upcoming conference, the results of all speakers and variables will be presented. We will discuss how much variation is tolerated in a dynamical speech system before the expression of prosodic functions is getting instable.

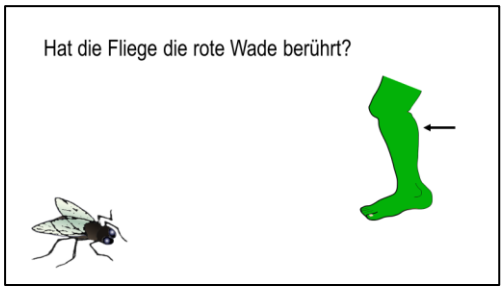

Figure 1. *Stimuli presentation: question-answer scenario - question as audio stimulus and the appropriate answer as production task.*

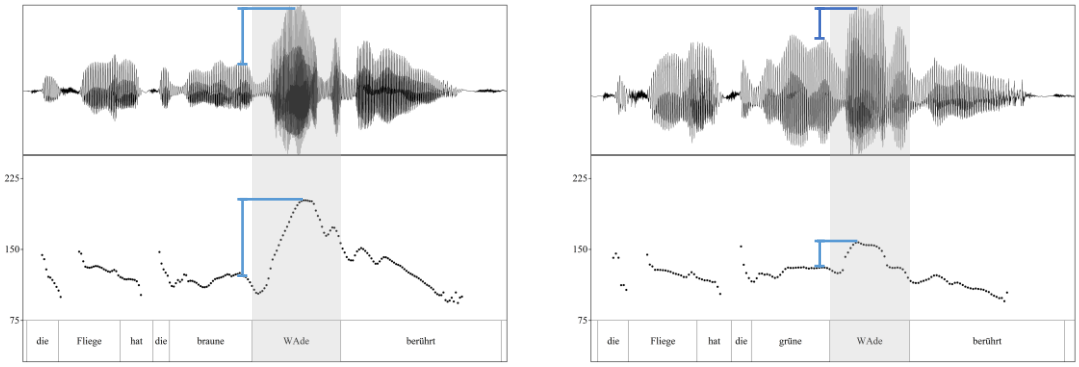

Figure 2. *Acoustic waveform and F0-contour for the target word <Wade> in the utterance <Die Fliege hat die braune/grüne Wade berührt> in Praat [7]: data of one patient produced in the same condition – (accented word <Wade> shaded in grey)*

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