

Word-initial glottalization in the function of speech rate and vowel quality

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Irregular phonation (a.k.a. glottalization) serve prosodic functions in typologically unrelated languages, e.g., American English (Dilley et al. 1996), Czech, Spanish (Bissiri et al. 2011), German, Polish (Kohler 1994; Malisz et al. 2013), Hungarian (Markó 2013) and others. The occurrence of irregularity may be influenced by several factors, and it shows high inter- and intraspeaker variability (e.g., Dilley et al. 1996; Redi & Shattuck-Hufnagel 2001; Markó 2013). Kohler (2001: 282) defined four types of glottalization, as follows: (1) Vowel-related glottalization phenomena which signal the boundaries of words or morphemes. (2) Plosive-related glottalization phenomena which occur as reinforcement or even replacement of plosives. (3) Syllable-related glottalization phenomena which characterize syllable types along a scale from a glottal stop to glottalization (e.g., Danish *stød*). (4) Utterance-related glottalization phenomena which comprise (i) phrase-final relaxation of phonation and (ii) truncation glottalization, i.e., utterance-internal tensing of phonation at utterance breaks. Studies performed on Hungarian irregular phonation documented type (1) and type (4) both in read and spontaneous speech (Böhm & Ujváry 2008; Markó 2013).

It is a prevalent view in the literature that irregular phonation is dependent on speech rate (Umeda 1978; Rodgers 1999). Studies in German and Polish read and spontaneous speech revealed that the appearance of word-initial irregular phonation is more frequent if the speech rate is slower and the word-initial vowel is back and open (Malisz et al. 2013; Lancia & Grawunder 2014).

In Hungarian a systematic analysis of speech rate and vowel quality has not been carried out so far. The lack of systematicity in earlier studies was partly due to unbalanced speech material (since previous studies analyzed mainly spontaneous speech which is inherently unbalanced in several aspects). Moreover, glottalization in Hungarian speech was analyzed only acoustically. In the present study we investigated two factors that may elicit glottalization, (i) speech rate, and (ii) vowel quality, by the analysis of the acoustic signal.

Based on previous results for other languages we plan to address the following questions. Is irregular phonation more frequent in the case of word-initial vowels if (i) the speech rate is slow (as opposed to

fast); (ii) the vowel is back (as opposed to front); (iii) the vowel is open (as opposed to close or close-mid) also in Hungarian? We hypothesize that the frequency of occurrences of irregular phonation is higher in slow speech and in the case of back and open vowels, in accordance with results for other languages.

The test material consisted of trisyllabic non-sense words (*Vtina*) preceded by an introductory phrase (*A szó: ‘The word is:’*) where the V represents one of the nine Hungarian vowel qualities /i e: ε y ø u o ɒ a:/. The stimuli were presented on a computer screen. Each trial consisted of two display screens: first the introductory phrase was showed to the participant, then the target item was displayed. In order to elicit speech rate differences between the conditions, the timing of the display screens was manipulated. In the “slow speech” condition, each display screen appeared for 1500 ms resulting in 3000 ms for one trial in total (including the introductory phrase and the target item). In the “fast speech” condition the timer was set to 300 ms, resulting in 600 ms for one trial in total. (In order to support the subjects’ accommodation to the accelerating tempo throughout the experiment, one inbetween tempo was also used in filler blocks.) The participants’ task was to read aloud the target items, but not the introductory phrase. However, as the timing of the introductory phrase reflected also the timing of the following (target) item, it enabled the subjects to prepare for the production of the following target item. The trials were ordered into blocks: within each block all the words including all the nine different vowels occurred in a randomized order once, and these blocks were repeated 5 times consecutively for each (“slow speech” and “fast speech”) condition. In the case of every participant, the conditions were recorded in the order of tempo starting with the “slow speech” condition and ending with the “fast speech” condition (while the timing of the stimuli was increased gradually). In the present study 10 participants’ speech samples were analyzed, and based on previous results (revealing that female speakers tend to glottalize more frequently than males, see e.g., Markó 2013) only female speakers were included.

Preliminary analysis of one speaker’s data showed that the experimental design is suitable for the elicitation of different speech rates, as in the “fast speech” condition the duration of the target words’ was on average $15.5 \pm 2.2\%$ shorter than in the “slow

speech” condition. In general, word-initial glottalization was 21.9% less frequent in “fast speech”, than in “slow speech”. In one speaker’s data systematic differences cannot be observed either in terms of tongue height (close vs. open) or in terms of the horizontal tongue position (back vs. front).

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