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DOMAIN-INITIAL COORDINATION OF PHONATION AND ARTICULATION IN CZECH RADIO SPEECH

RADEK SKARNITZL AND PAVEL MACHAČ

ABSTRACT

Domain-initial strengthening has been documented for several phonetic phenomena, such as linguopalatal contact, consonant duration, or voice onset time, suggesting a "strong" character of the initial position. This study analyzes two domain-initial phenomena in the speech of Czech radio newsreaders, preglottalization and devoicing. Both these phenomena are associated with the coordination between glottal and supraglottal activities. The results of a perception test suggest that contrasts in voicing are discriminated at chance level, while preglottalization is perceptually more salient. The modality of phonation in the glottal segment may be important for correct discrimination. Preglottalization appears to be similar to other reported examples of domain-initial strengthening, but not identical from the perspective of its function in everyday communication.

Key words: articulatory strengthening, glottalization, devoicing, media speech

1. INTRODUCTION

Traditional approaches to the scientific examination of the properties of human speech have emphasized either the segmental or the suprasegmental viewpoint. Indeed, phoneticians even referred to themselves as "segmentalists" or "suprasegmentalists" (although there have been exceptions like John Firth (1957) with his Prosodic Analysis). The last decades have, however, proven that the articulation of a given speechsound can be affected by its location within a larger domain. Research is thus growing into what has been called "articulatory prosody" (e.g., Fougeron, 2001; Tabain, 2003), an area of phonetics dealing with relationships between segmental and suprasegmental phenomena. These relationships may be considered from both perspectives: we may talk about segmental differences induced by prosodic structure (Fougeron, 2001) or about phonetic details on the segmental level serving as cues to specific prosodic phenomena (Cho *et al.*, 2007; Cho & Keating, 2009).

There are several higher-level prosodic contexts which have been shown to induce segmental variation. Of these, the best known is probably phrase-final lengthening or deceleration, i.e., longer segment durations in phrase-final positions relative to their mean durations (e.g., Klatt, 1976; Wightman *et al.*, 1992; Byrd, 2000; Byrd *et al.*, 2006; see also Dankovičová, 2001 and Volín & Skarnitzl, 2007 for Czech).

Another area of articulatory prosody which has been extensively researched is the articulatory strengthening of prominent syllables, i.e., syllables pronounced with stress or accent (e.g., de Jong, 1995; Loevenbruck, 1999; Erickson, 2002; Cho & Keating, 2009).

The third area of relationships between segmental and prosodic aspects of speech is articulatory declination. Declination is well attested not only for fundamental frequency (Liberman & Pierrehumbert, 1984) but also for gestural magnitude of supralaryngeal organs such as the lower jaw (Vayra & Fowler, 1992) or the velum and the lower lip (Krakow *et al.*, 1991).

The last prosodic context which affects the articulation of individual speechsounds is the utterance- or phrase-initial position. In what has become known as domain-initial strengthening, initial segments undergo spatio-temporal expansion and are more resistant to coarticulatory effects (Cho *et al.*, 2007). Cho & Keating (2009: 467) also use the term "local hyperarticulation" (*cf.* de Jong, 1995).

Domain-initial strengthening has been attested by both articulatory and acoustic investigations. Electropalatographic (EPG) studies have shown that coronal consonants display greater linguopalatal contact in initial positions (Fougeron & Keating, 1997; Cho & Keating, 2001; Fougeron, 2001; Onaka, 2003; Bombien *et al.*, 2007; Cho & Keating, 2009). Directly related to this is the finding that domain-initial consonants are lengthened (e.g., Fougeron, 2001; Onaka, 2003). As for the articulation of vowels, Tabain (2003) showed, in a study using electromagnetic articulography (EMA), that the tongue body was significantly lower for /a/ at the beginning of higher-level prosodic boundaries. Fougeron (2001) reported an increase in linguopalatal contact for /i/ in the phrase-initial as opposed to the word-initial position. Fougeron (2001) also reports her previous study (1998) in which domain-initial /i/ displayed higher F3 frequencies in labial contexts, which may be interpreted as resistance to contextual labialization.

Domain-initial strengthening has also been, to a certain extent, examined at the level of the glottal behaviour. Voice onset time (VOT) tends to be longer in domain-initial fortis plosives than in non-initial positions (e.g., Cho & Keating, 2001; Cole *et al.*, 2003; Cho & Keating, 2009). Pierrehumbert & Talkin (1992) have also discovered greater gestural magnitude in phrase-initial /h/ in American English as opposed to phrase-medial contexts, rendering the sound more consonantal.

Several studies have dealt with glottalization related to the domain-initial position. Pierrehumbert & Talkin (1992) showed that vowels initial in full intonational phrases are more likely to be glottalized than word-initial vowels in other prosodic contexts. Dilley *et al.* (1996) studied glottalization in the speech of five radio broadcasters and found that all of them glottalized word-initial vowels significantly more often at the beginning of both full and intermediate intonational phrases. Similarly, Fougeron (2001) found that initial /i/ was more frequently glottalized in higher prosodic units and hypothesized that initial vowel glottalization may also be regarded as articulatory strengthening.

All these results suggest that domain-initial segments assume more extreme positions: consonants are more constricted and vowels are articulated more

peripherally. The initial position in general has been traditionally regarded as a "strong" position. For instance, in her study focused on the movements of the velum, Vaissière (1988: 127) introduces the suprasegmental feature [± strong] to account for her results, with the initial position described as [+ strong]. Moreover, the findings of the above-mentioned studies indicate that the extent of domain-initial strengthening correlates with the position in the prosodic hierarchy. In other words, the initial segment's articulation becomes stronger in higher prosodic units (see, for instance, Cho & Keating, 2001; Cho *et al.*, 2007).

There are two points which remain to be mentioned. First, Cho *et al.* (2007) showed that domain-initial strengthening is not only an issue of production but also one of perception: American English listeners exploited the acoustic correlates of the above-mentioned differences when performing word recognition (lexical segmentation) tasks. And second, it must be emphasized that these segmental effects induced by prosodic structure are in fact quite variable. According to Fougeron (2001: 128), these variations are on the one hand not random, but on the other hand should be regarded as optional in the sense that they are not cues necessary to decode prosodic structure.

So far, domain-initial strengthening has been investigated in several languages; the studies presented above examined and reported articulatory strengthening in English, French, German, Korean, and Taiwanese. No investigation focused specifically on domain-initial strengthening has been carried out for Czech. In studies on temporal properties of segments, no significant strengthening has been found in the duration of initial plosives (Machač, 2006: 86) or fricatives (Homolková, 2009: 45).

The present study will discuss selected non-systemic forms of utterance beginnings in Czech and relate them to domain-initial strengthening. Utterance-initial speechsounds may vary from the viewpoint of the temporal coordination of articulatory and phonatory activities. It is well known that the activity of supraglottal organs is not completely synchronized with that of the vocal folds. As an example, we can mention voicing continuation into a (phonologically) voiceless occlusion, after the closure in the oral cavity has been formed (Stevens, 1998: 333). In the domain-initial position, phonation can both precede and lag behind articulation, resulting in preglottalization and devoicing, respectively.

It should be pointed out at this stage that by preglottalization, we mean non-systemic glottal activity preceding consonants; one can imagine the (domain-initial) phrase *dozens of friends* pronounced [ˈʔdʌzənzəv ˈfrendz]. Domain-initial (and in Czech also frequently word-initial) vowels are typically preceded by a glottal stop; this is, however, systematic behaviour and will not be analyzed here. In other words, we are not interested in linking (or liaison) or its absence with respect to initial vowels.

The objective of this study is to relate preglottalization and devoicing in Czech to the findings mentioned above concerning domain-initial strengthening in other languages. Although we are talking about domain-initial phenomena, this does not mean that they will serve the same communicative function (i.e., strengthening of a prosodically relevant position). The motivation for devoicing and preglottalization

will probably differ (we can presumably talk about a physiological motivation for the former and a paralinguistic motivation for the latter), but both phenomena will be examined in this study because both are manifestations of phonetic variability in the initial position, determined by glottal-supraglottal coordination.

It is interesting to point out that while phonetic devoicing is a phenomenon frequent in casual speech in general (e.g., Möbius, 2004; Jessen, 2004; see also Machač, 2008 for Czech), preglottalization (mostly but not only in domain-initial positions) has been documented almost exclusively in the speech of radio and television speakers, and possibly in affected speech (Machač & Skarnitzl, 2009a; see also section 4.2 of this paper). This study will thus examine to what extent these two phenomena are perceptible in radio news broadcasts. We hypothesize that preglottalization will be perceptually salient, while devoicing will be more inconspicuous. Subsequently, selected items will be analyzed with the aim to explain what affects the ability of listeners to discriminate items with and without preglottalization, and those with and without devoicing.

2. OCCURRENCE OF PREGLOTTALIZATION AND DEVOICING

2.1 Method

Initial preglottalization and initial devoicing have been examined in the speech of eight newsreaders of the public broadcaster Czech Radio (three females and five males). The news bulletins lasted on average 3.2 minutes. The recordings had been previously divided into breath groups and manually segmented as part of the development of Prague Phonetic Corpus (see Machač & Skarnitzl, 2009b for segmentation rules). For the purposes of this study, all initial positions have been checked by the first author for instances of preglottalization and devoicing. In total, the material analyzed in this study consisted of 386 breath-group beginnings.

With instances of preglottalization, the type of glottal onset in each particular case was noted. It has been shown that various types of voice onset may be used when speakers initiate phonation (see, e.g., Cooke *et al.*, 1997; Kunduk *et al.*, 2006), with the most frequent ones mentioned in these medically motivated studies being normal onset, hard onset, and breathy (or soft) onset. Studies reported in these sources indicate that a hard glottal onset involves a more forceful closure of the glottis, greater stiffness and greater muscular tension of the laryngeal structures. A soft glottal onset, on the other hand, is characterized by slower approximation of the vocal folds toward the median line, reduced stiffness and tension. In phonetic investigations into the speech of normal speakers, one must be careful with direct comparisons of descriptive labels taken from medically based studies.

For the purposes of categorizing preglottalization in this study, we only distinguished hard and soft glottal onset. Moreover, we marked instances of creaky phonation in the glottal onset. In several instances, the canonical consonant was preceded not only by a glottal gesture, but by a glottal gesture followed by a *schwa*-like vocalic element (e.g., *dobrý den* as [ʔəˈdobriː ˈdɛn] as opposed to [ˈʔdobriː ˈdɛn]).

This phenomenon has been called reinforcement of the glottal gesture (Matoušek *et al.*, 2009; Machač & Skarnitzl, 2009a). This reinforcement was also marked in our analyses.

The marking of (de)voicing in the initial position was different for phonologically voiced plosives and for other speechsounds (voiced fricatives and sonorants). Plosives were considered to be fully voiced when voicing in the waveform and in the spectrogram exceeded 30 milliseconds, fully devoiced when voicing was present for less than 5 milliseconds, and partially voiced in the remaining cases. In fricatives and sonorants, we marked the percentage of the sound duration which was devoiced.

2.2 Results and discussion

Of the 386 breath-group beginnings analyzed for this study, 63 started with a vowel, 91 with a voiceless plosive, and 7 with a voiceless affricate – contexts in which no preglottalization or devoicing was expected and none occurred (in case of the consonantal contexts), or the glottalization was not the object of the current study (in case of initial vowels; see the Introduction). The following data are based on the remaining 225 items.

Figure 1 shows the representation of preglottalization and devoicing in initial voiced obstruents. Surprisingly, devoicing was not too frequent in initial voiced plosives: 21 out of the 26 plosives without preglottalization contained more than 30 ms of voicing. As for preglottalization in initial voiced plosives, 13 instances involved /d/, two involved /b/ and one /ɡ/ (these plosives were fully voiced). Of the 16 cases of preglottalization, five were realized with a hard onset, five with a breathy onset, four with a vocalic reinforcement (with any type of glottal onset), and two with a creaky onset.

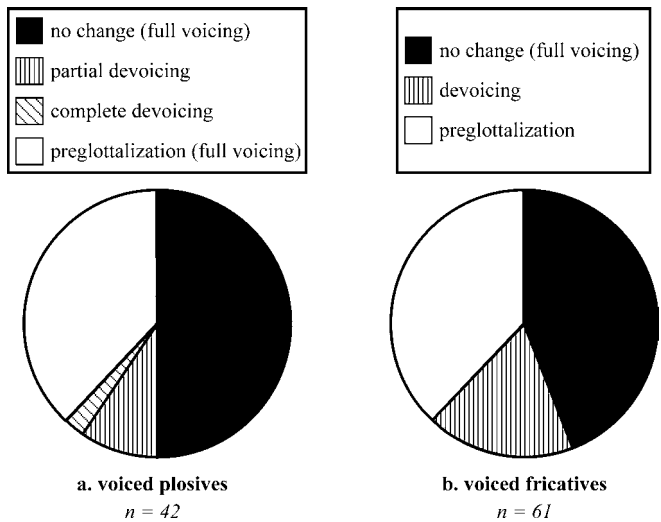

Figure 1: Occurrence of preglottalization and devoicing in phonologically voiced plosives (left) and voiced fricatives (right)

No devoicing or preglottalization was noted in 27 out of 61 voiced fricatives. Devoicing (partial or complete) was most frequent in /ɦ/ (6 out of 11 items). Preglottalization occurred in 23 fricatives, with nine cases of breathy glottal onset, seven cases of hard onset, four with a vocalic reinforcement, and three with a creaky onset. In relative numbers, preglottalization was most frequent in /ʒ/ (3 out of 4 items), followed by /z/ (12 out of 21 items) and /v/ (10 out of 29 items).

It is interesting to note that our sample of Czech Radio recordings contained two items of preglottalization before voiceless fricatives (whose production obviously involves no glottal activity, and preglottalization thus appears to be quite a strained gesture). This phenomenon was considerably more frequent in the two speakers analyzed in Matoušek *et al.* (2009) and Machač & Skarnitzl (2009a). This may be caused by the fact that while our previous studies focused on speakers from local radio stations, this study analyzes speakers of a national radio station where the emphasis on standard pronunciation may be greater.

In initial sonorants, instances of devoicing and preglottalization were less common and they will not be displayed graphically. Out of the ten items of /r/, five were realized with preglottalization and one was devoiced. The approximant /j/ occurred twenty times; nine of these were partially devoiced (on average in 44% of their duration) and one was preceded by a hard glottal onset. The lateral /l/ was pronounced with preglottalization in two out of five items. As for nasals, only five out of 53 were realized with preglottalization and one was devoiced.

To summarize, preglottalization is, as a way of modification of an initial speechsound, more frequent in our corpus than devoicing, in both obstruents and sonorants. The absolute numbers of occurrences are quite low, but it should be remembered that we do not seek to describe the behaviour of domain-initial preglottalization and devoicing in Czech in general, but in the speech of media professionals. There are at least two reasons why we have selected this target group for our analyses. First, radio or television broadcasters are frequently used, thanks to their ability to maintain relatively constant melodic and dynamic characteristics, in concatenative speech synthesis systems. Second, we hypothesize that these phenomena may have an intrusive effect on listeners: we presume that especially preglottalization will, at least in some contexts, create a negative, non-neutral perceptual impact. If our future research shows this to be the case, our ultimate objective will be to raise awareness of such intrusive phenomena, and, ideally, to eliminate them from the speech of media professionals.

3. PERCEPTION EXPERIMENT

3.1 Method

Based on the identified instances of preglottalization and devoicing, we compiled a standard AXB test so as to discover whether the two target phenomena are actually perceptible for listeners. This is regarded as a step which is necessary before their possible intrusive effect can be examined (see above).

Items were selected from the bulletins of all eight analyzed newsreaders, although the numbers of items from the individual speakers varied. (One speaker, for example, did not produce any item of glottalization at all.) In all, we selected 27 items, 18 of them focused on preglottalization and 9 on devoicing. The aim was to obtain a set of items including, according to the authors, both salient and less conspicuous target phenomena, so as to avoid a ceiling effect in the perception test.

In order to be able to examine the perceptual salience of preglottalization and devoicing, the original utterances had to be manipulated. With preglottalization, the manipulation consisted in removing the glottal element and the subsequent smoothing (fading in) of the amplitude envelope in Cool Edit 2000, so as to obtain a softer, more natural onset of phonation. The naturalness of the resulting manipulated sound was compared with standard productions of similar items (i.e., ones with no preglottalization) and carefully analyzed by both authors. To obtain pairs of initial voiced-voiceless speechsounds which would otherwise remain identical, it would be very difficult to start with a devoiced item and to add F0. Instead, we started with a voiced speechsound and filtered out F0. The initial speechsound was high-pass filtered from 1.5 times its fundamental frequency, and the resulting manipulation was again compared by both authors with similar items which had actually been devoiced by the speakers.

In the test itself, each item contained between two and four words (i.e., between one and three words following the domain-initial word; when three additional words were included, it was because at least one of them was a synsemantic word). Six items were repeated (four targeting preglottalization and two targeting devoicing) so as to check within-subject consistency, yielding the total of 33 items in the test. The items were presented in random order, with 2.5 seconds for marking the answer sheet, followed by an approximately three-second desensitization passage of unobtrusive instrumental music. The total duration of the test was eight minutes. Four items, not included in the main test, were used for training.

The AXB listening test was administered to ten undergraduate students of Phonetics via the KOSS UR/15 headphones. The participants were not informed about the focus of the experiment; however, they were instructed to concentrate on subsegmental phenomena. The test was presented as an integral part of the coursework (a course focused on the auditory analysis on the segmental and subsegmental level), and the students were not compensated for their participation.

3.2 Results and discussion

Table 1 shows the results of the AXB discrimination test for both devoicing and preglottalization. In agreement with our hypothesis, devoicing in the domain-initial position appears to be difficult to discriminate. In fact, the number of correct and false discriminations is exactly the same. Discrimination rate ranged between 3 and 9 for the devoicing items. The results are more interesting for preglottalization where correct discrimination was significantly more frequent than false discrimination: χ^2 (1; n = 240) = 36.04; $p < 0.0001$ with Yates' correction.

Discrimination rate ranged between 1 and 10 (with only four items discriminated incorrectly by fewer than five participants). The results for either of the two phenomena does not seem to involve an effect of learning (i.e., the listeners did not seem to be improving throughout the test).

Table 1: Correct and false discrimination of domain-initial devoicing and preglottalization

	devoicing	preglottalization
correct	45	167
false	45	73

As far as individual variability is concerned, the mean correct discrimination rate for the ten listeners was 21.2 (out of 33), ranging between 12 and 29. For preglottalization only, mean correct discrimination rate was 16.1 (out of 24; range between 10 and 20), and for devoicing 4.2 (out of 9; range between 1 and 8). Fleiss' kappa indicates that inter-rater agreement for both categories (preglottalization and devoicing) taken together is quite low ($\kappa = 0.24$); it is only slightly higher for the preglottalization items considered separately ($\kappa = 0.32$).

The results clearly indicate that while the discrimination of the voiced-devoiced contrast in the initial position is at chance level, preglottalization is a much more salient phenomenon. Obviously, we have to keep in mind the possibility that the results are in part affected by the nature of the manipulations, although the two authors carefully checked the naturalness of manipulations.

4. ACOUSTIC ANALYSIS

In this section, we will attempt to find some acoustic properties which might shed some light as to what is relevant for successful discrimination. One must bear in mind, however, that such an attempt is inherently constrained by the material which we had at our disposal.

Since the discrimination of devoicing in the listening test was at chance level, we will only deal with instances of preglottalization. The three best discriminated and three worst discriminated items will be analyzed here; in other words, we will focus on three items in which the presence and absence of preglottalization were discriminated most successfully, and three items in which performance was the lowest. The list of the domain-initial contexts, along with the discrimination rate of each item, is shown in Table 2.

The reason for the choice of three best and three worst discriminated items stems from the results of the perception test. As we can see, the best items (numbers 4 to 6 in Table 2) were correctly discriminated by all or nearly all of the listeners. However, the items with poor discrimination (numbers 1 to 3) approach the middle of the range (item 3 was correctly discriminated by four out of the ten listeners). Including more of the remaining 12 items in our analyses would therefore diminish the difference between the two groups.

Table 2: List of three worst and three best discriminated items and their discrimination rates

number	context	rate
1	za oznámení	1
2	rozptylové podmínky	3
3	více než	4
4	rakouští odpůrci	9
5	dnes očekáváme	10
6	v nárazech	10

4.1 Method

In the attempt to find acoustic properties which might differentiate well and poorly discriminated items, we looked at temporal, dynamic, and periodicity aspects of preglottalization. Naturally, the type of preglottalization (i.e., the type of glottal onset; see section 2.1) was also taken into account. All measurements were carried out in the Praat software (Boersma & Weenink, 2009). The individual parameters are described in the following paragraphs and summarized in Table 3.

Table 3: List of acoustic parameters examined (C = consonant, V = vowel)

description	domain
duration from glottal onset to C onset	temporal
interval between strongest glottal moment and C onset	temporal
difference between intensity of entire glottal segment and first V	dynamic
difference between intensity of glottal burst and first V	dynamic
difference between HNR of glottal segment and first V	periodicity

From the temporal perspective, we measured the duration from the onset of visible/audible glottal activity to the onset of the canonical consonant. We were also interested in the temporal separation between the strongest portion of the glottalized signal and the onset of the canonically produced consonant. Differing syllable structure and vocalic quantity of the domain-initial words precluded the use of other temporal measures. It should be pointed out that we are not talking about simple prevoicing before plosives; prevoicing is essentially a continuous sound, in terms of amplitude. What we mean by preglottalization is prototypically non-modal phonation which is phonetically not justified.

Dynamic measures included the difference between the intensity (or more precisely, sound pressure level) of the entire glottal segment and the intensity of the vowel in the first syllable, and the difference between the intensity of the burst of the glottal segment and the intensity of the vowel in the first syllable.

Finally, we measured the harmonics-to-noise ratio (HNR) of the glottalization and compared it with the HNR of the vowel.

4.2 Results and discussion

It is virtually impossible to draw some hard, statistically significant facts from the comparison of three and three cases. In fact, however, one parameter did turn out to be significant, namely the difference between the intensity of the burst and the vowel: $t(4) = 4.05$; $p < 0.02$. The difference was greater for the good discrimination group (hereafter G) than for the poor discrimination group (hereafter P). In other words, the burst of glottalization was relatively weaker in the G group than in the P group – a result which appears to be counterintuitive at first sight. Similarly, the appealing parameter of temporal separation between the strongest element of glottalization and the onset of the canonical consonant, though not statistically significant ($p = 0.15$), appears to point in the counterintuitive direction: the mean separation for group G is 3.6 ms and that for group P 18.9 ms. We would probably expect greater temporal separation to lead to better discrimination. The other parameters measured (harmonicity and the remaining temporal and intensity relations) did not yield any interesting differences.

As for the two counterintuitive tendencies, they do have a sensible explanation when we consider the type of glottal onset and the characteristics of the initial consonant. Our analyses (in this study, as well as in our previous studies, Machač & Skarnitzl, 2009a; Matoušek *et al.*, 2009) indicate that preglottalization is most frequent before /ʒ/ and /z/ (i.e., the voiced strident fricatives). This may be caused by the fact that it is actually very difficult in these speechsounds to achieve synchronization between glottal and supraglottal activities (e.g., Ohala, 1983; Fuchs, 2005). As such, preglottalization may be perceptually less conspicuous before voiced strident fricatives simply because it is more frequent, even in casual speech outside the media, and the differences in the realization of voiced fricatives is thus "filtered out" by the listeners (*cf.* Ohala, 1981).

The type of glottal onset appears to be, at least from our limited data, even more important for the success rate when discriminating items with and without preglottalization. This is to an extent related to harmonicity, but the problem with HNR is that if no energy is detected in the harmonic part of the spectrum, the result of the query is "undefined" (the same would be true for jitter). Therefore, HNR cannot be used if the glottal segment consists only of one glottal pulse. We thus have to rely on visual and auditory inspection of spectrograms.

Let us therefore examine the six items (shown in Table 2) from this perspective. Item 1 begins with the preposition [za] in which /z/ is preceded by a hard glottal onset and reinforcing *schwa*. Our hypothesis is that its low discrimination rate may be caused by a lower conspicuousness of preglottalization before [z] (see above). The remaining items 2 and 3 also start with a hard glottal onset.

Figure 2 shows the waveform and spectrogram of Item 4 in which /r/ is preceded by a creaky onset reinforced by three periods of a *schwa*-like vocalic element. In item 5, illustrated in Figure 3, the canonical /d/ is preceded by a breathy glottal onset and *schwa*-reinforcement. In item 6, illustrated in Figure 4, preglottalization consists only of two irregular pulses. Based on the comparison of these three items with those from

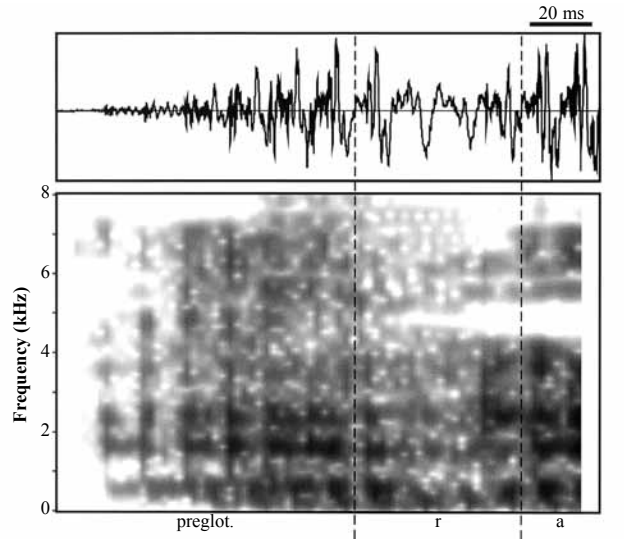

Figure 2: Item 4 (see Table 2) showing the gradual creaky onset and the subsequent periods of schwa before /r/

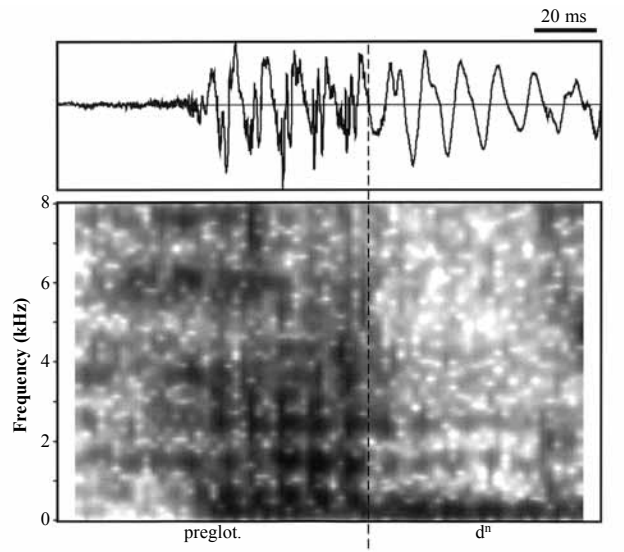

Figure 3: Item 5 (see Table 2) showing the breathy onset and the subsequent periods of schwa before /d/

group P, it seems that some sort of non-modal phonation in the glottal onset facilitates the discrimination of preglottalization.

The presence of non-modal phonation is in accordance with the somewhat counterintuitive results for intensity and duration mentioned above. Both creaky and

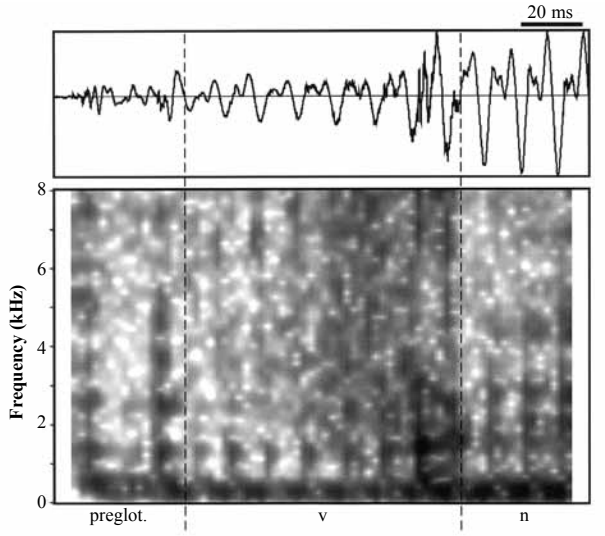

Figure 4: Item 6 (see Table 2) showing two irregular glottal pulses before /v/

breathy voice are characterized by lower intensity. Also, both types of phonation onset, as well as the reinforcing schwa, are more "continuous" in terms of amplitude envelope than the hard glottal onset, which necessarily results in a lower temporal separation from the following speechsound.

5. GENERAL DISCUSSION

In this study, we analyzed two domain-initial phenomena in Czech relating to the coordination of glottal and supraglottal activities. Depending on the order in which phonation and articulation start, we talk about devoicing or preglottalization. Newsreaders of the Czech Radio have been selected for this study because, as it has been shown before, domain-initial preglottalization appears almost exclusively in persons from the media. For the purposes of this study, we had also analyzed recordings of 75 university students reading a short story and had not discovered any domain-initial preglottalization except for a few before voiced strident fricatives (however, see section 4.2 above for our hypothesis regarding preglottalization in this segmental context). The choice of material resulted in the number of instances analyzed in this study being comparatively low, and we can thus talk merely about tendencies.

The results suggest that devoicing is less frequent in the speech of our newsreaders, and its discrimination from full voicing is at chance level. Preglottalization, on the other hand, was discriminated more reliably. Comparison of the three poorly and three well discriminated preglottalization items seems to indicate that the relevant parameter might be the modality of phonation in the glottal segment. Discrimination

rate of glottalization items containing breathy or creaky phonation was higher than in items with a simple hard glottal onset.

One of the objectives of this study was to relate domain-initial devoicing and preglottalization to articulatory strengthening described in the Introduction. It is obvious that devoicing cannot be considered as strengthening. First, it is not perceptible for listeners even in a task that induces phonetic listening and second, devoicing as such could probably not function as strengthening unless the sounds were turned into their fortis counterparts, which, on the other hand, might lead to the loss of contrast.

We believe that preglottalization may be considered domain-initial strengthening, but not of the same order as the examples mentioned in the introduction. The articulatory changes which have been reported as perceptible and exploited by listeners (Cho *et al.*, 2007) are quite subtle compared to preglottalization. It appears that preglottalization is too "rough" a phenomenon to serve the same purposes in communication. It is forceful, probably affected, and unnecessary from the communicative point of view, since "normal speakers" outside the media use it only rarely.

To conclude, this study showed that preglottalization is a perceptible phenomenon. In our future research, we will focus on the degree of its intrusiveness. We hope that, if preglottalization turns out to have an intrusive effect on listeners, the results will be useful for television and radio professionals who seek to improve their pronunciation.

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RESUMÉ

Artikulační posilování iniciální pozice bylo v různých jazycích zjištěno pro několik fonetických jevů, například lingvopalatální kontakt, trvání konsonantů nebo dobu nástupu hlasivkového tónu, což svědčí o „silném“ charakteru iniciální pozice. Tato studie se zabývá dvěma jevy v iniciální pozici nádechového úseku u moderátorů Českého rozhlasu, preglotalizací a desonorizací. Oba tyto jevy se týkají časové koordinace mezi glotální a supraglotální činností. Výsledky percepčního testu naznačují, že rozdíly v částečné a plné znělosti jsou vnímány na úrovni náhody, zatímco preglotalizace je percepčně výraznější. Správné rozpoznání preglotalizace by mohl ovlivňovat typ fonace v glotalizovaném úseku. Preglotalizace je zřejmě podobným jevem jako ostatní uvedené příklady iniciálního artikulačního posilování, ale ne zcela identickým z hlediska její funkce v každodenní komunikaci.