Is Hungarian Losing the Vowel Quantity Distinction?

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Abstract

The Hungarian vowel system is traditionally regarded as quantity-based. In such languages, length is primarily realised as a durational difference with little or no distinction in vowel quality. In this paper, we argue that the various types of interrelationship between quantity and quality have an impact on the target configuration of short and long vowels, and that quantity distinction is not equally important for all vowel height categories in Hungarian.

1 Introduction

Standard Hungarian contains 14 vowels: [i, iː, y, yː, u, uː, ø, øː, o, oː, ɛ, eː, ɒ, aː]. There are two competing views on the role that quantity plays in the system. According to the **phonetic** concept, the vowel system includes nine vowels—as there are nine different vowel qualities [2]. The **phonological** argumentation focuses on the fact that long vowels alternate with short ones according to certain morphophonological rules [6].

An alternative to the phonetic and phonological concepts is to take into consideration that there is a strong interaction between (1) the morphophonological behaviour of the vowels, (2) their phonotactic distribution, and (3) their functional load in lexical distinctivity. These factors seem to result in three phonological categories depending on vowel height: (1) **high vowel pairs** /i/, /y/, /u/ go along with an inconsistent distinction of both quantity and quality, (2) **/a/ and /e/** retain a consistent distinction of quantity and quality, (3) **mid vowel pairs** /o/, /ø/ show an intermediate behaviour [4].

We have argued previously that the above categories are accompanied by different patterns for durational distinction: long and short low vowels show little or no durational overlap, while high vowels do [4]. It has also been shown that perception of vowel length is not only dependent on duration, but also on vowel height category [3, 4].

Based on the above assumptions, it seems that there is an ongoing loss of quantity distinction in Hungarian. The vowel pairs /a/ and /e/ that are easy to distinguish by their quality alone still maintain phonetic parameters of quantity distinction as an additional feature, while there is a neutralisation process for high vowels, that have little or no quality distinction. Some authors claim that the pairs of the mid vowels /o/ and /ø/ are the only representatives of a classical quantity pair in which quality differences are a consequence of duration [3]. On the other hand, mid vowels can also be described as being intermediate between the primacy of quality (as for /a/ and /e/) and the neutralisation of quantity and quality, as in high vowels.

In the present experiment we will investigate the interaction of vowel length and quality. First, we will examine whether vowel pairs are distinguished by duration in various conditions. Then we will turn to the question of target configuration for the vowel height categories. We expect that vowel pairs with a primary quality distinction such as [ɒ] and [aː] have different target configurations, while high vowels do not. Identical target configurations for long and short mid vowels would support the hypothesis that the distinction between these vowels is primarily based on quantity.

Our data collection aimed at eliciting highly variable vowel durations from each speaker in order to achieve overlapping durations for long and short members of a vowel pair. Vowel duration was supposed to be influenced by sentence and word length, stress, and position of the word within the sentence. Previous results on the effect of these factors on vowel duration and quality have been inhomogeneous, thus these need to be checked first.

2 Materials and methods

Ten native speakers of Hungarian (6 females, 4 males, mean age: 28.9 years) were recorded in

a sound-proof room at the Laboratory of Speech Acoustics, Budapest University of Technology and Economics.

The target words and sentences were constructed according to the following parameters:

- 2 vowel lengths: short and long vowels,
- 3 vowel heights: high /u/, mid /o/, and low /a/,
- word length: 1 vs. 3 syllables,
- stress: target syllable stressed vs. unstressed (N.B. stress in Hungarian is always on the first syllable),
- sentence length: 6 vs. 16–18 syllables,
- sentence position: medial vs. final position of word in the sentence.

All conditions were balanced except for the sentence-final position (as this is the subject of a separate study, see [7]). Target vowels were always flanked by singleton alveolar consonants, mostly by /t/, in some cases by /d/ or /s/. Target words were non-compound nouns or verbs. Some of the words were monomorphemic (e.g. *tud* 'he/she knows', ***tat****aroz* 'he/she renovates'), or they contained a suffix for the accusative, *-(V)t* (e.g. *szót* 'word+acc.', ***tot****emet* 'totem+acc.'. As the distribution of long high vowels in final syllables is limited in colloquial speech, the 3-syllable word with an unstressed /u:/ was a compound word (*vona****tút*** 'train journey') in which the /u:/ is normally produced as a long vowel (this is often not true for polysyllabic non-compound stems like *hábo****rút*** 'war+acc.').

Thus, the data set included 3 vowels × 2 quantities × 2 word lengths × 2 stress levels. Since monosyllabic words cannot contain unstressed syllables, there were 18 target words altogether. In long sentences, target words were embedded in sentence-medial position (= 18 sentences). Short sentences contained target words in sentence-medial and sentence-final position, the latter for words that were monosyllabic or trisyllabic with the target vowel in the last syllable (30 sentences in total). Subjects were instructed to utter short sentences slowly and long sentences with normal speed in order to achieve a durational overlap between short vowels in the short sentences and long vowels in the long sentences. All sentences were repeated five times, in 10 randomised blocks.

It was not always possible to find an existing Hungarian word with the structure /tVt/ in the desired position. If the vowel was flanked by other consonants than /t/, durations were corrected according to intrinsic durations listed in [5]: the intrinsic duration of the vowel V in a /t_t/ sequence was divided by the intrinsic duration of the vowel in the sequence in question (e.g. /d_t/). Vowel durations in sequences other than /tVt/ were multiplied by this ratio. Analysis of duration (as described in 3.1) was performed on both the raw and the corrected values.

3 Results

3.1 Effects of prosodic parameters on segment duration

The following comparisons took place in condictions in which only the parameter in question was varied, all other parameters being identical. The confidence interval for statistical analysis was set to 95%.

In our data, **word length** had a strong effect on vowel duration. This confirms results of e.g. [2], but contradicts our previous findings in [7]. The word-length effect was less obvious in long sentences, thus the issue needs more careful investigation with controlled prosodic structures in the near future.

Stress had a lengthening effect on most vowels, but not on all. Unstressed short /u/ had a higher mean duration than stressed /u/ (for both raw and corrected durations). It was probably due to lexical effects of the target *kaka****dut*** 'cockatoo+acc.' which was produced with a long final vowel by some subjects.

Vowels were longer in short **sentences** than in long ones. This is not surprising, as participants were asked to utter short sentences more slowly, in order to induce more variation in vowel duration. **Final position** led to longer durations for stressed and unstressed vowels in all vowel height categories. F1 and F2 of vowels subject to final lengthening were not systematically different from comparable vowels with the same duration. This is consistent with [1] who showed for English that target configuration is not influenced by final lengthening.

3.2 Durational distinction and overlap

Now we will turn to the question whether vowel height categories differ with regard to the durational distinction associated with them. The following analysis is based on 3-syllable words in non-final sentence position.

Boxplots for vowel durations are shown in Figure 1 for both stressed and unstressed syllables. Results from our previous studies with pseudowords were confirmed here for real words: long and short /a/ had considerably less durational overlap than long

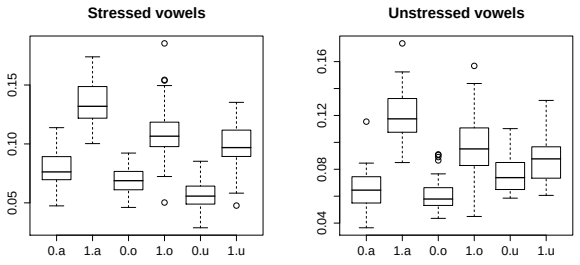

Figure 1: *Raw durations (in ms) for vowels /a/, /o/, /u/,* ***0:*** *short vowel,* ***1:*** *long vowel*

and short /u/, with /o/ showing an intermediate pattern.

3.3 Target configuration

F1 and F2 values for short and long vowels with overlapping durations were compared using Student's t-test (3 vowel height categories × 2 stress conditions). F2 values were significantly different for all conditions, while F1 did not differ significantly for unstressed short and long /u/. If male and female subjects were regarded separately, the difference in F1 did not reach significance for unstressed /o/ and /u/ of female speakers, while F2 was significantly different in all six conditions.

The relation between formants and vowel duration was modelled by third order polynomial regressions, carried out independently for each vowel quality and quantity in stressed and unstressed position.

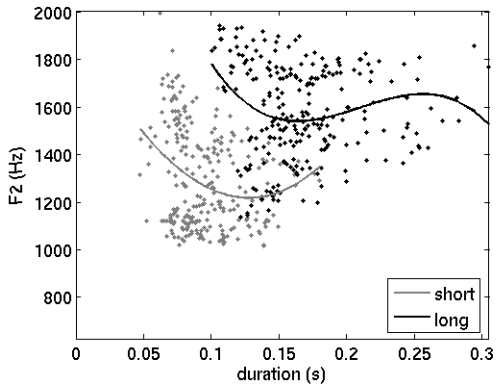

Figure 2: *Third order polynomial regression for stressed /a/*

F2 values for stressed short and long /a/ were approximately parallel without intersection (see Figure 2). Short segments had increasing F1 and F2 with increasing duration. Lower F2 in [ɒ] than in [aː]

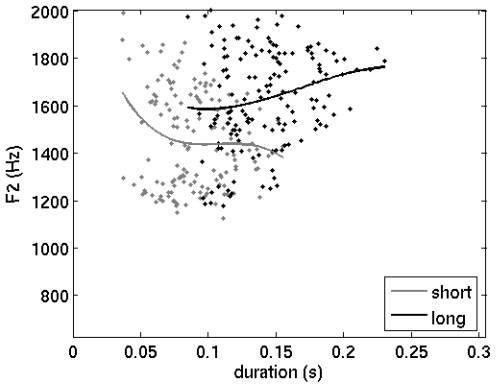

Figure 3: *Third order polynomial regression for unstressed /a/*

emerges from two factors: backness and lip rounding. The parallel increase of both F1 and F2 for the more hyperarticulated short segments might signalise a larger opening of the jaw and thus the decrease of lip rounding—another option would be the centralisation of horizontal tongue position. In the unstressed condition, F2 for long /aː/ decreased towards short /a/ (Figure 3). Despite the approaching polynoms, no intersection was visible in the plot.

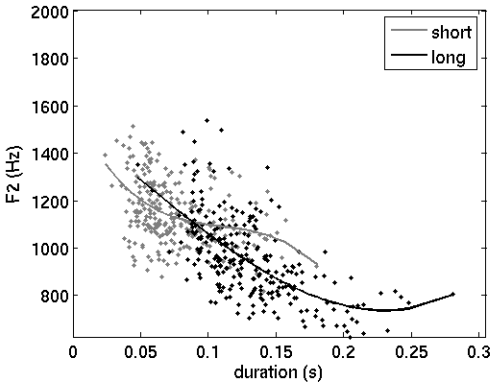

Figure 4: *Third order polynomial regression for stressed /u/*

No obvious difference was seen for stressed and unstressed /u/ (Figure 4). The polynoms for short and long vowels crossed each other in the region of overlapping durations. A higher degree of centralisation for short segments with longer duration was observed in all polynoms except for F1 of the unstressed vowels.

Polynoms for stressed /o/ (Figure 5) had no intersection for any of the formants, they were either parallel or drifting apart. The difference was similar, but less obvious for the unstressed segments: the polynoms for F1 had two crossings, and those for F2

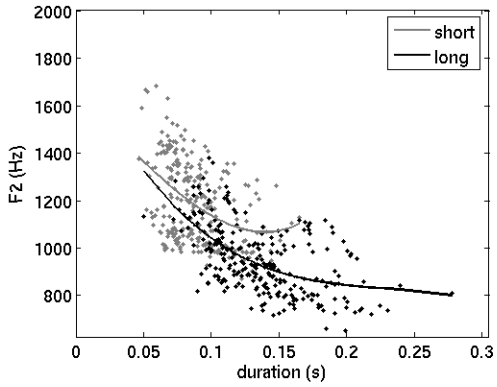

Figure 5: *Third order polynomial regression for stressed /o/*

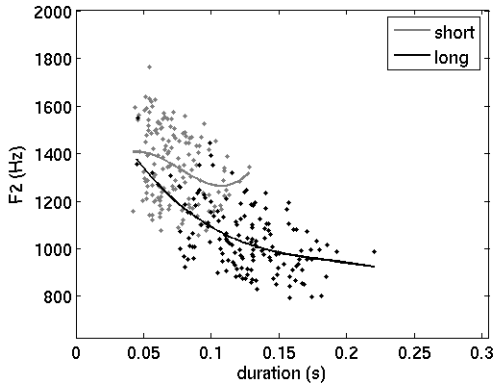

Figure 6: *Third order polynomial regression for unstressed /o/*

were approximating each other towards lower durations (Figure 6).

4 Summary and discussion

Recent investigations on the Hungarian vowel system have raised the question whether vowel quantity distinction is a primary distinctive feature in this language. Previous research suggested that quantity might not have the same importance for different vowel height categories. Our goal was to investigate the distinction in terms of duration and target configuration.

Cubic regression functions shed light on the vowel dependent non-linear relations between target undershoot and duration. In our data, these relations showed in general more or less asymptotic behaviour (e.g. for unstressed long /o/) indicating that acoustic targets are reached given sufficiently high durations. Non-asymptotic behaviour was given for stressed short /a/, where the F2 trend reversed with increasing duration. This observation might reflect acoustic effects of the speakers' effort to further enhance prominence beside vowel lengthening by decreased lip rounding.

According to our results, duration distinction in Hungarian is clearly dependent on the degree to which differences in quality are involved in the quantity distinction. The hypothesis that long and short /o/ share the same target undershoot was not supported, as there was no approximation of the polynoms when the duration was increased. Instead, short segments tended to be more centralised even with long durations. Future work will include the investigation of spontaneous speech and the analysis of the possible influence of social factors on quantity realisations.

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