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Observations on the transitions from vowels to voiceless obstruents: a comparative study

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Abstract

It has been observed that the when segmenting running speech, placing a boundary between a vowel and a following voiceless stop is not always a trivial task. When discussing segmentation criteria in an international cooperation, it showed that different realisations of V+voiceless stop sequences occurred between the recorded material of the involved languages, which led to differences in where the boundary marker between the two segments was placed.

The study presented here aims to give an overview over which types of transitions that may occur in the phase from a vowel to a voiceless stop. Such transtions are related to the timing of two features, namely: oral closure for the stop and voice offset from the vowel. Data from speakers of Swedish, German and Italian has been analysed and quantity charactaristics of the different languages, vowel quality and place of articulation of the stop consonant has been taken into consideration as possible factors which promote different types of transitions.

Introduction

The transition from a vowel into a voiceless stop requires the coordination of oral closure with the offset of vocal fold vibration. In most cases, these two actions are aligned, but it may happen that the two processes occur at different points in time. In the case of a disalignment, a section similar to frication-like sound may turn up. In previous studies (Tronnier, 2002a, 2002b) such frication noise has been accounted for in a similar way as the phonological feature of preaspiration in Icelandic and some other Swedish dialects (cf. Helgasson, 2002).

In an ongoing project on the L2-acquisition of the contrast between singletons and geminates in Italian by L1-speakers of German on one hand and Swedish (Einfeldt et. al. 2017) on the other hand, the discussion about where to establish the end of the vowel in the case of a sequence of *V+voiceless obstruent* arose. This was due to the variation of alignment of the above mentioned processes. In most cases, Italian L1-speakers and German speakers of L2-Italian produced a proper alignment for oral closure and voice offset, and only occasionally a frication noise in the transition between a vowel and a voiceless stop. For that reason, voice offset was chosen as the criterion for the segment boundary inbetween and the frication noise was accounted for as part of the occlusive phase of the following stop or in case of a following voiceless fricative, as a part of that consonant. For the Swedish speakers of L2-Italian, however, large sections of frication noise in addition to remaining formant structure from the previous vowel was observed. This led to the choice to group the corresponding section to the vowel.

The following study aims to give a picture on how the transition between the elements of a sequence *V+voiceless stop* is carried out by L1-speakers of the three languages. Hereby, the type of realistion of the transition – i.e. with or without frication noise or even the occurrence of other glottal features – is explored with regard to different factors. These factors are:

1. The speakers' L1
2. The quantity characteristics in which the sequence takes place
3. Vowel quality
4. Place of articulation of the stop.

The study

Carrier sentences with target words containing the sequence of interest in German, Italian and Swedish were recorded, when read by L1-speakers. For all three languages, the speakers were asked to produce the target words – which were highlighted by bold print in the presented text – as a word in focus.

The list of focus words for all three languages contains samples with on the one

hand contrasting vowels /i/ and /a/ and on the other hand contrasting place of articulation for the consonant, namely bilabial and alveolar, resulting in /p/ and /t/. In addition, quantity contrast was included in the samples according to the quantity characteristics for each language. In that way, geminated and singleton consonants with otherwise similar traits in the sequence occurred for the target words in Italian. For German and Swedish, the contrast of long vs, short vowels was included in the choice of target words. For Swedish, such contrast may co-occur with complementary variation in consonant length.

For example:

Italian: *fata – fatta* [fata] – [fat:a]
German: *Rate – Ratte* [ra:tə] – [ratə]
Swedish: *mata – matta* [mɑ:ta] – [mat:a]

So far, eight speakers of each language have been recorded. They were randomnly chosen and are in all groups between 25 and 45 years of age.

The sound quality of the recordings varies, as the recording environment was chosen for practicality reasons. Some recordings had to be excluded from further analysis due to considerable echo-effects.

For the analysis of the data, the vowel, the stop and in the case that some transitional phase appeared in the target word, that section was manually segmented in Praat.

Preliminary results

The analysis of the recordings so far have shown that different types of transitions do occur, however with a varied degree. Most frequently an alignment of voice offset and oral closure is observable. Next to it in frequency, a pattern with an early devoicing is produced, which is followed by a frication noise before the oral closure sets in. This is the type of devoicing that has been observed in the earlier studies on L2-production (Einfeldt et. al. 2017). Other – rather rare – types that can be found in the data, consists of either a short phase of creaky voice or a phase of a clearly breathy vowel between a modal vowel and the onset of the occlusive phase of the following stop.

Further examination on whether other factors (cf. above, 1. – 4.) are influential on the appearance of a fricative transition, reveals so far only that language background is a convincing factor. Other factors, like a certain vowel quality, a certain consonantal place of articulation, quantity character do not seem to play a larger role. In that way, most of the speakers of Swedish produce such transitions in all conditions. The speakers of German and Italian produce that type of transition only occasionally and in case it does, no contextual influence seems to be the reason for it either.

The preliminary results from this rather exploratory study raise the question on whether fricative-transitions in Swedish are part of the sound characteristics of the language, however not being normative, but accepted.

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