WORD-FINAL (MOR-)PHONOTACTIC CONSONANT CLUSTERS IN STANDARD AUSTRIAN GERMAN

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ABSTRACT

Morphonotactic consonant clusters originate through morphological operations and are mostly combinations of consonants across morpheme boundaries. As they are processed faster and acquired earlier than phonotactic clusters, it is hypothesised that in speech production, morphonotactic clusters are more robust and highlighted than phonotactic clusters.

The present study pursues two goals: it examines a) whether word-final morphonotactic and phonotactic clusters are differentiated and b) whether within morphonotactic clusters, inflected verbs of the 2nd and 3rd person singular are distinguished.

On a sample of 336 word-final morphonotactic and phonotactic consonant clusters of Standard Austrian German, an acoustic-phonetic analysis regarding relative duration and intensity of the cluster was performed. Additionally, duration of the preceding vowel was measured. The analyses revealed no differences between morphonotactic and phonotactic clusters. Also, the expected distinction between clusters in verb forms in the 2nd and 3rd person singular could not be confirmed.

Keywords: morphonotactics, phonotactics, consonant cluster, Standard Austrian German

1. INTRODUCTION

Phonotactic clusters are allowed sequences of phonemes in a given language, which occur within a single morpheme, whereas morphonotactic consonant clusters are mostly combinations of consonants across morpheme boundaries [2].

Investigations of English clusters revealed that in morphonotactic clusters a word-final coronal stop is less often deleted than in monomorphemic words [5]; for German, no phonetic studies examining this distinction exist so far. In first language acquisition it was shown that morphonotactic clusters are acquired earlier [7, 13] or at least not later [3] than phonotactic clusters. In perception experiments, adults recognised words faster, if there is a phoneme combination at the word boundary which does not occur within words [11]. In phoneme combinations which could occur within morphemes as well as across morpheme boundaries, the morphonotactic cluster is detected faster in processing experiments [8]. In a computational simulation, differences in the cognitive representation of German phonotactic and morphonotactic clusters were detected [1].

From the aforementioned results, we assume that these effects are also reflected in speech production. Thus, we hypothesise, as an extension of the Strong Morphonotactic Hypothesis [2], that morphonotactic clusters are more robust and more highlighted in speech production than phonotactic clusters. However, a pilot study on phonotactic and morphonotactic consonant clusters revealed that in speech production, no global differences between the two types of clusters exist. Yet, in some clusters, significant differences with respect to their relative duration could be observed.

Based on these preliminary results, the present study was designed to test whether the results obtained in the pilot study recur in an analysis of a larger corpus. We specifically focussed on whether differences occur between the production of morphonotactic consonant clusters in verb forms of the 2nd and 3rd person singular. In addition, these morphonotactic clusters were compared with homophonous phonotactic clusters.

2. MATERIAL AND METHOD

2.1. Subjects and recordings

Semi-structured interviews containing approximately 20 minutes of spontaneous speech and several reading tasks were conducted with 12 speakers of

two age groups (20-25 years and 45-55 years), balanced for gender. All subjects were speakers of Standard Austrian German as defined by [9]. Since in several studies [4, 9, 10], the Standard Austrian German variety as spoken in Vienna turned out to be most prestigious, we concentrated on speakers born and raised in Vienna, with at least one parent born and raised in Vienna as well. The subjects were students or university graduates. At least one parent has an academic education or both parents have a qualification for university entrance.

2.2. Material and procedure

14 monosyllabic German words (nouns and conjugated verbs in present tense) with word-final consonant clusters consisting of two or three consonants were selected as target words.

The target words were pairs of homophonous or quasi-homophonous monosyllabic words with the same word-final consonant cluster which either had a phonotactic or morphonotactic status. The selected clusters and the corresponding target words are shown in Table 1.

Table 1: Consonant clusters and target words

	phonotactic	morphonotactic 2nd person singular	morphonotactic 3rd person singular
/st/	Hast *(hurry)*	hasst *(you hate)*	hasst *(he/she hates)*
	Mist *(dung, rubbish)*	misst *(you measure)*	misst *(he/she measures)*
/ft/	Schaft *(stem)*		schafft *(he/she manages)*
	Gift *(poison)*		kifft *(he/she smokes grass)*
/nst/	Dienst *(service)*	dienst *(you serve)*	
	Kunst *(art)*	kannst *(you can)*	

For the three selected clusters the type and token frequency is high in German, and all clusters occurred more frequently in monomorphemic words than at morpheme boundaries [8].

The 12 speakers were asked to read the target words embedded in sentences in a post-focal position. To ensure high comparability, carrier phrases with the following structure were used:

(1) *Zu mir? - Ich habe zu Peter „du kannst" gesagt, glaube ich.*
(To me? - I said to Peter "you can", I think.)

By structuring the sentences this way, the focus is on the name 'Peter', whereas our target word ("*kannst*") is in post-focal position. The participants were asked to read all sentences twice. This resulted in a total of 336 target words.

The recordings of the speakers were segmented, annotated, and transcribed manually. Thereafter,

measurements and semi-automatic extraction of the following acoustic parameters were carried out: relative duration and intensity of the words, clusters, individual consonants of the clusters, and phonemes surrounding the clusters. The measurements of the parameters were analysed statistically with R by using analyses of variance and t-tests.

3. RESULTS

3.1. Deletion of the final consonant

In 39 out of 336 clusters the final consonant was deleted acoustically. For the cluster /st/ (144 realisations) 12 cases of /t/-elision occurred. In this cluster two elisions were in phonotactic clusters and ten in morphonotactic clusters (five in the 2nd and the 3rd person singular, respectively). In the /ft/ realisations (96 in total) the final /t/ was deleted only once in a phonotactic cluster. In the /nst/ cluster (96 in total), the final consonant was deleted 26 times (10 elisions in morphonotactic clusters and 16 in phonotactic clusters).

In the analysis of the duration and intensity of the whole cluster, inclusion/exclusion of the clusters with /t/-elision showed no effect on the results. Therefore, the clusters with /t/-elision were included in these analyses. Obviously, in the analysis of the final consonant of the clusters, the deleted consonants were not regarded.
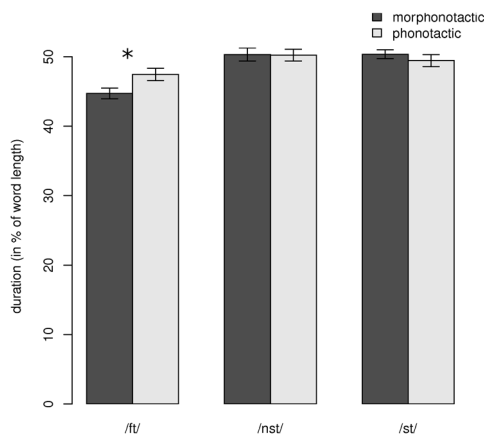
3.2. Duration and intensity

The global comparison of morphonotactic and phonotactic clusters revealed no statistically significant difference in relative duration and intensity, as shown in Figure 1.

**Figure 1**: Comparison of duration and intensity
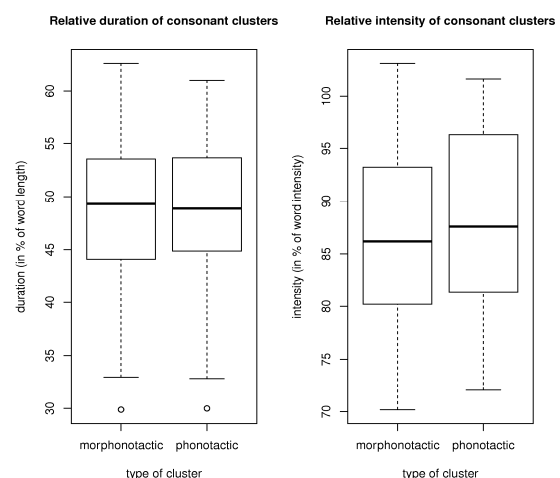
Splitting up the individual consonant combinations, a significant distinction between phonotactic and morphonotactic clusters occurred in the relative duration of the cluster /ft/ (t(92) = -2.359, p < 0.05). As shown in Figure 2, the phonotactic clusters were longer than the morphonotactic clusters. In the other clusters, no significant differences occurred (see Figure 2).

Figure 2: Relative duration of consonant clusters

Additionally, both relative duration and intensity of the cluster /st/ rendered no difference with respect to the morphonotactic clusters of verbs in the 2nd person singular and the 3rd person singular (e.g. /st/ in *"du hasst"* ('you hate') vs. *"er hasst"* ('he hates')) (Figure 3).

Figure 3: Duration and intensity of /st/

m2 = morphonotactic cluster - verb inflection in the 2nd person singular
m3 = morphonotactic cluster - verb inflection in the 3rd person singular
p   = phonotactic cluster
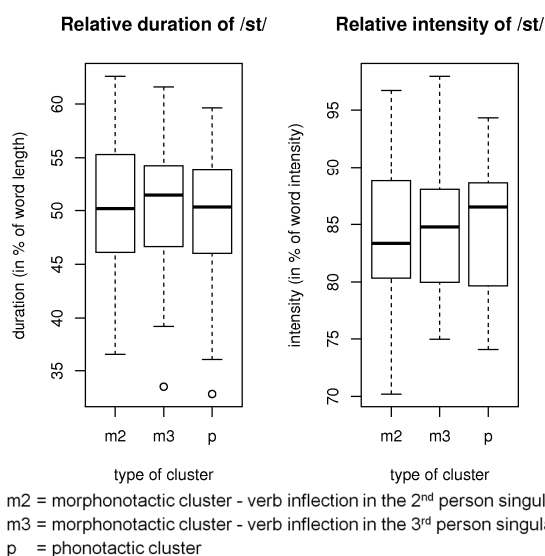
In the relative duration of the vowels preceding the clusters, no global duration differences occurred.

However, the relative vowel duration in combination with the cluster /nst/ reached significance (t(93) = 2.782, p < 0.01) with a longer duration of the vowels preceding the morphonotactic cluster. In the cluster /ft/ the significance level was not reached (t(94) = -1.943, p = 0.055) but a tendency for longer vowels preceding the phonotactic clusters exists.

An analysis of the final consonant of the clusters, which is always /t/, revealed no statistically significant differences in the relative intensity and duration between morphonotactic and phonotactic clusters. As stated in 3.1, the clusters with /t/-elisions were excluded from this analysis.

3.3. Gender-age-specific differences

A two-way analysis of variance with regard to the relative duration of the clusters revealed a main effect of age (F(1,332) = 8.966, p < 0.01) and gender (F(1,332) = 12.817, p < 0.001) and an interaction of gender and age (F(1,332) = 9.806, p < 0.01). Post-hoc tests showed that in the group of female speakers, the two age groups differed significantly (F(1,166) = 15.977, p < 0.001), i.e. that the difference was bigger in the group of female speakers, with shorter relative durations in the elder female speakers.

Regarding relative intensity, the clusters of the male speakers had a higher intensity than those of the female speakers (F(1,332) = 4.239, p < 0.05). Moreover, among the male speakers, there was a not significant tendency for the older speakers to realise the clusters with a higher relative intensity than the younger speakers (F(1,166) = 3.178, p = 0.076).

Deletion of the final consonants revealed large inter-speaker variability. Some speakers never deleted the final consonant, whereas others showed up to 39 % deletions.

No statistically significant gender or age effects emerged with respect to the distinction of morphonotactic vs. phonotactic clusters.

4. DISCUSSION

The aim of the present study was to test whether a distinction between morphonotactic clusters deriving from 2nd or 3rd person singular verb conjugation and between morphonotactic and homophonous phonotactic clusters exists with respect to the acoustic parameters analysed.

No statistically significant global differences between phonotactic and morphonotactic clusters occurred concerning the relative duration of the clusters. A more detailed analysis revealed that the morphonotactic realisation of the cluster /ft/ is shorter than the phonotactic realisation. Likewise, the intensity values show no significant differences between the two types of clusters.

Also, the duration of the vowel preceding the cluster revealed only tendencies in opposite directions with regard to the phonotactic/morphonotactic distinction.

In comparing the realisations of the final /t/ of the clusters, it is interesting to see that there were large speaker specific differences in the number of /t/-elisions. In the 28 clusters each speaker produced, the elisions ranged from zero to eleven (39 %). In contrast to the findings of Guy [5], the majority of /t/-deletions of the cluster /st/ occurred in morphonotactic clusters (with an equal distribution in verbs of the 2nd and 3rd person singular).

As concerns the individual clusters, /t/-elisions occurred most frequently in the /nst/-cluster, but hardly ever in the /ft/-cluster. The hypothesis that morphonotactic clusters are more robust than phonotactic clusters could not be proved by our results on /t/-deletions, the analysis of the /st/-cluster revealed that /t/ is preferably deleted in morphonotactic clusters.

True homophonous words exist with the cluster /st/ in both 2nd and 3rd person singular verb inflections and in monomorphemic words (see Table 1). These were used to test whether differences occur within the two morphonotactic conditions and between morphonotactic and phonotactic clusters. Again, no significant duration and intensity differences occurred in the /st/-cluster, neither between phonotactic and morphonotactic clusters nor between morphonotactic clusters in verb inflections of the 2nd vs. 3rd person singular.

Unexpectedly, gender- and age-specific differences emerged with respect to relative duration and intensity of the clusters. In particular, relative duration of all clusters was shorter in the group of elder female speakers. However, age- and gender-specific differences did not concern the morphonotactic/phonotactic distinction.

As a conclusion, it has to be conceded that our hypothesis that morphonotactic clusters are more robust than phonotactic clusters could not be proved. However, before we abandon the hypothesis altogether, we should go into more detail with respect to the following aspects: As Zimmerer [12] showed, phonological context effects have a greater influence on the deletion of word-final /t/ than the morphological information contained in word-final /t/. This finding could explain why no distinction exists between homophonous morphonotactic clusters derived from the 2nd and 3rd person singular verb inflections.

As a possible phonological context effect, we analysed the duration of the preceding vowels, which revealed contrary tendencies. However, as becomes evident from Table 1, with the exception of *Dienst* 'service' – *dienst* 'you serve', all vowels are short. As phonetic analyses revealed [6], short vowels tend not to be shortened. Therefore, in future studies, we will balance our analysis for vowel quantity and vowel quality.

In the design of the experiment discussed in the present study, a verb was always immediately preceded by the subject pronoun, which possibly led to high redundancy of the morphonotactic cluster involved. The interviews performed with the speakers also contained semi-spontaneously produced utterances of the target words which will be analysed in the next step. Furthermore, we will also conduct further recordings with utterances in which pronoun and verb are separated, as in, e.g. "*Ob du vielleicht doch die Temperatur misst, gleich jetzt bitte*" 'Whether you measure maybe the temperature, immediately please'. Thus, redundancy of the morphonotactic clusters might be reduced.

In a further step, apart from extending our study to a bigger corpus, it is planned to investigate additional word-final clusters and to compare them with phonotactic and morphonotactic word-medial clusters.

Outstanding issues concerning the influence of word frequency on the acoustic parameters of phonotactic and morphonotactic consonant clusters will be tested in future research.

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