The interaction of prosody and phonotactics: Resyllabification in three varieties of German

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Resyllabification is a syllable optimizing process, in which a coda consonant is assigned to the following syllable if the phonotactics of the language allows such reassignment. Since the process optimizes the structural well-formedness of the syllable, it is mostly observed in quantifying languages. The Middle Bavarian varieties of German feature some quantifying aspects as well. It was therefore tested whether, with respect to the word-final fricative /s/, resyllabification can be found in the Viennese dialect (VD) and in Standard Austrian German (SAG). The results were compared with results on Standard German German (SGG), a language in which resyllabification is blocked by glottal stop insertion or glottalization in the onset. Results indicate that stress plays a crucial role: before a stressed word starting with a vowel, resyllabification is blocked by glottalization in all varieties, whereas before an unstressed word, absolute and relative durations rendered contradictory results. The results on absolute durations show a tendency towards resyllabification, whereas relative durations render significant differences between word-final /s/ in a context of resyllabification and word-initial /s/.

1. Introduction

Many researchers argue that CV structures constitute the optimal sequence of phonemes and constitute a language universal (e.g., Greenberg 1978; Vennemann 1988; Blevins 1995), since these structures are prevalent in all languages analysed to date. Yet, such a statement, though obviously true, inevitably entails the question of why so many language forms violate this optimal state. Morphology definitely plays a decisive role: Dziubaska-Kołaczyk (2014) shows that in Polish, consonant cluster size correlates with morphological complexity: "70 percent of the 2-consonant clusters are phonotactic while 70 percent of 4-consonant long clusters are morphologically complex" (2014: 13).

Thus, rich consonant clusters contain morphological information and make the (phonological) word more "visible" (Szczepaniak 2014), especially if they appear at the edges of the word. Therefore, they optimize the word by highlighting the word boundaries. On the other hand, in languages optimizing the syllable, word-boundaries are blurred and it is more difficult to decode morphological information. Therefore, an alternative approach to explain the predominance

of CV structures is provided by a typology based on prosody in which languages are classified according to whether they optimize the (phonological) word or the syllable. The approach of differentiating prototypical "word languages" and prototypical "syllable languages" has been elaborated by Auer (1991, 1993, 2001) as a continuation of the pure phonetically conceived concept of "stressed-timed" and "syllable-timed" languages (Pike 1945). Auer qualified the strong isochrony hypothesis advocated by Abercrombie (1967) by a) shifting the typological classification from the phonetic to the phonological level[1] and by b) proposing a continuum between the two prototypes and providing a list of mostly phonological parameters such as whether the sonority hierarchy is respected in consonant cluster sequences, whether vowels are reduced in non-accented syllables, or whether rules enhancing CV-structures or rich consonant sequences are observed (see Auer 1991: 303 for a complete list of processes).

Siebenhaar (2014) argues that it cannot be ultimately decided whether "segmental aspects result in a different rhythmic concept, or whether the rhythmic concept of a language entails the phonological structure" (2014: 332). However, whereas the first option has to rely on the admittedly intriguing but questionable concept of the well-known paradigm of ease of articulation and ease of perception in order to justify the preference for CV-structures, the second option provides a functional and more dynamic explanation for the continuous sliding of languages on a scale where either the word or the syllable is optimized. While this model still entails some shortcomings, such as too loosely defining the phonological word, and would profit from some refinements (Auer 2014), it still provides a typological explanation for why CV structures are common in all languages, whilst rich consonant clusters are predominantly found in "word" languages. Furthermore, it provides a good tool for handling mixed types such as the Alemannic (Siebenhaar 2014) or the Middle Bavarian (Bannert 1976, Moosmüller & Brandstätter 2014) varieties of German.

Typologically, Old High German (OHG) was a quantifying language, meaning that quantity opposition of both vowels and consonants was prevalent in all prosodic positions. On its way to New High German (NHG), unstressed syllables were gradually reduced, geminates were degeminated, long vowels became short vowels in unstressed positions, and short vowels were deleted (see Szczepaniak 2007 for a detailed overview of the processes which took place from OHG to NHG). Thus, German changed from a quantifying language to a word language, with rich consonant clusters and an uneven distribution of stressed and unstressed vowels (less vowel quality diver-

sity in unstressed positions, mostly reduced to schwa). However, these changes have also led to dialectal differences.

2. Description of the varieties

In the 19th century, the north German varieties spoken by the educated elites gained highest prestige and replaced the Upper Saxonian varieties which commanded this position at the times of Gottsched or Gellert. Thus, today, Standard German German (SGG) is strongly associated with the variety spoken in the northern part of Germany, advocated in the media and ranked most prestigious in perception experiments (Herrgen 2015). However, some German scholars propose a broader definition of SGG, including regional standards. Therefore, it is predominantly the average educated speaker, independent of his or her regional origin, who is conceived as a speaker of SGG (Deppermann *et al.* 2013).

Among the varieties of German, SGG, both as defined in Herrgen (2015) and in Deppermann *et al.* (2013), with its rich consonant cluster inventory, its prevalence of schwa-vowels and the concomitant backgrounding of unstressed syllables, is located nearest to a prototypical word language.

The Middle Bavarian dialects, on the other hand, preserved some quantifying aspects. Though the number of consonants allowed in a cluster is at least as high or even higher than in SGG, e.g., [ˈɡʃɓʀũːŋɑ] *gesprungen* "spring, PRF", [ḓẕfriːʃ] *zu frisch* ('too fresh'), [ɓ̥ʃviɓ̥sḓ] *beschwipst* ('tipsy'), the existence of full vowels in unstressed syllables and especially the specific timing of VC-sequences in stressed position still point to the preservation of old quantifying aspects in these varieties. Bannert (1976) and Ronneberger-Sibold (1999) assume an isochronous relationship between long vowel + lenis consonant sequences and short vowel + fortis consonant sequences, thus excluding further vowel + consonant combinations. However, Moosmüller (2007) and Moosmüller & Brandstätter (2014) demonstrate the existence of further combinations, especially long vowel + fortis plosive sequences. From their results, they favour a moraic approach in analysing stressed syllables in the Middle Bavarian dialects. Thus, the Middle Bavarian dialects show traits of both a word language and of a quantifying language (see also Siebenhaar 2014 for the Alemannic dialects).

The Viennese dialect (VD), which is analysed in the current contribution, belongs to the eastern Middle Bavarian dialects. As

an urban dialect, it holds the lowest prestige of all Austrian dialects (Moosmüller 1991). It is spoken by speakers of the lower social classes, mostly with a low educational background. Nevertheless, VD speakers learned a standard language in school and thus acquired passive, and, dependent on the speaker, a certain degree of active competence in SAG. Since many changes are currently observable in the speech of young speakers of the lower social classes (Glaunigner 2011), we will restrict VD speakers to speakers of the older generation, whose variety coincides with what is stereotypically considered as VD.

Among Austrian scholars, no uniform definition of Standard Austrian German (SAG) exists. As concerns the selections of speakers, some scholars rely on professional speakers (Muhr 2007; Wiesinger 2009), others on educated speakers not further specified (Bürkle 1995; Ehrlich 2009; Kleiner 2010). Some scholars restrict standard language use to specific text-types (predominantly reading of texts or official talks), others include spontaneous speech as well. These different approaches naturally result in different descriptions of SAG (see Moosmüller 2011, 2015).

Moosmüller (1991) based her definition of SAG on the results of perception and attitude experiments, conducted in the cities of Graz, Innsbruck, Salzburg, and Vienna. From these results it follows that above all, speakers from Salzburg and Vienna, to a lesser degree speakers from Graz, are accepted as speakers of SAG. Education turned out to be a decisive criterion: only speakers with a high educational background, whose parents also had a higher-level education, were accepted as SAG speakers. Most interestingly, Viennese speakers fulfilling these criteria were rated best. From these results it can be concluded that SAG as spoken in Vienna enjoys the highest prestige. These results were corroborated by more recent studies (Soukup 2009, Goldgruber 2011).

A historical view on the development of SAG reveals that the Middle Bavarian variety spoken by the nobility and educated elite of the 18th century held a very low prestige (Wiesinger 1985). Thus, speakers of these social classes geared towards the most prestigious variety spoken in the respective German countries of the time (see Moosmüller 2015 for an overview). Consequently, SAG holds an in-between position, showing both traits of its Middle Bavarian basis, especially as concerns phonetics and phonology, and of SGG, especially as concerns morphology, syntax, and the lexicon.[2] The congruities of SGG and SAG on higher grammatical levels severely challenge the quantity approach advocated by Bannert (1976) and Ronneberger-

Sibold (1999), since an abundant number of lexical items violate the phonotactic restrictions put forward in their treatises. An integration of SGG lexical items into the Middle Bavarian timing patterns is more easily achieved in the mora-based approach proposed by Moosmüller & Brandstätter (2014), which challenges the traditional view that only long vowel + lenis consonants or short vowel + fortis consonants are allowed in the Middle Bavarian varieties and prove the existence of a third category, namely of long vowel + fortis consonant sequences.

From the results described so far, it can be concluded that in SGG, the word is optimized, whereas in VD and SAG, both word optimizing and syllable optimizing tendencies can be observed.

3. Resyllabification

Resyllabification constitutes a further parameter which optimizes the syllable and consequently blurs word boundaries. As such, resyllabification is most extensively described for languages which are generally thought of to belong to a syllable-optimizing type such as Spanish (Torreira & Ernestus 2012, Strycharczuk *et al.* 2014), Catalan (Caro Reina 2014), French (Gaskell *et al.* 2002, Fougeron 2007), Italian (Loporcaro & Bertinetto 2005), and Alemannic (Siebenhaar 2014).

In a process of resyllabification, coda consonants are assigned to the following syllable if the phonotactics of the language allow such reassignment. A word-final consonant followed by a word-initial vowel would constitute a very typical context for resyllabification, termed *enchaînement* in French. In the case of resyllabification, the coda consonant is assumed to adopt the traits of an onset consonant and thus impede word recognition. Fougeron *et al.* (2003) looked for acoustic cues of resyllabification and analysed three conditions: a) condition of enchaînement ($V_1.C\#V_2$), b) word boundary condition ($V_1\#CV_2$), and c) syllable boundary condition ($V_1.CV_2$). However, with speaker-specific differences, they found significantly longer durations of the vowel preceding the consonant in the enchaînement condition and in the vowel in the word boundary condition as compared to the vowel in the syllable boundary condition. In a condition of resyllabification or enchaînement,[3] the vowel preceding the consonant turns into a word-final vowel and is subject to word-final lengthening. As concerns the consonants, Fougeron *et al.* (2003) obtained different results dependent on consonant type. While stops in the enchaînement conditions

were realized shorter than in both the word boundary and the syllable boundary conditions, no such differences occurred with respect to fricatives and liquids. These differences are also reflected in the duration of V_2: vowels following stops are shorter in the enchaînement condition, whereas vowels following fricatives show no differences regarding the three boundary conditions. From their results, Fougeron *et al.* (2003) conclude that enchaînement in French is not simply a resyllabification of the word-final coda to the onset of the following syllable.

Similar results have been obtained for French by Dumay *et al.* (1999), Spinelli *et al.* (2002), Gaskell *et al.* (2002), and Fougeron (2007), and for Spanish varieties by Lipski (1999) and Strycharczuk & Kohlberger (2014).

For Alemannic, Siebenhaar (2014) could show that word-initial fricatives are significantly longer than word-medial and word-final fricatives. In a condition of resyllabification, i.e., a word-final fricative preceding a word-initial nasal, liquid, or vowel, the word-final fricative is lengthened and reaches the mean duration of the word-initial fricative (2014: 339). Thus, in Alemannic, full resyllabification is observed, at least as far as durational parameters are concerned.

In SGG, glottal stop insertion before word-initial vowels usually blocks resyllabification. However, Bergmann (2014) showed that boundary weakening, i.e., glottalization,[4] sometimes takes place in unaccented positions and in high frequency words. In Alemannic, glottal stop insertion does not exist, and is therefore open for resyllabification. In the Middle Bavarian varieties, glottal stop insertion is optional, and mostly replaced by glottalization. In addition, word boundary marking can be further weakened and be signalled by a drop in F0 or a drop in amplitude (Moosmüller 1999). Therefore, a gradual pacing from glottal stop to a loss of marking the word boundary can be observed, the latter case constituting a condition for resyllabification.

In the current contribution, the fricative /s/ is analysed with respect to resyllabification. For /s/, however, variety-specific outputs for resyllabification have to be assumed for the three varieties under consideration. While SGG features voiced [z] word-initially, but voiceless [s] word-finally, in a condition of resyllabification, the resyllabified fricative should surface as voiced [z], accompanied by a shortening in duration in order to equal the durations of word-initial [z]. In the Middle Bavarian varieties, on the other hand, both word-final and word-initial /s/ is voiceless. Therefore, in a condition of resyllabification, the resyllabified fricative should, in accordance with Siebenhaar (2014), show the same durational traits as a word-initial fricative.

Therefore, it is hypothesized that
1. for all varieties, glottal stop insertion or glottalization blocks resyllabification before stressed syllables,
2. glottal stop insertion or glottalization blocks resyllabification in SGG,
3. for the Middle-Bavarian varieties, resyllabification takes place before unstressed syllables,
4. resyllabification takes place more readily in VD than in SAG.

4. Method

Eight speakers (4 females and 4 males, age range 45-60 years) of the Viennese dialect, 16 speakers of SAG (4 females and 4 males, age range 45-60 years, and 4 females and 4 males, age range 18-25 years), and 4 speakers of SGG (3 females and 1 male, age range 25-59 years)[5] were asked to read a list of 72 sentences twice.

The Austrian subjects were raised in Vienna with at least one parent raised in Vienna as well. The dialect speakers have finished secondary school, but not all of them have finished an apprenticeship. The SAG speakers of the older group hold an academic degree. The younger speakers have finished grammar school with 'Matura' (Austrian high school diploma/school leaving certificate) and were pursuing a university education at the time of recording. At least one parent of each SAG speaker held an academic degree as well.

The German subjects hold an academic degree and were chosen according to the criteria proposed in Deppermann *et al.* (2013), which defines a standard speaker as an averagely educated speaker.

From the list of read sentences, the following duration measurements of the fricative /s/ were performed:[6]
- the word-initial /s/, in a stressed position of a content word (n = 168): e.g., *Saft* 'juice', *Siebe* 'sieves',
- the word-initial /s/, in an unstressed syllable of a content word (n = 168): e.g., *Salat* 'salad', *Sekretär* 'secretary'
- the word-initial /s/, in an unstressed position of a pronoun (n = 168): e.g., *wie sich der Kater* 'as the cat itself', *können Sie* 'you can', *ergriff sie* 'she was grasped',
- the word-final /s/ of a stressed word (n = 56): e.g., *mit Kies bestreut* 'strewn with gravel',
- the word-final /s/, followed by a stressed vowel (V_1s#$'V_2$) (n = 56): e.g., *köstliches Essen* 'delicious food' = resyllabification Condition 1,
- the word-final /s/, followed by an obstruent (V_1s#$'OV_2$) (n = 56):

e.g., *köstliches Bier* 'delicious beer',
* the word-final /s/ of an unstressed word, followed by an unstressed word (n = 56): e.g., *aus der* 'from the',
* the word-final /s/, followed by an unstressed vowel ($V_1s\#V_2$) (n = 56): e.g., *zünd nicht das Haus an* 'don't torch the house' = resyllabification Condition 2,
* V_1 in the conditions ($V_1s\#\textrm{'}V_2$), ($V_1s\#\textrm{'}OV_2$), and ($V_1s\#V_2$). Durations of the fricative were normalized for word duration.

5. Results

5.1. /s/ in word-initial position

For word-initial /s/, three positions were tested: word-initial /s/ for stressed content words, word-initial /s/ for content words in which the first syllable is unstressed, and word-initial /s/ of pronouns in an unstressed position. Figure 1 reveals that, unsurprisingly, the absolute duration of /s/ in unstressed pronouns is shortest, whereas, on the other hand, surprisingly, the relative duration of word-initial /s/ in unstressed pronouns is higher than in word-initial /s/ in a stressed position or in an unstressed position of a content word, thus taking up more than half of the total word duration.
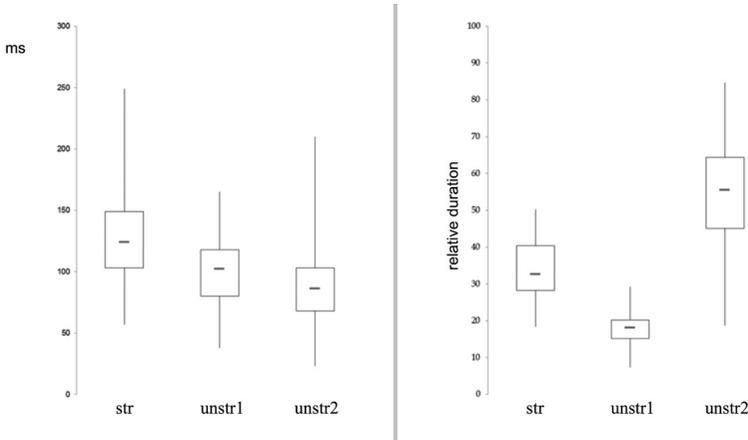

Figure 1. Boxplots of absolute duration (left) and relative duration (right) of word-initial /s/ in a stressed position (=str), in an unstressed position of a content word (=unstr1), and in unstressed pronouns (= unstr2) for all groups of speakers.

However, the results of a two-way ANOVA (speaker group x type of /s/) not only disclose a highly significant main effect for the three types of /s/ [$F_{(2,483)}$ = 766.49, $p < .0001$], but also a highly significant main effect for the speaker group [$F_{(6,483)}$ = 7.24, $p < .0001$]. Figure 2 presents the results broken down by speaker group. Because of space constraints and since the results on the word-initial /s/ in unstressed pronouns are the most relevant in the context of resyllabification Condition 2, only these results will be presented in Figure 2.
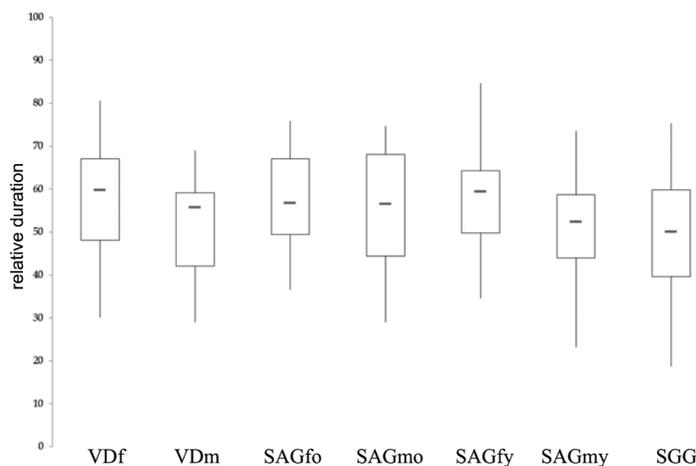
Figure 2. Boxplots of the relative duration of word-initial /s/ in unstressed pronouns, broken down by groups of speakers. VD = Viennese Dialect, SAG = Standard Austrian German, SGG = Standard German German, f = female, m = male, o = older generation, y = younger generation.

With respect to the relative durations of word-initial /s/ in unstressed pronouns, young male SAG speakers behave similarly to SGG speakers. This might be due to the fact that in two of the three items tested, namely in *wie sich der Kater* 'as the cat itself' and in *können Sie* 'you can', the /s/ is preceded by a vowel/voiced sonorant. Although the phoneme inventories of SAG and VD feature no voiced /z/ in word-initial positions, voiced contexts might cause a voicing of the fricative. Figure 3 shows the percentage of voicing in these two conditions, broken down by speaker group.

As expected, /z/ is voiced in SGG.[7] In SAG, voicing of /s/ occurs predominantly in the production of male SAG speakers. However,

the percentage of voiced [z] in young male SAG speakers is not high enough to justify the assumption that the comparable results in the relative durations of young male SAG speakers and SGG speakers is due to voicing.
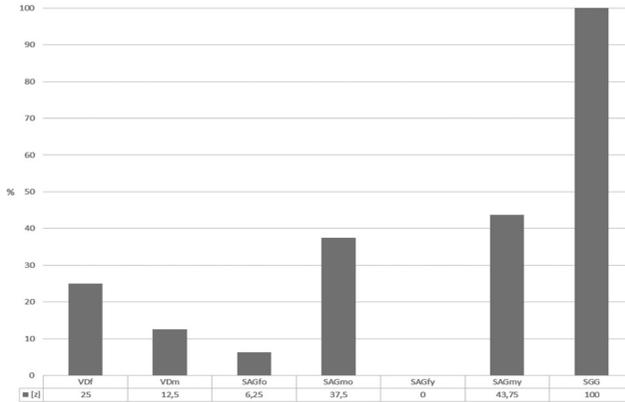

Figure 3. Percentage of voicing of word-initial /s/ in the contexts *wie sich der Kater* 'the cat itself' and *können Sie* 'you can'. VD = Viennese Dialect, SAG = Standard Austrian German, SGG = Standard German German, f = female, m = male, o = older generation, y = younger generation.

5.2. /s/ in word-final position ($V_1s\#OV_2$)

Three positions were tested for word-final /s/: the word-final /s/ of a stressed word followed by a word-initial consonant of an unstressed syllable, the word-final /s/ of an unstressed word followed by a word-initial consonant of a stressed word, and the word-final /s/ of an unstressed word followed by a word-initial consonant of an unstressed word. A comparison of absolute and relative durations yielded differences with respect to the stressed vs. unstressed condition followed by a stressed word (see Figure 4). In these two conditions, absolute durations disclose no significant differences [$t(119) = 0.13$, $p = .45$], whereas relative durations yielded a highly significant difference [$t(85) = 24.16$, $p < .0001$]. This result is interesting, since it indicates that relative durations are sensitive to the number of syllables (one syllable in *Kies* 'gravel', three syllables in *köstliches* 'delicious'), whereas absolute durations are not influenced by the composition of the word.

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As concerns unstressed words followed by an unstressed word, results resemble those for absolute and relative durations in unstressed word-initial position: absolute durations are shortest, while relative durations are highest. However, the results of a one-tailed t-test revealed a highly significant difference [$t(129) = 12.24$, $p < 0.0001$] between the relative duration of a word-initial unstressed /s/ in pronouns and a word-final unstressed /s/ followed by unstressed words. Relative duration is lower in a word-final unstressed position followed by an unstressed word than in the word-initial position of unstressed pronouns (see right figure of Figure 1 and right figure of Figure 4 for comparison).
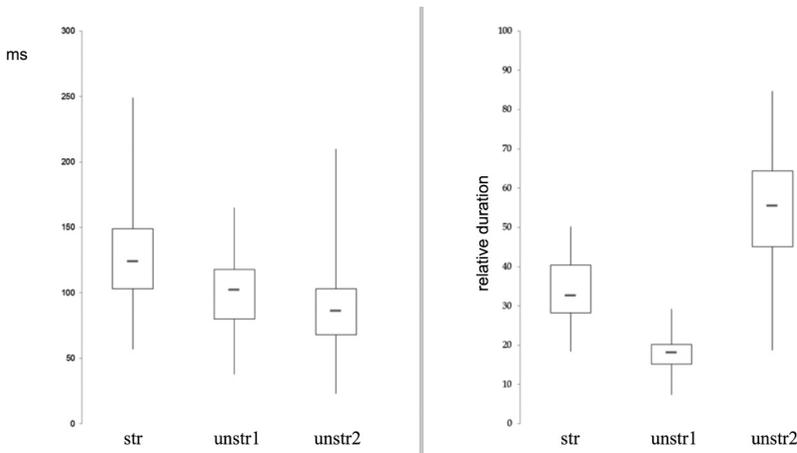

Figure 4. Boxplots of absolute duration (left) and relative duration (right) of a word-final /s/ in a stressed position (=str), in an unstressed position followed by a stressed word (=unstr1), and in an unstressed word followed by an unstressed word (= unstr2) for all groups of speakers.

A two-way ANOVA (speaker group x type of /s/) revealed a highly significant main effect for the three types of /s/ [$F(2, 147) = 210.13$, $p < .0001$] and a highly significant main effect for the speaker group [$F(6, 147) = 4.19$, $p < .001$]. Figure 5 presents the results on relative durations of word-final stressed /s/, broken down by speakers, since this condition is the most relevant for a comparison with resyllabification Condition 2.

As becomes apparent from Figure 5, no significant differences exist between the SGG speakers and the young SAG speakers [$t(22) = 0.29$, $p = .39$]. The same holds for absolute durations [$t(22) = 0.40$, $p = .35$].
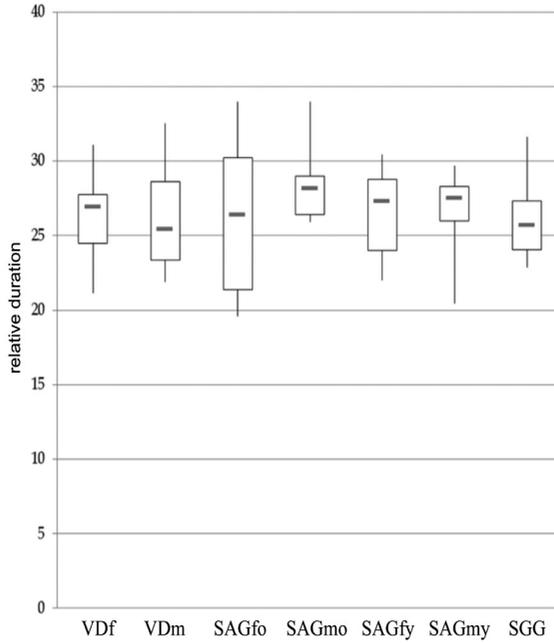
Figure 5. Boxplots of the relative duration of word-final /s/ in stressed words, broken down by groups of speakers. VD = Viennese Dialect, SAG = Standard Austrian German, SGG = Standard German German, f = female, m = male, o = older generation, y = younger generation.

5.3. /s/ in resyllabification Condition 1: (V_1s# $'V_2$)

In this condition, resyllabification is blocked by glottal stop insertion or by glottalization of the stressed vowel. Bergmann (2014) differentiates between glottal stop insertion and glottalization, since the latter constitutes a weakening of glottal stop insertion. However, in the current contribution, both are treated as equal, since both block resyllabification. Since glottal stops are rare in the Austrian varieties, glottalization occurs in the majority of cases. Therefore, the term "glottalization" will be used for both glottal stop insertion and glottalization.

In the V_1s#$'V_2$ condition, glottalization is suppressed in four items only, namely by one VD speaker, by one female SAG speaker of the older generation (twice) and by one male SAG speaker of the older generation.

Since the condition for resyllabification is met only in the four cases mentioned, the durations of /s/ in the condition (V_1s#$'V_2$) and (V_1s#$'OV_2$), *köstliches Essen* and *köstliches Bier*, respectively, should

remain the same. With respect to absolute duration, this is in fact the case. A two-way ANOVA yielded no significant result for the type of /s/; [F(1, 98) = 3.51, p = .06]. However, with respect to relative duration, a highly significant difference occurred [F(1, 98) = 10.76, p < .001], as shown in Figure 6.
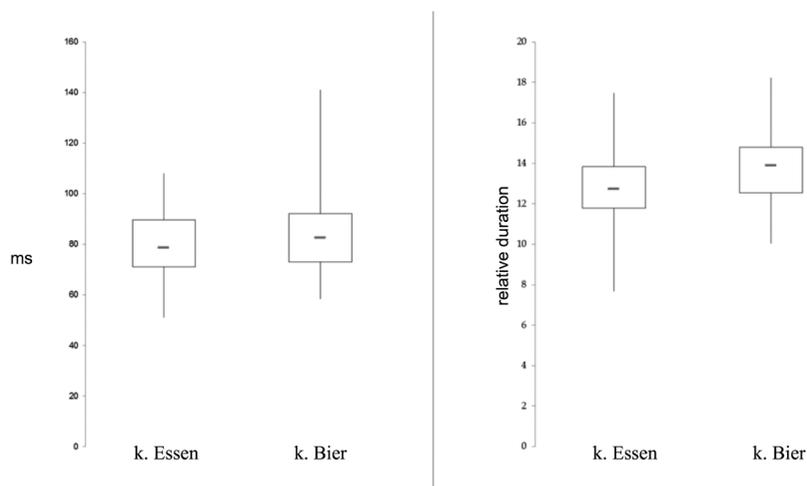

Figure 6. Boxplots of absolute duration (left) and relative duration (right) of the word-final /s/ in *köstliches Essen* (= k. Essen) and *köstliches Bier* (= k. Bier), for all groups of speakers.

Both the results on relative and absolute duration yielded a highly significant main effect for the speaker group, but only the results on absolute duration rendered a significant interaction for the type of /s/ and the speaker group [F(6,98) = 2.4, p < .04]. Pronounced differences between the two types of /s/ are obvious in SAG speakers of the older generation, whereas no such differences are observable in the SGG speakers and the SAG speakers of the younger generation, and much smaller differences are visible in the VD speakers.

5.4. /s/ in resyllabification Condition 2: (V_1s#V_2)

Things are quite different in resyllabification Condition 2 as compared to resyllabification Condition 1. In the case of a word-final /s/ followed by an unstressed word-initial vowel, glottalization is suppressed

in 40% of all observed $V_1s\#V_2$ sequences. Again, some group-specific differences appear (see Figure 7), especially within the group of VD speakers. While all male VD speakers suppress glottalization in this condition, this is not the case among the female VD speakers. Most interestingly, one SGG speaker also suppresses glottalization in this condition.
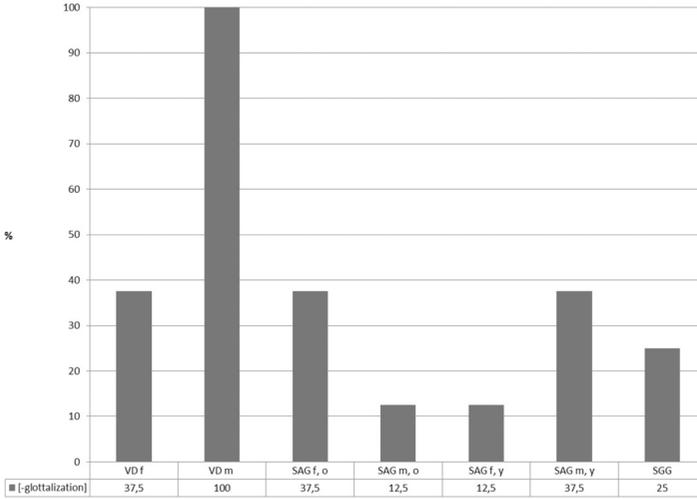

	VD f	VD m	SAG f, o	SAG m, o	SAG f, y	SAG m, y	SGG
■ [-glottalization]	37,5	100	37,5	12,5	12,5	37,5	25

Figure 7. Suppression of glottalization (in %) in the condition $V_1s\#V_2$. VD = Viennese Dialect, SAG = Standard Austrian German, SGG = Standard German German, f = female, m = male, o = older generation, y = younger generation.

Consequently, in the case where glottalization takes place, /s/ is supposed to stay in the word-final position and should thus remain on par in duration with the word-final /s/ of a stressed word. In the case of a suppression of the process, a word-final /s/ is supposed to move to the onset of the next syllable and should thus be on par in duration with a word-initial /s/ in unstressed pronouns. For SGG speakers, resyllabified /s/ should surface as voiced [z]. Since this is not the case, it can be assumed that no resyllabification takes place in SGG. Consequently, SGG speakers are excluded from the following calculations.

However, t-tests rendered different results according to whether absolute or relative durations were tested. In the condition where

resyllabification is blocked by glottalization, absolute durations of /s/ in *Haus* 'house' and /s/ in *Kies* 'gravel' are the same [t(78) = 0.25, p = .803]. However, highly significant differences occur with respect to relative duration [t(78) = -8.48, p < .0001]; the relative duration of word-final /s/ in *Haus* being lower than of word-final /s/ in *Kies*. Figure 8 compares the results of absolute and relative durations for the [+glottalization] condition.
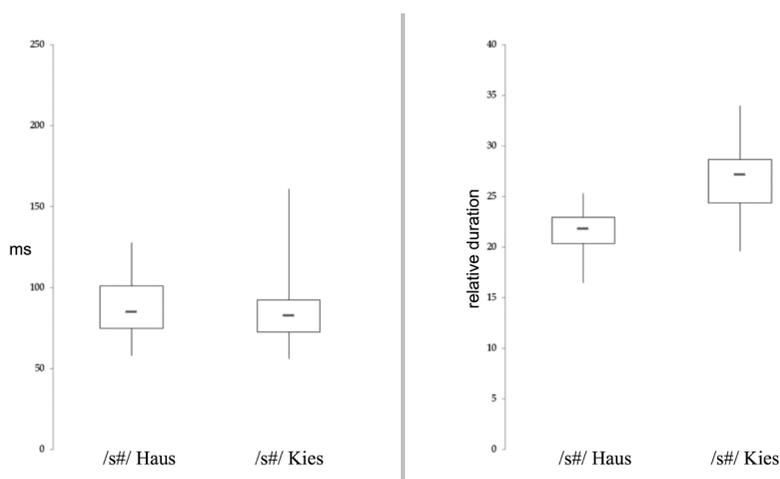

Figure 8. Boxplots of absolute duration (left) and relative duration (right) of word-final /s/ of Haus in the [+glottalization] condition (= /s#/ Haus) and of word-final /s/ of Kies (= /s#/ Kies), for all groups of Austrian speakers.

In the other condition, where resyllabification is not blocked by glottalization, absolute and relative durations of the word-final /s/ of *Haus* and of the word-initial /s/ of unstressed pronouns show statistically significant differences. Absolute durations are longer in word-initial unstressed pronouns than in the word-final /s/ of *Haus* [t(156) = -1.65, p = .05]. Highly significant differences occur for relative durations [t(51) = -25.01, p < .0001]; relative durations being higher in word-initial unstressed pronouns. Figure 9 compares the results of absolute and relative durations for the [-glottalization] condition.
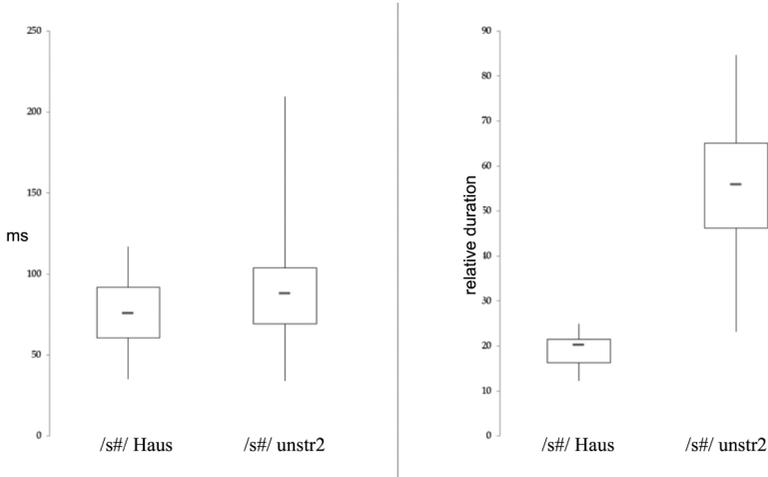
Figure 9. Boxplots of absolute duration (left) and relative duration (right) of word-final /s/ of Haus in the [-glottalization] condition (= /s#/ Haus) and of word-initial /s/ of unstressed pronouns (= /s#/ unstr2), for all groups of Austrian speakers.

A comparison of the [+glottalization] and the [-glottalization] condition of the word-final /s/ of *Haus* revealed minor differences in absolute durations [t(18) = 1.48, p = 0.08]; /s/ tends to be shorter in the [-glottalization] condition. Differences in relative durations are significant [t(17) = 2.02, p = .03], with relative duration being lower in the [-glottalization] condition. The diphthong of *Haus* tends to be longer in the [-glottalization] condition [t(46) = -1.41, p = .08], however, with respect to relative durations, highly significant differences occur [t(46) = -3.31, p < .001]. Relative durations are higher in the [-glottalization] condition as compared to the [+glottalization] condition.

6. Discussion

In this contribution, it was tested whether resyllabification takes place across a word-boundary when the following word starts with a vowel, or whether resyllabification is blocked by glottal stop insertion or glottalization. The realization of resyllabification would further undermine quantifying aspects of VD and SAG, since resyllabification is a syllable optimizing process. It was hypothesized that resyllabification would more readily take place in VD and SAG as compared to

SGG. This general hypothesis was confirmed; in SGG, resyllabification is blocked by glottalization. In the unstressed context of $V_1s\#V_2$, one SGG speaker suppresses glottalization. However, since the word-final /s/ is not pronounced as a voiced [z] as demanded by the phonotactics of SGG in a word-initial position, it is assumed that /s/ is not resyllabified.

In the condition ($V_1s\#'V_2$), i.e., in the condition of a word-final /s/ with a subsequent word-initial stressed vowel, resyllabification is blocked by glottalization in all varieties under consideration. In the second condition ($V_1s\#V_2$), i.e., in the condition of a word-final /s/ with a subsequent word-initial unstressed vowel, glottalization is suppressed in 40% of all cases.

When glottalization is suppressed, i.e., in the [-glottalization] condition, only minor differences occur with respect to absolute durations of the word-final /s/ of *Haus* and the word-initial /s/ of unstressed pronouns. In addition, the diphthong of *Haus* shows a tendency to be longer in the [-glottalization] condition than in the [+glottalization] condition. Therefore, if absolute durations are considered, a tendency to resyllabification can be observed.

These results are not corroborated when relative durations are considered. The relative duration of the word-final /s/ of *Haus* is significantly lower than the relative duration of the word-initial /s/ of unstressed pronouns. However, the relative duration of the diphthong in the [-glottalization] condition is significantly higher than in the [+glottalization] condition. Considering relative durations, only the results of the diphthong duration indicate a resyllabification. The relative duration of word-final /s/ is both lower than the duration of the word-initial unstressed pronouns and the word-final /s/ in the [+glottalization] condition, establishing the following hierarchy: word-initial /s/ of unstressed pronouns > word-final /s/ in the [+glottalization] condition > word-final /s/ in the [-glottalization] condition.

Differences with respect to absolute and relative durations were also observed in resyllabification Condition 1: considering the absolute duration of the word-final /s/ of *köstliches,* no differences occurred with respect to the following context (consonant vs. vowel), as expected, whereas a comparison of the relative durations rendered highly significant differences.

These results address the question of whether absolute or relative durations have to be considered in clarifying whether resyllabification occurs in the Austrian varieties analysed. However, this question can only be answered by conducting perception experiments, after which, an extension of the analysis to spontaneous speech is

meaningful and will further reveal whether, with respect to resyllabi-fication, the Middle Bavarian varieties of German show quantifying or word-optimizing traits.

Results also revealed similarities between SGG speakers and young SAG speakers. Currently, immigrants from Germany constitute the larg-est immigrant group in Austria, especially in Vienna. Since SGG is the most prestigious standard variety of the German speaking countries, a contact-induced sound change seems natural. Therefore, further investi-gations to identify a sound change in progress and find out if this sound change is influenced by SGG will be dealt with in future studies.

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Notes

[1]   The correlation of rhythm and language structure goes back to Donegan & Stampe (1983).
[2]   Generally, works discussing SAG lexical entries mostly discuss the differences between SAG and SGG lexicon; hardly ever do they focus on differences between SAG and the dialects.
[3]   Except for the discussion and conclusions part, Fougeron *et al.* (2003) use the terms "enchaînement" and "resyllabification" synonymously.
[4]   The boundary is signalled by creaky voice in the vowel. Acoustically, it is sometimes difficult to detect the exact point in time of the boundary.
[5]   The results from Bergman (2014) proved that resyllabification is blocked in SGG. Therefore, the group of SGG speakers only served as a control group and was thus not balanced for gender or age.
[6]   The software STx has been used, see http://www.kfs.oeaw.ac.at
[7]   In the third context, namely *ergriff sie* 'she was grasped', /z/ is voiceless in SGG. Contrary to SAG and VD, a process of devoicing has to be assumed in SGG.

Bibliographical References

Abercrombie David 1967. *Elements of General Phonetics*. Edinburgh: Edinburgh University Press.

Auer Peter 1991. "Stress-Timing" vs. "Syllable-Timing" from a Typological Point of view. In Palek Bohumil & Přemysl Janota (eds.), *Proceedings of the Conference Linguistics and Phonetics: prospects and applications*. Prague: Charles University Press. 292-305.

Auer Peter 1993. Is a rhythm-based typology possible? A study of the role of prosody in phonological typology. *KontRI Working Papers 21*. (http://paul.igl.uni-freiburg.de/auer/userfiles/downloads/Phonotypo_Kontri1.pdf).

Auer Peter 2001. Silben- und akzentzählende Sprachen. In Haspelmath Martin, König Ekkehard, Oesterreicher Wulf & Wolfgang Raible (eds.), *Language Typology and Language Universals*. Berlin/New York: Walter de Gruyter. 1391-1399.

Bannert Robert 1976. *Mittelbairische Phonologie auf akustischer und perzeptorischer Grundlage*. Lund: Gleerup.

Bergmann Pia. 2014. Reduction and deletion of glottal stops and geminates at phonological word boundaries in German compounds: Effects of word frequency and accentuation. In Caro Reina Javier & Renata Szczepaniak (eds.), *Syllable and Word languages*. Berlin/New York: Walter de Gruyter. 251-278.

Blevins Juliette 1995. The syllable in phonological theory. In Goldsmith John (ed.), *The Handbook of Phonological Theory*. Cambridge: Wiley-Blackwell. 206-244.

Bürkle Michael 1995. *Zur Aussprache des österreichischen Standarddeutschen*. Frankfurt/Main: Lang.

Caro Reina Javier 2014. Central Catalan in the framework of the typology of syllable and word languages. In Caro Reina Javier & Renata Szczepaniak (eds.), *Syllable and Word languages*. Berlin/New York: Walter de Gruyter. 349-390.

Deppermann Arnulf, Kleiner Stefan & Ralf Knöbl 2013. 'Standard usage': Towards a realistic conception of spoken standard German. In Auer Peter, Caro Reina Javier & Göz Kaufmann (eds.), *Language Variation – European Perspectives IV*. *Selected Papers from the Sixth International Conference on Language Variation in Europe (ICLaVE)*. Amsterdam: John Benjamins. 83-116.

Donegan Patricia & David Stampe 1983. Rhythm and the holistic organization of language structure. *Chicago Linguistic Society* 19. 337-353.

Dumay Nicolas, Content Alain & Ulrich Frauenfelder 1999. Acoustic-Phonetic Cues To Word Boundary Location: Evidence From Word Spotting. In Ohala John, Hasegawa Yoko, Ohala Manjari, Granville Daniel & Ashlee C. Bailey (eds.), *Proceedings of the 14th International Congress of Phonetic Sciences*. San Francisco. 281-284.

Dziubaska-Kołaczyk Katarzyna 2014. Explaining phonotactics using NAD. *Language Sciences* 46. 6-17.

Ehrlich Karoline 2009. *Die Aussprache des Österreichischen Standarddeutsch – umfassende Sprech- und Sprachstandserhebung der österreichischen*

Orthoepie. PhD thesis, University of Vienna.

Fougeron Cécile 2007. Word boundaries and contrast neutralization in the case of enchaînement in French. In Cole Jennifer & José Ignacio Hualde (eds.), *Laboratory Phonology 9*. Berlin, New York: Walter de Gruyter. 609-642.

Fougeron Cécile, Bagou Odile, Content Alain, Stefanuto Muriel & Ulrich Frauenfelder 2003. Looking for acoustic cues of resyllabification in French. In Solé Maria-Josep, Recasens Daniel & Joaquim Romero (eds.), *Proceedings of the 15th International Congress of Phonetic Sciences (ICPhS 2003)*. Barcelona. 2257-2260.

Gaskell M. Gareth, Spinelli Elsa & Fanny Meunier 2002. Perception of resyllabification in French. *Memory & Cognition* 30(5). 798-810.

Glauninger Manfred 2011. "Wiener(isch) zwischen Wunschbild und Wirklichkeit. Dialekt im Wienerlied und im Wiener Sprachalltag". *Jahrbuch des Österreichischen Volksliedwerkes* 60. 142-153.

Goldgruber Barbara 2011. *Einstellungen zu Dialekt und Standardsprache in Österreich. Eine empirische Untersuchung in Graz und Wien*. Master thesis, University of Vienna.

Greenberg Joseph 1978. Some generalizations concerning initial and final consonant clusters. In Id. (ed.), *Universals of Human Language. Volume 2. Phonology*. Standford: Stanford University Press. 243-280.

Herrgen Joachim 2015. Entnationalisierung des Standards. Eine perzeptionslinguistische Untersuchung zur deutschen Standardsprache in Deutschland, Österreich und der Schweiz. In Glauninger Manfred & Alexandra Lenz (eds.), *Standarddeutsch in Österreich – Theoretische und empirische Ansätze*. Wien: Vandenhoeck & Ruprecht. 137-162.

Kleiner Stefan 2010. Zur Aussprache von nebentonigem –ig im deutschen Gebrauchsstandard. *Zeitschrift für Dialektologie und Linguistik* LXXVII, 3. 259-303.

Lipski John M. 1999. The Many Faces of Spanish /s/-Weakening: (Re)alignment and Ambisyllabicity. In Gutiérrez-Rexach Javier & Fernando Martínez-Gil (eds.), *Advances in Hispanic Linguistics*. Somerville, MA: Cascadilla Press. 198-213.

Loporcaro Michele & Pier Marco Bertinetto 2005. The sound pattern of Standard Italian, as compared with varieties spoken in Florence. *Journal of the International Phonetic Association* 35(2). 131-151.

Moosmüller Sylvia 1991. *Hochsprache und Dialekt in Österreich. Soziophonologische Untersuchungen zu ihrer Abgrenzung in Wien, Graz, Salzburg und Innsbruck*. Wien/Köln/Weimar: Böhlau.

Moosmüller Sylvia 1999. The modulation of formant amplitude during assimilation processes of homorganic and quasi-homorganic V1V2-sequences. In Ohala John, Hasegawa Yoko, Ohala Manjari, Granville Daniel & Ashlee C. Bailey (eds.), *Proceedings of the 14th International Congress of Phonetic Sciences*. San Francisco. 1329-1332.

Moosmüller Sylvia 2007. On some timing aspects in the Viennese dialect. *The Phonetician* 95. 19-27.

Moosmüller Sylvia 2011. Aussprachevarianten im Österreichischen Standarddeutsch. In Bose Ines & Baldur Neuber (eds.), *Interpersonelle Kommunikation: Analyse und Optimierung*. Frankfurt/Main: Lang. 193-199.

Moosmüller Sylvia 2015. Methodisches zur Bestimmung der Standardaussprache in Österreich. In Glauninger Manfred & Alexandra Lenz (eds.), *Standarddeutsch in Österreich – Theoretische und empirische Ansätze*. Wien: Vandenhoeck & Ruprecht. 163-182.

Moosmüller Sylvia & Julia Brandstätter. 2014. Phonotactic information in the temporal organization of Standard Austrian German and the Viennese dialect. *Language Sciences* 46. 84-95.

Muhr Rudolf. 2007. *Österreichisches Aussprachewörterbuch. Österreichische Aussprachedatenbank*. Frankfurt/Main: Peter Lang.

Pike Kenneth L. 1945. *The Intonation of American English*. Ann Arbor: University of Michigan Press.

Ronneberger-Sibold Elke 1999. Ambisyllabic consonants in German: Evidence from dialectal pronunciation of lexical creations. In Rennison John & Klaus Kühnhammer (eds.), *Phonologica 1996*. The Hague: Theseus. 247-271.

Siebenhaar Beat 2014. Phonological and phonetic considerations for a Classification of Swiss German dialects as a word language or a syllable language. In Caro Reina Javier & Renata Szczepaniak (eds.), *Syllable and Word languages*. Berlin/New York: Walter de Gruyter. 327-345.

Soukup, Barbara 2009. *Dialect use as interaction strategy. A sociolinguistic study of contextualization, speech perception, and language attitudes in Austria*. Wien: Braumüller.

Spinelli Elsa, McQueen James M. & Anne Cutler 2003. Processing resyllabified words in French. *Journal of Memory and Language* 48. 233-254.

Strycharczuk Patrycja, van 't Veer Marijn, Bruil Martine & Linke Kathrin 2014. Phonetic evidence on phonology-morphosyntax interactions: Sibilant voicing in Quito Spanish. *Journal of Linguistics* 50(2). 403-452.

Strycharczuk Patrycja & Martin Kohlberger 2014. Resyllabification reconsidered. On the phonetic properties of derived onsets in Spanish. Presentation given at the *11th Old World Conference in Phonology (OCP11)*, January 22-25, 2014, Leiden University Centre for Linguistics.

Szczepaniak Renata 2007. *Der phonologisch-typologische Wandel des Deutschen von einer Silben- zu einer Wortsprache*. Berlin: Mouton de Gruyter.

Szczepaniak Renata 2014. Vowel and consonant epenthesis in the history of German from the typological perspective of syllable and word languages. In Caro Reina Javier & Renata Szczepaniak (eds.), *Syllable and Word languages*. Berlin/New York: Walter de Gruyter. 160-180.

Torreira Francisco & Mirjam Ernestus 2012. Weakening of intervocalic /s/ in the Nijmegen Corpus of Casual Spanish. *Phonetica* 69. 124-148.

Vennemann Theo 1988. *Preference Laws for Syllable Structure and the Explanation of Sound Change*. Berlin: Mouton de Gruyter.

Wiesinger Peter 1985. Die Diagliederung des Deutschen seit dem 17. Jahrhundert. In Besch Werner, Betten Anne, Reichmann Oskar & Stefan Sonderegger (eds.) *Sprachgeschichte*. Bd. 2. Berlin: de Gruyter. 1633-1650.

Wiesinger Peter 2009. Die Standardaussprache in Österreich. In Krech Eva-Maria, Stock Eberhard, Hirschfeld Ursula & Lutz Christian Anders (eds.), *Deutsches Aussprachewörterbuch*. Berlin: de Gruyter. 229-258.