Phonological and phonetic considerations for a classification of Swiss German dialects as a word language or syllable language

Beat Siebenhaar

[blɪtstststʃʊ:ɡ]
Blitzt s z Zug?
Is there lightning in (the town of) Zug?

1. Introduction

Swiss German dialects have often been interpreted as syllable languages, as opposed to Standard German which is said to be a word language (Nübling and Schrambke 2004, Szczepaniak 2007: 317–325). The example above may very well enlighten the problems that arise with the assignment of a language to be a word language or a syllable language, and it raises the question of whether a language with a sentence of four words that contains only two vowels could be a syllable language. I will try to obtain some answers on the basis of phonological and phonetic differences between Standard German and Swiss German dialects. Furthermore, some prosodic analyses will complement the view and show that phonetics should again be considered for the typological discussion.

Nübling and Schrambke (2004) presented a distinction of Northern Alamannic and Southern Alamannic not on the difference of selected perceptually or historically important isoglosses (as it is usually done), but instead focused on aspects representing a typological difference of word and syllable languages. The distinction fits very well into my timing model for a dialectal speech synthesis system, emerging from the concept in the model for Swiss Standard German (Siebenhaar et al. 2001). The statistical model of Swiss German dialects’ timing in this project was more effective when the syllable boundaries based on the sonority hierarchy alone were taken into account, than when a phonologically defined syllable boundary was respected. Moreover, considering word boundaries did not alter the model fit (Siebenhaar 2004a, 2004b; Leemann and Siebenhaar 2007). Therefore, this statistical modeling gives additional evidence for a definition of Swiss
German dialects as syllable languages. However, this is a model on phonetic grounds while Nübling and Schrambke's distinction is based more on phonological differences. I will therefore go back to the roots of the distinction of syllable-timed and stress-timed languages. However, I do not adhere to a purely phonetic model of Ramus, Nespor, and Mehler (1999) or Low, Grabe, and Nolan (2000), who both calculate duration relations of vocalic and consonantal segments, but I will focus on the phonetic differences of the phonological aspects that are mentioned to distinguish word languages from syllable languages. Finally, some phonetic evidence is given to support an attribution of Swiss German dialects to a syllable language.

In his seminal publication, Auer (1993) presents a list of prosodic aspects that can account for typological differences between word and syllable languages. The following list (table 1) is enhanced by features mentioned by Nübling and Schrambke (2004: 284–285) and Szczepaniak (2007: 52–53). This list is ordered so that features mentioned at the top are on a phonological level while features at the bottom of the list are more phonetic consequences. This ordering takes into account that a clear cut differentiation of phonetics and phonology is not possible (Siebenhaar and Leemann i. pr.).
Table 1. Prosodic aspects defining a typological difference of word and syllable languages

<table>
<thead>
<tr>
<th>Prosodic aspects defining a typological difference of word and syllable languages</th>
</tr>
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<tbody>
<tr>
<td>syllable type</td>
</tr>
<tr>
<td>variable or fixed syllable boundary</td>
</tr>
<tr>
<td>respecting the sonority hierarchy</td>
</tr>
<tr>
<td>differences of the vocal system in stressed and in non-stressed syllables</td>
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<tr>
<td>use of word-delimiting allophones</td>
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<tr>
<td>epenthesis used to optimize the word or syllable boundaries</td>
</tr>
<tr>
<td>vowel elision used to optimize the word or syllable boundaries</td>
</tr>
<tr>
<td>presence of geminates</td>
</tr>
<tr>
<td>resyllabification in syllable languages</td>
</tr>
<tr>
<td>presence of external sandhi phenomena</td>
</tr>
<tr>
<td>regular or irregular reanalysis</td>
</tr>
<tr>
<td>difference or lack of difference between heavy syllables and light syllables</td>
</tr>
<tr>
<td>lexicalized or rule-based stress attribution</td>
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<tr>
<td>presence of word stress</td>
</tr>
<tr>
<td>compression of syllables within a foot or within a syllable</td>
</tr>
<tr>
<td>isochrony on stress or syllable level</td>
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<tr>
<td>different reduction phenomena</td>
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<td>different phonological processes with an increase of the speech rate</td>
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2. Phonetic correlates of phonological differences

To define the typological difference between syllable languages and word languages, phonological aspects are at the centre of interest. The focus of this paper lies in phonetic aspects that can be taken into account for a typological difference. Therefore, it goes back to the phonetic roots of the distinction of syllable-timed and stress-timed languages (Abercrombie 1967, Pike 1946) or rather, it supports the phonological argumentation with phonetic evidence on the prosodic level. It is obvious that most phonological differences are reflected in phonetics, and many of the phonetic differences also affect prosody: The majority of the typological differences are on the level of the syllable structure, but there are still some that are entirely on a
segmental level. But both suprasegmental and segmental aspects may have an inherent influence on the temporal dimension of speech. Concerning the typological difference, segmental and suprasegmental aspects should therefore not be separated.

A well-known example may illustrate the segmental impact on prosody. Since the 1950s it has been known (cf. the summaries of Klatt 1976 and van Santen 1992) that high vowels have a shorter intrinsic duration than low vowels, and high vowels are generally uttered with a higher pitch than low vowels. These effects of vowel height are segmentally conditioned, and therefore are within the realm of segmental phonetics. However, the segmental aspect has a clear influence on the temporal structure of languages and therefore on prosody, which may be taken into account for a typological distinction.

In the following, it is discussed which consequences on the prosodic levels result from some of the phonologically defined differences listed in table 1: syllable type, sonority hierarchy, difference of the vocalism in stressed and in unstressed syllables, phonotactics, epenthesis and elision, and sandhi. Resyllabification and the reduction of unstressed syllables are discussed in section 4, where prosodic consequences of the phonologically defined differences are empirically tested.

The syllable type directly affects the temporal structure; in word languages, the syllable structure tends to be more variable and more complex in stressed syllables compared to a relatively simple structure in unstressed syllables. Syllable languages, on the other hand, tend to have identical syllable structures in stressed and unstressed syllables. As a consequence, the different relation between vowels and consonants has been taken up for different models to test the isochrony hypothesis on a purely temporal level (Ramus, Nespor, and Mehler 1999; Low, Grabe, and Nolan 2000). With controlled laboratory data it could be shown that languages of different rhythmic types (syllable-timed, stress-timed, and mora timed languages) have different relations to the succession of vocalic and consonantal parts of speech.

While syllable languages more or less respect the sonority hierarchy, word languages show different violations of the sonority hierarchy. This distinction is mainly looked at on the word level as the word is still one of the main entities of phonology. However, the phonological word is often not stable as soon as we look at complex words or at utterances. Furthermore, it is crucial to look at utterances of spontaneous speech because communication happens in utterances, not in isolated words. When word
boundaries are disregarded in spontaneous speech in favor of the sonority hierarchy, this results in many resyllabification processes, which can resolve some – but not all – of the perturbing syllable contacts. Additionally, they can be affected by sandhi phenomena (cf. Moulton 1986). However, resyllabification can also be found without sound quality changes on the segmental level. In these cases, a word-final consonant is delinked from the phonological structure of the word without being removed from the melodic stream but it is relinked with the following syllable. Thus, [er het œs oʊto] 'he has a car' turns into [er he.ɪ.oʊ.to]¹. A word-final consonant therefore becomes a syllable-initial consonant of a syllable belonging to the following word. This resyllabification process can also be found the other way round, as a word-initial consonant, mainly a fricative before a stop, can be linked to the coda of the last syllable of the preceding word. Thus, [er g'æt ij'ul] 'he goes into the stable' becomes [er g'ɑː.tɪʃ.t'ul]. The position of a consonant in the onset or the coda of a syllable has a considerable influence on its duration, because syllable-onset consonants are shorter than syllable-final consonants as shown in section 4.1. In consequence, a different observance of the sonority hierarchy directly affects the temporal structure.

If the vocalism is different in stressed and non-stressed syllables in word languages, this has an influence on the temporal structure. In German, long and short vowels are found in stressed syllables but in unstressed syllables there are only short vowels. If a long vowel of a stressed syllable shifts into an unstressed position, it is phonologically shorted. Phon [fɒm] is shortened when it shifts into an unstressed position: Phonologie [fonologiː]. The duration of stressed syllables is therefore more variable than of unstressed syllables; the temporal structure is directly affected.

Word languages show word delimiting markers, which are usually different allophones or extrasyllabic consonants (in German, mainly [s]) in word-internal or word-final position. In Standard German, all obstruents in word-final position are unvoiced. As the voiced obstruents have a shorter intrinsic duration than their unvoiced counterparts (Nocchi and Schmid 2006, Kuzla et al. 2007), devoicing directly entails the temporal structure.

Epenthesis and vowel elision have different functions in word and syllable languages. Depending on the language type, they optimize the word boundaries or the syllable structure. In Standard German, a word-initial vowel is usually preceded by an initial glottal stop while in word-internal position it only occurs under specific circumstances. The glottal stop epenthesis affects the rhythmic structure of voiced and unvoiced parts of an
utterance (Dellwo, Fourcin, and Abberton 2007). In word languages, vowel deletion is the extreme reduction of non-accented syllables. The reduction of Standard German [r'etn] to [r'etn] 'to save' is a classic example. This vowel deletion results in complex consonant clusters at the word boundary that reduces the duration of the voiced part of a word and, consequently, the rhythmic structure.

If a language has word-internal geminates, there are a greater number of phonetically longer consonants than in languages without geminates. Again, the temporal relation of the vowel-consonant succession is different.

If we have external sandhi, which is typical for syllable languages, latent word-final consonants are reinstalled immediately before a vowel, as in French liaison: ton père vs. ton oncle ([tõ pɛʁ vs. tõ.nœ̃.klœ] 'your father vs. your uncle'). Before a consonant, the assimilation processes can replace one segment by another across word boundaries: Swiss German si händ ball gschpilt /zi hœⁿd ˈbal kʃpil/ becomes [zi hæm pɔl kʃpilt] 'they were playing (foot)ball' where firstly the two lenis consonants fuse to a fortis plosive and then the place of articulation of the nasal is assimilated (Fleischer and Schmid 2006: 248–249, Moulton 1986). Consonant epenthesis as in the French example changes the rhythmic succession of consonants and vowels. Consonant assimilation in the Swiss German dialect example also changes the rhythmic structure, as different segments have different intrinsic durations.

Without explaining all of the aspects which differentiate word languages from syllable languages listed by Auer (1993) and Nübling and Schrambke (2004), it becomes clear that segmental differences and varying phonotactic restrictions have a direct influence on the temporal structure of a language. However, it is not clear whether these aspects of the segmental structure result in a different rhythmic concept, or if the rhythmic concept of a language entails the phonologic structure. This seems to be the question of which came first, the chicken or the egg, which cannot be satisfactorily answered.

These comments on the temporal effect of the different features are in some way a direct answer to Peter Auer’s (1993: 89) question of whether the model of word languages and syllable languages can be reshaped such that reference to duration is avoided altogether. I don’t think that this link to phonetics should be given up. The correlation to phonetics, as exemplified in section 4, strengthens the model.
3. Swiss German dialect – a syllable language?

Nübling and Schrambke (2004: 304) assign the Swiss German dialects to the pole of the syllable languages. Szczepaniak (2006, 2007: 317–325) supports this position and she shows that Standard German has undergone a typological drift to a word language. However, the assignment of the two varieties to the different poles is not straightforward throughout. Some divergent examples of Standard German and Swiss German dialect equivalents are discussed below in the light of the word/syllable language type differentiation.

3.1. Word-related features in Swiss German dialects

Comparing Standard German and Swiss German dialects regarding the syllable structure, Swiss German dialects often do not behave as syllable languages. Syllable languages tend to have simple CV-syllables. However, Swiss German dialects even show more complex consonant clusters than Standard German. The following examples show where Swiss German dialects behave more as a word language than Standard German. The nearly systematic syncope of schwa in Swiss German word-initial syllables results in word-initial onsets that are more complex than in Standard German corresponding words ([gəʃpˈɛnst vs. kʃpˈæŋʃt] 'ghost', [ʒɔfɪˈaːkt vs. kʃˈɔːɡt] 'asked'). Also, the coda is not necessarily simpler in the Swiss German dialects than it is in a Standard German equivalent: The affricate [kʃ], which is – besides [x] – a usual correspondence to Standard German [k], is more complex than the simple [k] of Standard German ([gəʃtrɪkt vs. kʃtrɪkt] 'knitted'). Moreover, schwa + /r/ is not vocalized in Swiss German dialects while there is a rule-based vocalization in Standard German (Krech et al 2009: 87). In word-final position of Swiss German /ɔr/ the schwa is even often elided ([pʰetɪ vs. pʰetɔr/pʰetər] 'Peter'). Besides, many Standard German bisyllabic plural forms have open syllables while the corresponding Swiss German plural form is often monosyllabic with a closed syllable ([ʃtˈɪlə vs. ʃtɪl] 'chairs'; [hˈʊndə vs. hyndʒ] 'dogs'). The Swiss German dialects even have grammatical words without a vowel ([das vs. dəs/s] 'the' (NOM/ACC,SG,NEUT); [tsuː vs. ts] 'to, in'). The neuter article də or s and the preposition z are therefore prototypically used proclitic (Nübling 1992: 240). This results in very complex syllable onsets ([das gəʃpenst vs. dʃkʃpæŋʃt] 'the ghost', [tsu: tsuk vs. tʃtʃuk] 'in Zug').
Word languages show more violations of the sonority hierarchy than syllable languages. Therefore, if Swiss German dialects should be closer to a syllable language, the sonority hierarchy should be respected more strictly than in Standard German. The examples mentioned above show that Swiss German violates the sonority hierarchy as Standard German does, especially in syllable onsets where the consonant cluster is even more complex than in Standard German ([gaʃp ’enst vs. kʃpæŋ[t] ‘ghost’; [ɡaʃt ’ikl vs. kʃtrɪkʃt] ‘knitted’). In the syllable coda, Swiss German dialects show similar violations as Standard German ([hɛrst vs. herb[t] ‘autumn’). However, if the fricatives [s] and [ʃ] would be defined as syllabic consonants and therefore as syllable nuclei or as part of a semisyllable as it is in found Bella Coola, Georgian, and Polish (Cho and Halloway King 2003) this would eliminate many of these violations in the Swiss German dialects and, to a lesser extent, also in Standard German. Therefore, depending on the definition of the syllable, Swiss German respects the sonority hierarchy less than or equal to Standard German.

Word languages have reduced vowel systems in stressed and unstressed syllables. The vowel of unstressed syllables in Standard German is normally [a]. Exceptions are full vowels in derivational suffixes such as -heit, -bar etc. in the determinatum of compounds, which therefore consist of more than one phonologic word, and some proteomic vowels in three syllable words as Forelle [fos’ɛlsa] ‘trout’. In many cases where schwa is not elided, the corresponding Swiss German vowel to a Standard German schwa is also a schwa, albeit with a less central quality: [a, a, æ, ə, ø] (SDS III, 1).

Besides, Swiss German dialects have [i] in inflection endings (e.g. as a conjunctive marker in mer sàit, er machi Ferie ‘one says he makes (PRES. CONJ. 3. SG. ACT) holidays’ or in e schööni Souerei ‘a nice (NOM/ACC. SG. FEM) mess’). Moreover, the alpine dialects have a very complex distribution of different vowel qualities in reduced syllables. Besides reduced schwa, the linguistic maps on the plural endings of normal verbs (SDS III 34) give evidence for -i, -a, -ā ([æ]) and -u. Thus, Swiss German dialects, like a word language, have a reduced vowel system in unstressed syllables. However, the reduction is not as advanced as in Standard German.

3.2. Syllable-related features in Swiss German dialects

On the other hand, the Swiss German dialects correspond more to a syllable language regarding word-final closed schwa syllables. In this position,
Phonological and phonetic considerations for a classification of Swiss German

Standard German in most cases has a schwa syncope, which results in a suboptimal syllable nucleus with a syllabic consonant. Swiss German dialects, on the other hand, have a systematic apocope of word-final -n resulting in open syllables, which optimizes the syllable structure ([z'ægn] vs. [z'æg̊o] 'to say'). In spoken Standard German, the non-optimal word-final syllable is very often subject to further reduction and assimilation processes that result in a monosyllabic word ([z'ægn] > [z'æg̊n] > [zaŋ] 'to say'). Resulting in a CVC structure, these processes strengthen the word boundary. In contrast, the Swiss German form has two prototypical CV-syllables ([z'æg̊o] 'to say'). Therefore, in this first central aspect of syllable structure differentiating both German varieties, Swiss German dialects are not clearly positioned as syllable languages. Word languages have the tendency for an alternation of allophonic or neutralized variants of a phoneme depending on the position within a word. These word-related processes, such as the classical example of final-obstruent devoicing of Standard German (Hall 2011: 51–54, for other languages see Auer 1993: 72–74), accentuate the boundaries of a word. Syllable languages do not show different allophonic or neutralized variants at word boundaries. Standard German has these different allophones at both edges of a word: word-initial vowels are usually marked with a glottal stop, which can be seen as a glottalized allophone of a vowel or as an epenthesis (see next paragraph), and in word-final position all obstruents are devoiced. Both processes highlight the word boundaries. Swiss German dialects do not have a glottal stop at all and they do not show final obstruent devoicing as they completely lack voiced obstruents. The lack of these word boundary marking allophones in Swiss German dialects triggers or allows a massive resyllabification process across word boundaries. In some cases, these resyllabification processes following a syllable optimizing n-epenthesis even result in reanalysis of nouns (e.g. en Eber, de Eber > e Neber, de Neber 'a boar, the boar', en Igel, de Igel > e Nigel, de Nigel 'a hedgehog, the hedgehog').

In word languages and syllable languages, elision and epenthesis have other functions. In word languages they optimize the word, while in syllable languages they optimize the syllable. The examples here show that Standard German and Swiss German dialects both show epentheses and elisions. However, Swiss German shows clear tendencies to a syllable optimization while Standard German tends towards an optimization of the word. Standard German has a glottal stop epenthesis before word-initial stressed vowels. In the Swiss German dialects, there is a syllable-initial
epenthesis of $n$ or $r$. The dialectal article [ə] before word-initial consonant ([aːn.hunt vs. ə.hun$\ddot{u}$] 'a dog') turns into [an] before a word-initial vowel, while the vowel in Standard German is preceded by a glottal stop ([(aːn.ʔaː.ːn$\ddot{u}$: $\ddot{u}$] 'an evening'). Sometimes the dialectal hiatus is avoided by inserting [r] [deːn.ʔa.pfl vs. ʔo.ɾ'æ.pfl] 'the apple'). This process is not a reinstallation of a historical sound; it is purely phonologically motivated. This is obvious in the example [ʔo.ɾ'æ.pf$\ddot{o}$] where there was an insertion of $r$ also in the accusative, where historically there was an $n$. Though the Standard German glottal stop is mainly a strengthening of the word boundary, it is consequently also a strengthening of the word-initial syllable. In Swiss German, the glottal stop is not part of the sound system. Here, the hiatus is avoided either by the elision of one of the adjacent schwa-sounds or by inserting an epenthetic $n$ ([ʔeː.ɡ'r.i:t.ʔiːɡ.ʔa.n.ɡ$\ddot{a}$] 'he gives her a present'). In both cases, the syllable is optimized and the morpheme structure gets opaque.

Concerning the word-final boundary, Standard German has strengthening with the schwa elision in the final syllables that results in complex syllabic codas or non-optimal (consonantal) syllable nuclei. The Swiss German dialects have open syllables in these cases ([aːn.ʔaː.ːn$\ddot{u}$] 'an evening'). The western Swiss German dialects show vocalization of word-final -al to -o, resulting in optimal syllable structures ([deːn.ʔa.pfl vs. ʔo.ɾ'æ.pf$\ddot{o}$] 'the.ACC apple'). The transition of the historical form [gərn > g'ɑ.r$\ddot{a}$n > 2 g'ɑ.ɾ$\ddot{a}$] 'yarn' in the alpine dialects shows different syllable strengthening processes. First, there is an epenthetic schwa that breaks up the consonant cluster, then the final $n$ is deleted. Both processes strengthen the syllable. Epenthesis and elision are therefore the processes that clearly separate syllable-profiling Swiss German dialects from word-profiling Standard German.

Swiss German dialects have geminates within a foot, which is a criterion for syllable languages. As all obstruents are voiceless and the distinction between fortis and lenis is maintained as an opposition of long and short consonants (Willi 1996). This can be interpreted as a distinction between singleton and geminate (Krähenmann 2003). The minimal pairs [ˈafa] 'ape' vs. [ˈafa] 'just' or [ˈaːf$\ddot{a}$] vs. [ˈaːf$\ddot{a}$] 'calf vs. 'cotton' exemplify this opposition. Most Swiss German dialects also have nasal geminates.

In contrast to Standard German, the Swiss German dialects show external sandhi (Moulton 1986, Nübling and Schrambke 2004, Szczepaniak 2006) that blends the word boundaries very much in favour of the syllable
optimization ([nɪcť:fiːl vs. nɪ.pfiľ] 'not much'; [diː: fraʊ vs. pfræʊ] 'the woman').

In word languages, stress is lexically assigned, whereas syllable languages have a more rule-based stress attribution. In general, Standard German and Swiss German dialects have the same stress attribution. However, there are some exceptions, and they mainly follow the same pattern. Swiss German is more radical in attributing the traditional Germanic word-initial stress to loan words and abbreviations ([tunˈɛl vs. tˈunel] 'tunnel'; [filˈɛː vs. fˈile] 'filet'; [t̪esˈɛː vs. tsˈɛːdə] 'CD'). The most striking examples can be found in the alpine Valais dialect ([mɪlɪtˈɛːr vs. mˈilɪtɛː] 'military'; [mætʰˈɛmætikx vs. mˈatematikx] 'mathematics'). This more rule-based stress attribution of the Swiss German dialects compared to Standard German is a further indication for an assignment of the Swiss German dialects to a syllable language while Standard German, with a more lexically-based stress attribution, is closer to a word type language.

Overall, Swiss German fulfills some requirements for a syllable language while for others the situation is not so clear. The Swiss German dialects have typical syllable language features such as geminates, and its word boundaries are not marked with specific allophones. Moreover, its epenthesis and elision processes, as well as syllabification and sandhi phenomena, optimize the syllable. In other cases, the classification is not as clear: In word languages, stress is generally attributed by the lexicon. However, compared to Standard German, Swiss German displays a more rule-based stress assignment. The same holds for its different inventory of vowels in stressed and unstressed syllables, which is typical for word languages. However, the inventory in unstressed syllables is broader than the Standard German inventory. The strongest argument against a classification of Swiss German as a syllable language is the syllable structure and the violation of the sonority hierarchy, which both are core aspects for the classification. Swiss German has even more complex consonant clusters in the syllable onset than Standard German, which, moreover, violate the sonority hierarchy. These violations, exemplified with the introducing sentence at the top of the chapter, may raise the question of how the syllable has to be defined. Besides the traditional explanation of extrasyllabic consonants, one should consider an interpretation of the voiceless fricatives [s] and [ʃ] in an interconsonantal position as syllabic consonants or, following Cho and Halloway King (2003), as semisyllabic consonants. With such an interpretation, which splits up obstruents in two different sonority classes, fricatives and plosives, the classification of Swiss German as a syllable lan-
guage would be much more consistent. This would also alter the syllable structure of Standard German. However, the change would be much more important for the Swiss German dialects as interconsonantal fricatives are much more frequent due to the syncope of schwa in prefixes.

4. Prosodic evidence on the phonetic level

As mentioned in section 2, phonological differences have a direct impact on the temporal organization of speech. This influence will be shown on the basis of a manually segmented corpus of more than 130,000 segments of spontaneous speech from four Swiss German dialects. The data consist of approximately two hours of spontaneous speech. Forty subjects aged twenty from four different dialect regions of German-speaking Switzerland were interviewed. Speakers (5 females and 5 males per dialect) from two Alpine varieties, Valais (VS) and Grisons (GR), and two Midland dialects, Bern (BE) and Zurich (ZH) were recorded in spontaneous interviews. Approximately three minutes per speaker were manually segmented and labelled on a segmental and syllabic level and analyzed for temporal aspects. Word boundary was labelled only for half of the data as the main goal of the analysis was to build models for timing and intonation. As respecting the word boundaries did not alter the model, its labelling was primarily omitted.

Ramus, Nespor, and Mehler (1999) and Low, Grabe, and Nolan (2000) have developed different algorithms that allow a distinction of syllable-timed languages and stress-timed languages on the grounds of a quantification of the consonantal and vocalic variability. With controlled data, they show that languages of different rhythmic types have different relations between the succession of vocalic and consonantal parts of speech. That concept has further been reduced to a voiced-unvoiced rate by Dellwo, Fourcin, and Abberton (2007). In both approaches the phonetic distinction of syllable-timed, stress-timed, and mora-timed languages is transferred to another phonetic level. Unpublished calculations of the Swiss German data used for the present article with the Ramus, Nespor, and Mehler (1999) algorithm located Swiss German at a much more stress-timed position than Standard German. The conclusion was that the spontaneous data do not fit into this rhythmic pattern. This corresponds to Arvaniti's (2009) results on Greek, Spanish and English spontaneous speech. She discloses that spontaneous data do not fit into this pattern that is based on read speech because
there are too many different and interacting factors, which cannot be controlled, that affect segmental duration. Spontaneous speech has to be calculated in a different way than read speech. Moreover, Arvaniti concludes that rhythm cannot only be based on timing but that other phonetic and psycholinguistic factors which define a succession of prominence must be respected.

The following exemplifies some of the mentioned aspects of timing that are more complex than the temporal relation of consonants and vowels. The selection of the phenomena is more or less arbitrary, as there is – up to now – no research on phonetics relating to the typological distinction of word languages and syllable languages besides the mentioned temporal effect of the succession of vowels and consonants. The focus of the following discussion relies on timing – the duration of segments in the Swiss German database. The first aspect looked at is the effect of resyllabification in cases where there is no articulatory assimilation, so that the only indication on resyllabification is prosody, in the case of the voiceless fricatives’ duration. The second aspect is the duration of schwa, which never has lexical stress, depending on the position within the syllable and the word. The discussion should show which factor, word boundary or syllable boundary, is more important for duration changes. The third aspect is only an outlook on intonation. The empirical research on the data is done in another publication (Leemann i. pr.), but here the results are discussed within the discrimination of syllable languages and word languages. Moreover, intensity should be respected too. However, regarding intensity, the data are not reliable as microphone distance was not controlled.

4.1. Resyllabification and the duration of fricatives

In Swiss German dialects, most consonant classes show a moderate influence of the word boundary on duration: For most consonant classes we find a non-significant lengthening in word-initial and word-final position. Yet, the influence of the position within a syllable is more consistent; the coda consonant usually is longer than the onset consonant. This can be interpreted as one aspect for the stability of the syllable, a fact that supports a classification of Swiss German towards a syllable language. However, fricatives show another distribution. Figure 1 shows the duration of fricatives depending on their position in the word. To avoid distortions due to phrase final and phrase initial lengthening, the fricatives in first, penultimate, and last syllables are excluded (cf. Cuzla, Cho, and Ernestus 2007,
The general distribution shows that word medial and word-final fricatives have more or less the same duration while word-initial fricatives have a significantly longer duration ($F(2,2577) = 3.4473, p < 0.05$). At the same time, the duration of the fricatives varies depending on the position within the syllable. Swiss German fricatives are longer in syllable onsets than in syllable codas ($F(1,2578) = 9.7836, p < 0.01$). However, these two aspects interfere due to resyllabification processes across word boundaries. With a phonetic definition of the syllable based on the sonority hierarchy alone, there is a resyllabification when a word-final fricative is before a word starting with a nasal, liquid or vowel. In these cases, the word-final fricative moves into the syllable onset of the following syllable ($[\text{das\#land} > \text{da\_sl\_and}]$ 'this land'). On the other hand, a fricative in the onset before a plosive moves to the coda of the preceding syllable ($[\text{das\_\s\_tern} > \text{da\_\s\_tern}]$ 'the star'). The additional lines mark the difference of onset and coda consonants for the different positions in the word. While the difference of onset and coda fricatives is not significant for word-initial and word medial fricatives, the difference for word-final fricatives is significant ($F(1,807) = 15.7897, p < 0.0001$). This distribution shows that syllable structure and word structure interact. It seems that word-initial fricatives are generally longer, while in word-final position the resyllabification process is dominant and alters the duration of the consonant. When a word-final fricative moves to the syllable onset, it is lengthened and reaches a mean duration of word-initial fricatives. As this is the predominant position for resyllabification, it can be interpreted that in the Swiss German dialects the syllable type processes are stronger than the processes to mark the word boundary. However, this should be compared to Standard German data, which has not yet been done.
Phonological and phonetic considerations for a classification of Swiss German

15

Figure 1: Duration in ms and confidence interval of fricatives in phrase-central syllables depending on the position in the word: initial, medial, final. Additional connecting lines display the position in the syllable. (n=2588)

Compared to the other consonant classes, fricatives seem to be quite complex, as word-related aspects show more influence than for the other consonants, which are mainly influenced by syllable-related aspects. The analysis of the fricative duration, however, shows that the phonological process of resyllabification has an important impact on consonant duration, thus a phonetic measure. Overall, the variation of consonant duration supports a tendency for a classification of Swiss German dialects as syllable languages.

4.2. Duration of schwa

The duration of schwa, whether it is positioned at a syllable border, i.e. it is syllable final in an open syllable, or it is nucleus of a closed syllable, shows an equally problematic distribution. Again, schwas in syllables at phrase boundaries are excluded from the analysis. At a first glance the situation seems to be clear. Schwas in an open syllable are significantly longer than schwas in closed syllables (compare the non-overlapping rhomboids in Figure 2; F (1,1271) = 22.2925, p < 0.0001). However, the distribution that is due to the position of the schwa-syllable in the word (F (2,1270) = 55.8423, p < 0.0001) is much more important. With respect to both aspects, the influence of the position of the schwa in open or closed syllables is radically reduced. Schwas in open syllables are still longer than those in
closed syllables but the main difference is due to the different position in the word. A General Linear Model, which respects both aspects, shows that the syllable boundary only has an F-ratio of 4.5948 (DF: 1) while the corresponding value for the position within a word is at 46.3560 (DF: 2). The connecting lines in Figure 2 show also that for a schwa in a word-final syllable, the position within the syllable does not have an influence, while this influence is significant for word-initial (F (1, 113) = 4.5141, p < 0.05)) and word-medial syllables (F (1, 580) = 5.2034, p < 0.05)).

Figure 2: Duration and confidence interval of schwas in phrase-central syllables depending on the position in the syllable. Additional connecting lines display the position in the word (n = 1272)

In this respect, the temporal structure of the Swiss German data does not clearly favour a classification of Swiss German as a syllable language or as a word language, as lengthening cannot clearly be linked to the word or the syllable. The duration of schwa is dependent on the position within the word, which indicates an assignment to a word language. At the same time, the duration is, to a lesser degree, dependent on the syllable type; schwa in a closed syllable is shorter than in an open syllable. However, this effect is less important so most of the evidence supports a classification of Swiss German as a word language.
4.3. Intonation contour

The last aspect to be mentioned is the anchoring of the intonation contour. Different publications (Atterer and Ladd 2004; Kleber and Rathcke 2008) have shown that the anchoring of the intonation contour in the syllable shows a regionally different distribution in Standard German read speech. In general, the pitch accent is earlier in northern regions and later in southern regions. Peter Gilles’ (2005) work on spontaneous data in eight German towns does in general support this regional distribution, and especially in southwestern Freiburg the pitch peak delay is very strong. Adrian Leemann (i. pr.) has analyzed the present Swiss German dialect data regarding intonation. His analyses show that the pitch accents are earlier in the Zürich and Grisons dialects, later in Bern and very variable in Valais, where there are often additional accents in unstressed and even in schwa syllables. As the analysis is done with a Command-Response model, the results are not directly comparable to Atterer and Ladd (2004) or Kleber and Rathcke (2008), but the distribution within the dialects maintains the tendency for later peaks in the southern German dialects and within the Swiss German dialects in the west.

This difference of earlier and later peaks may also be a reflex of the typological difference of syllable and word languages because the late accent gives a higher value to the non-accented syllables, as the peak shifts from the stressed to the non-stressed syllable. The Valais dialect is even more clearly positioned as a syllable language because quite often even schwa-syllables have an intonation accent, a feature that levels out the difference of accented and non-accented syllables even more.

5. Conclusion

The Swiss German dialects have some aspects that characterize them a syllable language. The most striking aspects are the presence of geminates and phonotactics as Swiss German has no word-delimiting allophones. Moreover, resyllabification and sandhi phenomena are very common. For some aspects, the assignment to a syllable language is ambiguous. Like a word language Swiss German has a distinction between full vowels in stressed syllables and reduced vowels in unstressed syllables. However, vowels in unstressed syllables show more phonetic variation than Standard German that has only schwa in this position. The syllable coda is less com-
plex than in Standard German. These phonological differences have direct reflexes in the temporal domain. Concerning intonation, the Swiss German dialects allow intonation accents on unstressed and even schwa syllables that is not possible in Standard German.

For some aspects, the Swiss German dialects have properties of a word language. The syllable structure in the onset is very complex; there are even words (articles and prepositions) without vowels that are only used as clitics. The proclisis may be interpreted as strengthening boundaries of the phonological word.

Generally, the analysis has shown that the definition of the syllable, as well as the definition of the word, has a considerable impact on the assignment of the Swiss German dialects to a syllable or word language. These basic definitions must be made clear. This is even more important when we analyze spontaneous connected speech, as many processes of temporal reorganization are an expression of communicative attitudes which cannot be analyzed in laboratory speech. Extrasyllabic consonants are problematic for an analysis of connected speech. Therefore, I postulate a purely phonetic definition following the sonority hierarchy that includes the definition of syllabic consonants as syllable nuclei. For Swiss German, this means even accepting [s] and [ʃ] as syllabic consonants.

Furthermore, it is worth looking at phonetic reflexes of different aspects of word and syllable languages. The exemplary and exploratory results discussed in section 4, the changing duration of consonants and especially fricatives as consequence of resyllabification, the dependence of the duration of schwa on position within the syllable and within the word and the different anchoring of intonation contours show the phonetic consequences of phonologic processes, which correlate with tendencies for a definition of a language as a word language or as a syllable language. For the Swiss German dialects, the analysis supports an assignment to the pole of the syllable languages. In a general linguistic perspective, this view on phonetic evidence may strengthen a phonological typological distinction. However, this work is still to be done.

Notes
Phonological and phonetic considerations for a classification of Swiss German

1 The Handbook of the International Phonetic Association (1999) proposes to put the accent sign before the accented syllable. However, the definition of the syllable boundary is one of the problems to be dealt with within this article. Therefore, the accent sign is set before the vowel of the accented syllable as it is partially done in the SAMPA transcription and also in the new wordbook on German orthoepy (Krech et. al. 2009).

2 Vowel lengthening before /r/ is very usual in most German dialects. As it is not clear whether this vowel lengthening did take place before the n-elision or if the n-elision was first this step of the explanation is omitted here.

3 The data were collected in the framework of a Swiss National Science Foundation (SNSF) project (Quantitative Approaches to Geolinguistics of Swiss German Prosody 2005-2008) (cf. Leemann and Siebenhaar 2008; 2010).

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Nocchi, Nadja, and Stephan Schmid

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Pike, Kenneth Lee

Ramus, Franck, Marina Nespor and Jacques Mehler

Santen, Jan van

SDS = Rudolf Hotzenköcherle [in collaboration with Konrad Lobeck, Robert Schläfler, Rudolf Trüb and with the assistance of Paul Zinsli] (ed.)

Siebenhaar, Beat

Siebenhaar, Beat
22 Beat Siebenhaar


Siebenhaar, Beat, and Adrian Leemann

Siebenhaar, Beat, Brigitte Zellner Keller, and Eric Keller

Szczepaniak, Renata

Szczepaniak, Renata

Willi, Urs