Year: 2020

Vowel and consonant length in four Alemannic dialects and their influence on the respective varieties of Swiss Standard German

Zihlmann, Urban

Abstract: Dass die Alemannischen Dialekte (ALM) die Vokalqualität des Schweizerhochdeutschen (SHD) prägt, wurde bereits mehrmals untersucht. Hingegen liegen noch keine systematischen Studien über die dialektale Prägung der Vokal- und Konsonantenquantität im SHD vor. Diese Studie erforscht deshalb bei vier Dialekten, wie sich ALM auf die Länge der Vokale (V) und Konsonanten (K) in den jeweiligen SHD-Varietäten auswirkt. Segmentdaueranalysen zweisilbigerWörter mit kurzen/langen V/K zeigten, dass (1) die vier Dialekte im Prinzip das gleiche V/K-Quantitätssystem aufweisen (trotz z.T. unterschiedlicher Verteilung der Vokalquantitäten bei bestimmten Wörtern) und dass dieses System auch im SHD angewendet wird. (2) Statistisch signifikante Dauerunterschiede in den regionalen SHD-Varietäten wurden nur bei Wörtern gefunden, bei denen ein phonologischer Quantitätsunterschied zwischen den ALM- und SHD-Äquivalenten vorliegt. Diese Unterschiede sind jedoch nicht dialektspezifisch, sondern können bei allen Dialekten mit diesen Quantitätsunterschieden vorkommen.

Other titles: Vowel and consonant length in Alemannic and Swiss Standard German

Originally published at:
Zihlmann, Urban (2020). Vowel and consonant length in four Alemannic dialects and their influence on the respective varieties of Swiss Standard German. Wiener Linguistische Gazette, 86:1-46.

[WLG]
WIENER LINGUISTISCHE GAZETTE

Vowel and consonant length in four Alemannic dialects and their influence on the respective varieties of Swiss Standard German

Urban B. Zihlmann

Sonderdruck aus: *Wiener Linguistische Gazette* (WLG) 86 (2020): 1–46

Universität Wien · Institut für Sprachwissenschaft · 2020

Eigentümer, Herausgeber und Verleger:
Universität Wien, Institut für Sprachwissenschaft
Sensengasse 3a
1090 Wien
Österreich

Redaktion: Markus Pöchtrager (Allgemeine Sprachwissenschaft),
Mi-Cha Flubacher, Jonas Hassemer & Sabine Lehner
(Angewandte Sprachwissenschaft),
Stefan Schumacher (Allgemeine und Historische Sprachwissenschaft)
Kontakt: wlg@univie.ac.at
Homepage: *http://www.wlg.univie.ac.at*

ISSN: 2224-1876
NBN: BI,078,1063

Die *Wiener Linguistische Gazette* erscheint in loser Folge im Open-Access-Format.
Alle Ausgaben ab Nr. 72 (2005) sind online verfügbar.

Vowel and consonant length in four Alemannic dialects and their influence on the respective varieties of Swiss Standard German

*Urban B. Zihlmann**

Wiener Linguistische Gazette (WLG)
Institut für Sprachwissenschaft
Universität Wien
Ausgabe 86 (2020): 1–46

Abstract

Dass die Alemannischen Dialekte (ALM) die Vokalqualität des Schweizerhochdeutschen (SHD) prägt, wurde bereits mehrmals untersucht. Hingegen liegen noch keine systematischen Studien über die dialektale Prägung der Vokal- und Konsonantenquantität im SHD vor. Diese Studie erforscht deshalb bei vier Dialekten, wie sich ALM auf die Länge der Vokale (V) und Konsonanten (K) in den jeweiligen SHD-Varietäten auswirkt. Segmentdaueranalysen zweisilbiger Wörter mit kurzen/langen V/K zeigten, dass (1) die vier Dialekte im Prinzip das gleiche V/K-Quantitätssystem aufweisen (trotz z.T. unterschiedlicher Verteilung der Vokalquantitäten bei bestimmten Wörtern) und dass dieses System auch im SHD angewendet wird. (2) Statistisch signifikante Dauerunterschiede in den regionalen SHD-Varietäten wurden nur bei Wörtern gefunden, bei denen ein phonologischer Quantitätsunterschied zwischen den ALM- und SHD-Äquivalenten vorliegt. Diese Unterschiede sind jedoch nicht dialektspezifisch, sondern können bei allen Dialekten mit diesen Quantitätsunterschieden vorkommen.

Schlüsselwörter: Swiss Standard German, Alemannic, phonetics, dialectology, vowel/consonant quantity

* Urban B. Zihlmann, Universität Zürich, Phonetisches Laboratorium, Rämistrasse 71, 8006 Zürich, urban.zihlmann@uzh.ch.

1 Introduction

Linguistically, Switzerland is quite a diverse country. Not only does it have four national languages – German, French, Italian, and Romansh – but in its German-speaking part, the sociolinguistic situation is what Ferguson (1959) called "diglossic", meaning that the speech community uses two different varieties depending on the communicative context. Specifically, Alemannic (ALM) dialects, commonly referred to by the umbrella term Swiss German[1] (SwG) or *Schwyzerdüütsch*, functions as the "low variety", i.e. the vernacular used in oral communication by all German-speaking Swiss independently of social class. It is no official language and has no formally defined orthographical rules, even though certain conventions regarding the spelling exist. Yet these conventions are either region-specific such as in the canton of Bern, where there is a relatively long tradition of literature written in dialect (Marti 1985a), or register-specific, i.e. Dieth's (1938) spelling based on phonology that is most often used in an academic context or in dialect literature, where there is a need for a certain regularity. In everyday life, these conventions have a relatively low level of awareness, however. The "high variety" is represented by Swiss Standard German (SSG) or *Schweizerhochdeutsch*, the official language also called *Schriftdeutsch* (verbatim 'script German'), which hints at the context in which it is used. It is acquired at school and is mostly spoken in formal settings, specifically in education, for military commands, in church, in political speeches in parliament, most contexts of broadcasting and printing, to address non-SwG speakers, and for deaf people who would like to be able to lip-read standard German (Rash 1998: 52). SSG is grammatically slightly more complex than ALM (Ferguson 1959: 333), and it has a vast amount of literature due to it being the variety traditionally chosen for written communication.

To understand the situation in German-speaking Switzerland (CH) better, this paper will first give an overview of its dialectological diversity, followed by a description of the vowel and consonant systems in four dialects as well as in the respective standard varieties; this overview allows us to state the research questions (RQs) regarding vowel and consonant quantity that guide the experimental investigation of the current study.

[1] ALM is not solely spoken in CH but also in all its surrounding countries. Thus, even though SwG and ALM are often used synonymously (which for simplicity's sake will also be done in this study), one should bear in mind that they are dialectologically distinct.

Subsequently, the methods used will be described, and the results will be presented and discussed. Finally, the article will end with a conclusion and suggestions for future research.

1.1 Dialect diversity in German-speaking Switzerland

The dialects spoken in CH can be grouped into four main areas (Christen et al. 2013: 29–30): Low ALM, spoken only in the city of Basel, High ALM, spoken in the northern half, Highest ALM, spoken in the southern half, and since the end of the 19th century also Southern Bavarian, which is only present in the village of Samnaun in the easternmost region of the canton of Grisons (Haas 2000: 71). Due to their relatively low number of speakers, Low ALM and Southern Bavarian are not part of the scope of this study.

Generally, ALM dialects in CH can be divided along two main axes (Hotzenköcherle 1984) as depicted in Fig. 1: There is the north-south divide, which roughly separates High from Highest ALM, and an east-west divide. While these divides are a simple way to bring structure into the considerable dialectal diversity within CH, they are by no means clear-cut. Rather, they are based on the average of several isoglosses. When we look at the north-south divide, for instance, we can see that in the north, hiatus diphthongisation exists whereas in the south it does not. E.g., the ALM equivalent of the verb ‘to snow’ will be [ˈʒ̊niː.ə] in the south and [ˈʒ̊nei̯.ə] in the north. Along with other phonetic, lexical, or morphosyntactic isoglosses as well as cultural borders that run in parallel to the hiatus diphthongisation, an approximate north-south division can be extrapolated (Hotzenköcherle et al. 1986). The situation with the east-west divide is similar. In this case too, the approximant average of numerous isoglosses as well as cultural differences splits CH in half. Thus, for example, can we find the close-mid front unrounded vowel [e] as the nucleus of the equivalents of the noun for ‘bed’ in the east, i.e. [b̥et], and the open-mid front unrounded vowel [ɛ] in the west, i.e. [b̥ɛt]. When the two axes are superimposed on a map, we see four broad regions that are linguistically distinct from one another (Fig. 1). Nevertheless, there is still a lot of variation in those regions, but as a general classification of dialects, the resulting four quadrants are practical and linguistically valid.

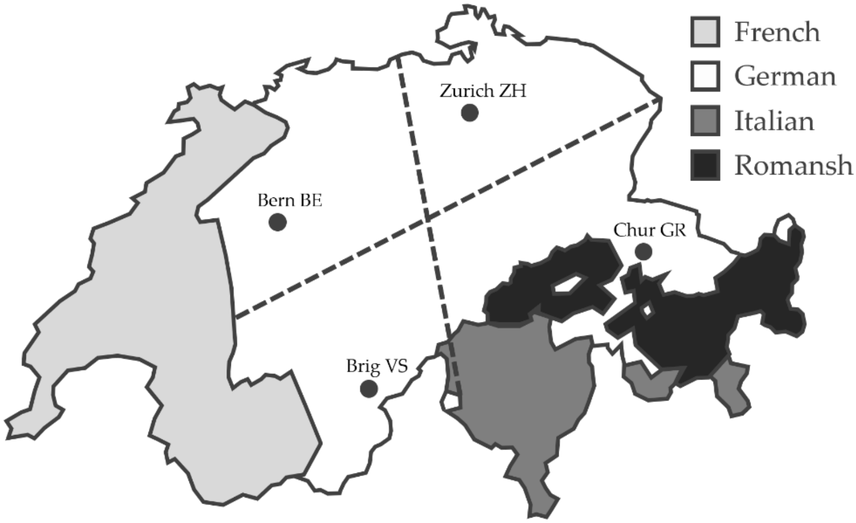

Fig. 1: Approximation of the ALM dialect quadrants in CH with the four cities whose dialects were scrutinised.

Previous research, in the early 20th century as well as more recently, has often focussed on the dialects of Bern (BE), Chur (GR; as it is located in the canton of Grisons), Brig (VS; as it is located in the canton of Valais), and Zurich (ZH), as these cities inhabit many speakers in their respective quadrant (e.g., Bigler 2007; Eckhardt 1991, 2016; Fleischer & Schmid 2006; Fulop 1994; Ham 2001; Keller 1961; Ladd & Schmid 2018; Leemann et al. 2014a, 2014b, 2018; Leemann & Siebenhaar 2007, 2008, 2010; Schmid 2004; Seiler 2005; Werlen 1977; Willi 1996). Thus, this current study will analyse the same four dialects due to the amount of documentation that can be used for a comparison.

1.2 Vowel and consonant quantity

1.2.1 Vowel and consonant quantity in Alemannic

Most ALM vowel systems have a rather big phoneme inventory, containing for instance typologically marked sounds such as front rounded vowels (Ladefoged & Maddieson 1996: 292). Though the dialects differ regarding certain vowel qualities, there is one common feature, i.e. the existence of two phonemic vowel quantities, namely long and short, and it is not very difficult to find minimal pairs in each dialect solely distinguished by vowel quantity, e.g., BE SwG [ˈʋæg̥] ‘because’ vs. [ˈʋæːg̥] ‘way’, GR SwG [ˈb̥ud̥ɑ] ‘Buddha vs. [ˈb̥uːd̥ɑ] ‘hut’, VS SwG [ˈʋiz̥ə] ‘meadow’ vs. [ˈʋiːz̥ə] ‘to indicate’, or ZH SwG [ˈz̥ib̥ə] ‘seven’ vs. [ˈz̥iːb̥ə] ‘to sieve’. As a matter of fact, it is so undisputed that Dieth’s (1938) suggestion for SwG orthographical rules is based on the two-way contrast in that V are written with one grapheme, and Vː with two. While all SwG dialects have V and Vː, the lexical distribution of vowel quantity is dialect-specific. So, for instance, the SwG equivalent of the verb ‘to bathe’ is pronounced with V in BE, i.e. [b̥ɑd̥ə] (spelled <bade>), while it is pronounced with Vː in the northern Lucerne dialect (LU), i.e. [b̥ɑːd̥ə] (spelled <baade>). For a detailed discussion of the specific vowel systems including the dialect-specific phoneme inventories, see Keller (1961: 87–115) for BE SwG, Eckhardt (1991) for GR SwG, Werlen (1977) for VS SwG, and Keller (1961: 30–86) or Schmid (2004) for ZH SwG. The differences in dialect-specific vowel inventories are, however, irrelevant for the purpose of this study.

Now turning to the consonant system, SwG has been used as a textbook example to outline the concept of *fortis* and *lenis* obstruents since the late 19th century (e.g. Sievers 1876; Winteler 1876). The two terms refer to a phonological contrast between homorganic obstruents which is implemented phonetically by duration and/or intensity rather than by the absence or presence of vocal-fold vibration. Specifically, fortis consonants tend to be longer and/or uttered with more energy than lenis ones. In the case of SwG, it has been proven that the main phonetic correlate used to contrast /b̥ d̥ g̊/ from /p t k/ is not Voice Onset Time (VOT) or intensity, but a difference in closure duration (Enstrom & Spörri-Bütler 1981: 138), which typologically occurs rather rarely, especially word-initially (Ladefoged & Maddieson 1996: 93). This had historically already been confirmed in analyses of various Swiss dialects, e.g. Streiff (1915) and Winteler (1876) for Glarus SwG, Berger (1910) and Wiget (1916) for St. Gall SwG, Vetsch (1910) for Appenzell SwG, Enderlin (1913) for Thurgovian SwG, Wanner (1941) for Schaffhausen SwG, or Fischer (1960) for LU SwG. When trying to determine other phonetic correlates involved in the distinction between fortis and lenis, Dieth & Brunner (1943: 746–751) found that the intraoral pressure is higher for fortes, even though there was much interspeaker variation. However, they too concluded that closure duration is the most salient correlate of fortis and lenis plosives in SwG. Enstrom & Spörri-Bütler (1981) provided evidence that VOT indeed does not play a crucial role in SwG, which Ladd & Schmid (2018: 239–241) confirmed in a recent study. While they showed that closure duration is the main factor, they pointed out that secondary cues typically used to distinguish voiced from unvoiced stops, i.e. a higher F0 after voiceless obstruents and a lower F0 after voiced obstruents, are present in ZH SwG, too, in that F0 is higher after fortes.

Besides the phonemic contrast between fortis and lenis, there are other factors that influence consonant duration. Dieth & Brunner (1943: 744–746) report that for intervocalic consonants the phonological environment, specifically the length of the preceding vowel, affects their length in that they will be shorter after Vː and longer after V. Moreover, the position within the word can influence a consonant's length as well, in that fortes in word-medial position tend to be longer than fortes in word-final or word-initial position.

This state of affairs has led to different phonological analyses of the ALM obstruent system, where basically two different approaches can be identified. According to Kraehenmann (2003: 116), one should distinguish two categories, namely singleton and geminate, which correspond to lenis and fortis. In contrast, Ham (2001: 61) argues that three distinct consonant categories exist, i.e. lenis, fortis, and geminate. This is because fortes after V have a longer closure duration than fortes after Vː. While Ham refers to them as "geminates" (i.e. double consonants), other researchers also call them "extrafortes" (Schmid 2019) as they are in complementary distribution to normal fortes, which occur after Vː and word-initially.

The concept of *geminate* comes in handy to describe certain sandhi phenomena, e.g. the regressive assimilation of two (in some cases even three) obstruents, a phenomenon which happens regularly in SwG. As Moulton (1986: 388) puts it: "Swiss German has a sandhi rule whereby most sequences of stops, fricatives, and nasals must be either all labial, or all dental, or all velar." Therefore, if in a sequence of words two or more stop phonemes follow one another, they are phonetically realised in one articulatory gesture, assimilated to the rightmost plosive such as in the LU SwG sentences *Hèsch t Beeri kchouft?* [hɛʃ ˈpːeːri k͡χɔu̯ft] 'Did you buy the berries?', where there is one assimilation, or *Wär hèd t Beeri ggässe?* [ʋ̥ær hɛ‿ˈpːeːri ˈkːæsːə] 'Who ate the berries?', where there are two assimilations. In either case, the fortis-lenis contrast is overturned and replaced by an overall closure duration that appears to be like the one of extrafortes. This is, however, not the focus of the present study despite the need for more research, as currently I am not aware of any acoustic study that measured the duration of word-initial fortes that arise from a sandhi process. Consider, nevertheless, that word-initial long stops are typologically rare (Ladefoged &

Maddieson 1996: 93), not least because if the word occurs utterance-initially as well, no acoustic reference point for the beginning of the plosive is available, rendering it auditorily ambiguous (Kraehenmann 2001: 141).

Summarising our knowledge about consonant quantity in ALM, we may claim that the phonological structure of the consonant systems is basically the same, while the phonotactic and lexical distribution of particular consonants differs among dialects. For instance, Basel SwG has a lenis plosive in word-initial position for [ˈd̥aːg̊] 'day', whereas GR SwG displays a fortis plosive there, i.e. [ˈtaːg̊]. The same applies to sonorants such as e.g. in the ZH SwG word [ˈhɒlə] 'hall', which is pronounced with a long /l/ in northern LU SwG, i.e. [ˈhɑlːə]. These examples show that while all dialects share the phonological quantity contrast in their consonant inventories, they differ regarding the phonotactic environment where these quantity contrasts are implemented.

1.2.2 Vowel and consonant quantity in Swiss Standard German

Presently, not much research has been conducted on the phonetics of SSG. The most comprehensive analysis so far has undoubtedly been done by Hove in her dissertation (2002), whose insights have been extended in many of her subsequent authored and co-authored articles and books (Hove 2008a, 2008b; Haas & Hove 2009; Christen et al. 2010). Siebenhaar has conducted research on SSG as well, with a focus on quality (1994; Siebenhaar & Wyler 1997). In his (1994: 53) study, he even recorded the same speakers speaking ALM and SSG but did not systematically analyse the ALM data. In this section, the concept of *SSG* will be elucidated and then it will be described how phonological quantity is expressed.

The word *standard* in Swiss Standard German may suggest a certain homogeneity and prescriptive pronunciation regulations. However, SSG is better described as a number of linguistics conventions, which serve to give its speakers a sense of group affiliation (Hove 2002: 6–10). There are multiple allophones available for a certain phoneme or a certain phoneme cluster. These allophones mostly have their origin in the speaker's respective ALM phoneme repertoire. Some of these phonemes are included in the linguistic conventions, some are not. Those not included in the conventions are linguistically marked, and speakers will try to avoid them as they are rather stigmatised. For instance, the pronunciation of <k> as the affricate [k͡x] rather than [kʰ] is very salient and generally has a negative connotation.

Yet, it is also not recommended to reach the ideal norm, i.e. prescriptive standard German (i.e. *Bühnendeutsch*, Engl. 'stage German'), as it may be perceived as too elitist. The resulting variety based on these conventions will be called *typical SSG* in the context of this study. These conventions may, however, change over time. For instance, <st> used to be pronounced as [ʃt] in all phonological environments – like in ALM – up until about the end of the 19th century. Pronouncing it as [st] was regarded as too German or too snobby. In the beginning of the 20th century this changed and <st> was only pronounced as [ʃt] in the syllable onset, elsewhere as [st]. From then on, the perception of [ʃt] everywhere else but in the onset was regarded as too close to the dialects (Hove 2002: 7). Thus, which allophones belong to the convention is determined by the zeitgeist.

Nevertheless, there being conventions does not imply that everyone abides by them, not least because occasionally there are many different variants to choose from and/or the speakers' dialect influences the way in which they speak SSG. Furthermore, sociolinguistic factors such as the educational background may also influence SSG. A very salient feature of supposedly uneducated speech is the pronunciation of /k/ as the affricate [k͡x] as mentioned before. This occurs as [k͡x] in most ALM dialects as well, while in German Standard German (GSG) it is pronounced as [k^h]. Thus, using the affricate [k͡x] in SSG is considered a clear ALM interference (Hove 2002: 134). This proneness to dialectal interferences for less educated people may be due to a lack of practice or knowledge since they are less likely to find themselves in a situation where the standard must be spoken (Hove 2002: 20). As one does not want to appear uneducated, variants that bear a connotation with low education are stigmatised and thus collectively avoided. But there is also intraspeaker variation, which is situationally or sociolinguistically determined. As for the former, if speakers find themselves in a formal context, such as being recorded and broadcast, they will monitor their speech more. Here, it is more likely that sounds included in the conventions will be uttered. In contrast, if someone speaks to a non-Swiss friend in their leisure time, there will be less monitoring, which makes it more likely that sounds not included in the conventions are used. There is, however, an exception to this, which is sociolinguistically motivated. Namely, it may occasionally prove beneficial to sound less educated, and different pronunciations are thus used strategically. If e.g. someone wishes to bond with a group of people, they can assimilate to the group's linguistic behaviour and appear more closely related to them. This is often applied by educated politicians to linguistically show how similar they are to the less educated (Rohrer 1973:

14; Löffler 1991: 44). Hence a greater variability can be observed, from which it can be referred that no real homogeneity exists in SSG pronunciation.

The SSG consonant system is generally adopted from ALM (Boesch 1957). While lenis /b d g/ can be produced as voiced or devoiced plosives, most of them are produced without voice (Hove 2002: 81–82). Similarly, the difference between <s> and <ss>/<ß> is determined by length and intensity both in ALM and SSG (Hove 2002: 83). Quantity-wise, next to fortes and lenes, extrafortes occur as well, mediated by their presence in ALM, where they can be found to varying degrees. Interestingly, even if the ALM equivalent of a SSG word with a typically geminated consonant does not have an extrafortis, such as [ˈtɒnə] 'fir tree' (e.g. ZH SwG), speakers of these dialects often pronounce the consonants in question with an extrafortis in SSG (Hove 2002: 85–86; Siebenhaar 1994: 45). The reason being, SSG traditionally is the written variety and thus spelling influences pronunciation. Specifically, vowel shortness is mostly orthographically represented by a subsequent double consonant spelling, e.g. as in <Schatten> /ˈʃatən/ 'shadow/shade'. There are some exceptions to this in that words containing /k/ will be spelled with <k> after Vː, but with <ck> after V. Nevertheless, the phonemic fortis plosive after V, phonetically appearing as an extrafortis, will be associated with the double letter. This association is then analogically transferred to all VCː words, fostering a spelling-based pronunciation (Hove 2002: 85). Due to this, as the ALM consonant system is transferred to SSG, even speakers of dialects with a limited degree of extrafortes will use those sounds in SSG where they would not in their own dialect (Hove 2002: 86). To summarise how the SSG consonant system works, the concept of *norm* comes in handy again. While there is a certain amount of convergence amongst the speakers, there is also much variation, which is why the term *rule* would not be accurate.

Regarding the vowel system, quantitatively not many differences exist between ALM and SSG, as the former is transferred to the latter. Yet when SSG is compared to GSG, the discussion about quantity becomes a bit controversial. Iivonen (1994: 318–326) has found that in absolute numbers, vowels are slightly longer in SSG than in GSG. Simultaneously, Vː also tends to be shortened more often in SSG if it is in a prosodically weak position in a sentence, as e.g. in *Sie sind mit Fragen über mich hergefallen.* 'They came at me with questions.', where the <ü> in the word *über* 'over' should prescriptively be pronounced with Vː. The fact that the ALM equivalent of *über* is pronounced with V might also influence this shortening phenomenon. There are, however, also words that can vary between V and Vː. Most often this occurs with vowels preceding /r/ (Hove 2002: 71) but it can also be lexically conditioned such as in *Igel* ‘hedgehog’, where GSG prescriptively has Vː, or *Büste* ‘bust’, where GSG has V (Panizzolo 1982: 15–18). A list with more examples can be found in Christen et al. (2010: 244–245). Furthermore, Siebenhaar (1994: 54) states that he has found more instances of long vowel shortening than short vowel lengthening in his data. Unfortunately, the reasons for the shortening of long vowels are not very clear. One could argue that it is due to dialect interference as the majority of the words on Christen et al.’s (2010) list have V in their ALM equivalent. For instance, the word *Kino* ‘cinema’ prescriptively has Vː in GSG but in most ALM dialects it is pronounced with a V. Furthermore, it is spelled with only one letter <i>, which might orthographically reinforce the vowel’s shortness. However, for the hypotheses of dialect interference and spelling pronunciation the following two counterarguments exist. Firstly, there are also words that do not have an ALM equivalent such as *ging* ‘went’ that should prescriptively be pronounced with V in GSG. Yet, Swiss speakers tend to favour Vː even though ALM does not have a direct translation as there is no simple past tense. Secondly, there are words, such as *gibt* ‘gives’, that have a prescriptive V in both ALM and GSG[2], yet SSG speakers produce it with Vː. Here, dialect interference would be rather unexpected, and the argument regarding a single-letter spelling does also not work as the spelling would already suggest V. In fact, Hove (2002: 71) finds that out of 25 instances of *ging* and *gibt* in her analysed corpus, SSG speakers produced 18 long vowels, 4 semi-long vowels, and only 3 short vowels. Further research is needed to understand these inconsistencies in vowel length.

At this point, it is important to underpin the sociolinguistic and phonological differences between the varieties of CH and the ones of other southern German-speaking areas which have been investigated recently. From a sociolinguistic point of view, in Bavaria and in the Viennese area the high varieties (GSG and Austrian Standard German (ASG), respectively) are much more spoken in everyday life than in CH (Ammon et al. 2016: XLIII–LVII) such that structural patterns of the standard language may be adopted in the low varieties as well (West Central Bavarian (WCB) in Munich; East Central Bavarian (ECB) in Vienna). Moreover, ALM differs from WCB and ECB dialects from a phonological point of view in that both ALM and

[2] The norms of GSG are based on northern German varieties. In southern varieties, the pronunciation of *gibt* ‘gives’ with Vː is also acceptable. Therefore, regional variation does indeed occur.

standard German allow four different patterns of vowel and consonant sequences (VC, VCː, VːC, and VːCː), whereas WCB and ECB dialects only allow sequences of complementary length (i.e. VːC and VCː), and sequences with equal quantity (VC and VːCː) do not occur in the traditional dialects (Kleber 2017). However, recent studies indicate that GSG and ASG both influence their respective regional Bavarian dialects regarding VC quantity in that the patterns that used to be phonotactically illegal (i.e. VC and VːCː) are becoming accepted by current dialect speakers (see Jochim & Kleber 2017; Jochim et al. 2018; Klingler et al. 2019; Schmid et al. 2019). While in WCB, this language change seems to be linked to the age of speakers, in ECB, age did not seem to be a key factor. Rather, it was assumed that lexical diffusion evoked by language contact is responsible for the change in quantity patterns observed in Central Bavarian.

Since ALM dialects are the dominant varieties in CH, it is possible that they influence the SSG quantity patterns, and not vice versa. Therefore, by focussing on the Swiss situation, the current study complements the research done on southern German varieties.

1.3 Research questions

Since the accent is rather salient when a Swiss person speaks standard German, the main RQ guiding the current study is the following:

RQ1: Is it possible to infer the ALM dialect of a speaker by analysing their spoken SSG regarding vowel and consonant length?

RQ1 is rather loaded entailing aspects of description, and prediction. To elucidate these aspects, it has been broken down in the following more specific RQs.

RQ2: How are vocalic and consonantal durational contrasts implemented in the four ALM dialects?

RQ2 is very descriptive. Consonantal length has been investigated in several ALM dialects (see Ham 2001 for BE; Kraehenmann 2003 for Thurgovian; Willi 1996 for ZH). Regarding vowel duration, the only experimental studies are on ZH (Schmid 2004), and to a minimal degree on BE (Ham 2001). Therefore, this study for the first time provides descriptive data on VC quantity and duration in GR and VS, and builds upon the minimal data collected for BE by Ham (2001).

RQ3: How are vocalic and consonantal durational contrasts implemented in SSG?

While there is a certain amount of research concerned with vowel and consonant quality in SSG (in particular Hove 2002; also Siebenhaar 1994 and Christen et al. 2010), the current study focuses on vowel and consonant quantity, a topic on which only little research has been conducted. From a phonetic point of view, SSG is, however, still underresearched: the existing literature is either concerned with prosody (Ulbrich 2002; Ulbrich & Ulbrich 2007) or does not contain specific measurements on the different types of plosives (Hove 2002). Moreover, the studies done so far were mainly based on ALM (e.g. Willi 1996; Schmid 2004; Leemann 2017).

RQ4: Do speakers' ALM quantity systems influence the way in which they speak SSG?

Moreover, the current study analyses the same speakers' ALM and SSG systematically for the first time. RQ4 deals with the predictive aspect of the study. Are the ALM quantity systems stable and do they affect SSG, or does SSG have its own quantity system, independent of the ALM one?

2 Methodology

2.1 Speakers

From each region, i.e. BE, GR, VS, and ZH, 8 speakers (4 male, 4 female; age range 17–32 years; mean: 22.5; standard deviation (SD): 3.42) were recorded, which resulted in a total of 32 speakers. At least one of each speakers' parents had to have grown up speaking the same dialect. Furthermore, the speakers had to either still live in the same city as they had grown up in or they could not have lived in another city for more than one year, reducing the amount of dialect contact. Lastly, speakers who met all these requirements, but who had a parent from another German-speaking country were excluded. The participants were reimbursed for their time with CHF 15.00 per 30 min of testing, so most of them received CHF 45.00 as most recording sessions lasted between 60–90 min.

2.2 Wordlists

For each dialect (BE, GR, VS, and ZH) and for SSG, disyllabic words with stress on the first syllable were chosen. All words contained one of the vowels /i a u/ plus the plosives /p b̥/, /t d̥/, or /k g̊/, the sonorants /l n/, or the fricatives /s z̥/ in the four possible vowel-consonant sequences VC, VCː, VːC, and VːCː. This resulted in 61 words for BE, 65 words for GR, 59 for VS, 64 words for ZH, and 62 words for SSG. The discrepancy in word counts is due to the specific phonotactic constraints of each variety.

In BE, short vowels in stem syllables have not undergone the Middle High German (MHG) lengthening process (Marti 1985b: 29), e.g. MHG *jagen* ‘to hunt’ has kept its short vowel in BE [ˈjɑg̊ə] (Kluge & Seebold 2011: 453), and stressed long vowels in open syllables have been subjected to MHG Open Syllable Shortening (OSS), e.g. MHG *b(e)līben* ‘to stay’ has lost its long vowel in BE [ˈb̥lib̥ə] (Kluge & Seebold 2011: 131). As evident from these two examples, MHG allowed both short as well as long vowels in stressed open syllables, and while in GSG only long vowels occur in stressed open syllables due to Open Syllable Lengthening (OSL; Lahiri & Dresher 1999), BE has encountered the opposite development (Seiler 2005: 477). Therefore, only a few BE words exist that fit the requirements of this experiment, namely those that have made it into its lexicon after the sound change had been completed. Nevertheless, anecdotal evidence suggests that the rule of OSS is still productive in BE, as in an interview, a speaker of this dialect referred to the ALM equivalent of the new verb *googeln* ’to google’ as /ˈg̊ug̊lə/ rather than the expected /ˈg̊uːg̊lə/. The situation in GR is slightly more complex. Eckhardt (1991: 36–38) states that the quantity opposition between short and long vowels might be disappearing and that there are interspeaker differences observable regarding vowel length. Therefore, it was not always guaranteed that the speakers abided by the GR model put together for this study. In VS, Old High German *ū* has developed into /yː/ except before /v/ (Wipf 1910: 35), so words containing /uː/ are rather rare and only occur in newer loan words that were adopted into the VS lexicon after this palatalization had occurred. In ZH, MHG short vowels were either maintained or shortened again after they had undergone OSL. In this context, Weber points out that a certain degree of variation regarding short and long vowels can be observed in ZH, correlating with the age of the speaker (1987: 70–75). Nevertheless, during the list-compilation process, words without much reported variation were chosen.

These words were then put into a generic carrier phrase created for each variety to limit data-skewing effects such as phrase-final lengthening and list intonation patterns. The phonological environment preceding the target word gap was a vowel in each carrier phrase to mitigate against coarticulation. All ALM carrier phrases consisted of four syllables (i.e. six with the target word), while the SSG one consisted of five (i.e. seven with the target word). The carrier phrases were (Engl. ‘I said ___ too.’): <Ig ha o ___ gsèit.> for BE; <I han au ___ gsait.> for GR; <Ich ha öi ___ gsèit.> for VS; <Ich han äu ___ gsäit.> for ZH; and <Ich habe ___ gesagt.> for SSG. As there is no official orthography for ALM dialects, all target words as well as carrier phrases were written in Dieth’s (1938) spelling. Minimal changes were applied to Dieth’s system e.g. when standard German uses <h> after a vowel as an indicator for vowel lengthening. This means that ALM equivalents of e.g. the standard German word *Fahne* ‘flag’ were spelled as <Fahne/Fahna> rather than <Faane/Faana> to avoid unfamiliarity effects. Similarly, ALM words with short liquids and nasals spelled with a double letter in standard German, as e.g. *Halle* ‘hall’ and *Tanne* ‘fir tree’, were spelled with double letters in non-geminating dialects such as ZH as pilot tests had revealed that speakers do not recognise the words if they are spelled in line with Dieth as <Hale> and <Tane>.

2.3 Data gathering and processing

2.3.1 Interview

In the beginning of each session, an interview lasting about 10 minutes was conducted with the aim to familiarise the interviewees with the recording situation and elicit a natural speech style. Speakers were told the interview was about finding out their attitudes towards ALM and SSG, and metadata about their linguistic background were collected (recorded with *Audacity* version 2.1.2). Those data have not been used for the analysis, however.

2.3.2 Recording procedure

After the interview, the actual data-gathering procedure began. All recording sessions included six blocks containing three ALM blocks and three SSG blocks in alternating fashion with block-internal randomised word order. The programme used was *SpeechRecorder*, version 3.28.0 (Draxler & Jänsch 2004) with the interface *USBPre® 2* by *Sound Devices* and the microphone *NT2-A* by *RØDE* (at 16-bit/44.1 kHz in mono, stored as .WAV). If possible, the recordings took place in the recording booth at the Phonetics Laboratory of the University of Zurich. Otherwise the participants were recorded at their homes with the same interface model (*USBPre® 2* by *Sound Devices*) and the microphone *Opus 54.16/3* by *BeyerDynamic* (at 16-bit/44.1 kHz in mono, stored as .WAV). The entire dataset contains approximately 12,000 tokens.

2.3.3 Data preparation

The sentences were automatically segmented with an *R* script (courtesy of Markus Jochim, LMU Munich) using the *Munich AUtomatic Segmentation (MAUS) System* (Schiel 1999; Kisler et al. 2017) with the language setting *General Swiss German* for all SwG dialect sentences, and the language setting *standard German* for SSG sentences. The automatically segmented sentences were then uploaded to the *EMU Speech Database Management System* (Winkelmann et al. 2017), where each sentence was manually corrected by the author (78%) and, due to time reasons, two other researchers (22%). The corrections included the beginning and end of the utterance as well as the entire target word. The target consonant was split in two phases, i.e. (1) the closure phase and (2) the burst and release phase.

2.4 Analyses and statistics

The measurements were taken in *R* (2019) with a script courtesy of Markus Jochim (LMU Munich). It measured (1) the absolute duration of the target vowel in ms, (2) the absolute duration of the target consonant in ms, (3) the absolute duration of the target consonant's VOT in ms, (4) the absolute duration of the entire utterance in ms, (5) the duration of the target vowel normalised with the utterance duration, (6) the duration of the target consonant normalised with the utterance duration, and (7) the Proportional Vowel Duration (PVD; Kohler 1979). This metric, also called VC ratio (Kleber

2017; Klingler et al. 2019) or V:V+C ratio quotient (Ham 2001), describes how much of the duration of a vowel and consonant sequence is vocalic. Specifically, it is calculated as the duration of the vowel in milliseconds divided by the duration of the VC segment in milliseconds, i.e. V/(V+C). Short/long vowels are labelled V/Vː, while lenis/fortis consonants are labelled C/Cː, resulting in the four categories VC, VCː VːC, and VːCː.

File-naming conventions included information on the speaker ID, the dialect of the speaker, the repetition, the specific VC category as well as the phonological context of the target VC sounds. From this corpus, a subset of words with possibly nonmatching phonological vowel or consonant quantity in some ALM dialects and SSG was created. The subset contained the words *bade* 'to bathe', *Wiese* 'meadow', *zielen* 'to aim', *Kilo* 'kilogram', *Kino* 'cinema', *Bude* 'den', and *Tube* 'tube', which have Vː in SSG, but V in some ALM dialects. Moreover, *Bullen* 'cops', *Halle* 'hall', *Hunnen* 'Huns', *Kanne* 'jug', and *Pille* 'pill', were added, which have a long consonant in SSG but a short one in some dialects.

The statistical analysis was conducted in *R* (2019) with help from Sandra Schwab (University of Zurich). It included linear mixed-effects models (LMM) with the package *lme4* (Bates et al. 2015) with *dialect* and *VC category* as fixed factors (with interaction term), and either *normalised vowel duration*, *normalised consonant duration*, or *PVD* as dependent variables. With regards to PVD, four dialects and SSG could not be compared amongst themselves, as they did not include the same words but words that fit the dialect-specific VC paradigm. Rather, the means of each speaker's PVD in the specific VC paradigms were considered and compared to one another. Random effects included intercepts for *speaker* and *target word*, and slopes for *VC category*. The residual plots did not show any obvious deviations from homoscedasticity or normality. Post-hoc analyses, i.e. pairwise comparisons of contrast with the Tukey method, were done with *lsmeans* (Lenth 2016).

3 Results

The presentation of the results will start with a qualitative analysis of the interviews in the beginning of the recording. Subsequently, the results of the acoustical measurements of vowel and consonant length will be presented moving from the ALM data to the SSG data including the results of words where there is a difference in vocalic and consonantal quantity between some of the investigated dialects and SSG.

3.1 Alemannic

In this section, the results of the normalised vowel and consonant durations will be reported, followed by the PVD values in ALM. The normalised values represent the percental vowel or consonant quota in the utterance, while in each cell the mean is to the left, and the SD (in parentheses) is to the right. The values are to be interpreted as follows: the value .134, as in the case of the BE-Vː C vowel condition, implies that the vowel made up for 13.4% of the entire utterance.

3.1.1 Normalised vowel durations in Alemannic

The ALM vowel durations normalised by utterance length are summarised in Tab. 1 and visualised in Fig. 2. To begin with, the overall patterns within the four dialects are very similar. Vowels before fortis consonants (the two panels to the right) tend to be slightly shorter than before lenis consonants (the two panels to the left). There is one exception though, namely in BE, where the vowel in the VCː sequence (.069) is slightly longer than in the VC sequence (.068). A LMM with *normalised vowel duration* as dependent factor, *dialect* and *VC category* as fixed factors (with interaction term), and random factors for *speaker* and *target word* (both random intercepts) and *VC category* as a by-speaker random slope reveals the effect of *VC category* to be highly statistically significant ($F(3,191.09)=110.42$, $p<.001$), while the same does not hold for *dialect*. The interaction between *dialect* and *VC category* is statistically significant, too ($F(9,71.16)=7.99$, $p<.001$).

Let us thus proceed with pairwise comparisons of each group. Within each VC category, only one pairwise comparison reveals statistically significant differences. In the VCː category, the Tukey test reveals that the normalised vowel durations of BE and VS differ significantly ($p=.037$). The difference between BE and GR in the VC category, however, is not statistically significant ($p=.098$). When we look at the two Vː groups, only VS does not show a statistically significant difference between VːC and VːCː. The difference between the two Vː durations in the other three dialects, however, proves to be statistically significant (BE: $p<.001$; GR: $p=.028$; ZH: $p=.002$). Within the two V categories, only VS shows a statistically significant effect between VC and VCː ($p<.001$). Lastly, the long vowels in VːC and VːCː differ in each case in a statistically significant way from the short vowels in VC and

VCː (for VːCː-VC in GR: $p<.001$ and in VS $p=.005$; all other contexts of these two dialects as well as all four contrasts of BE and ZH $p<.001$).

Tab. 1: Normalised ALM vowel durations and SD (in parentheses) by speakers' dialect and VC category.

Category	**BE**	**GR**	**VS**	**ZH**
VːC	.134 (.028)	.128 (.027)	.116 (.027)	.128 (.023)
VːCː	.116 (.022)	.105 (.031)	.107 (.028)	.107 (.025)
VC	.068 (.018)	.081 (.024)	.069 (.018)	.068 (.014)
VCː	.069 (.015)	.067 (.015)	.059 (.014)	.061 (.014)

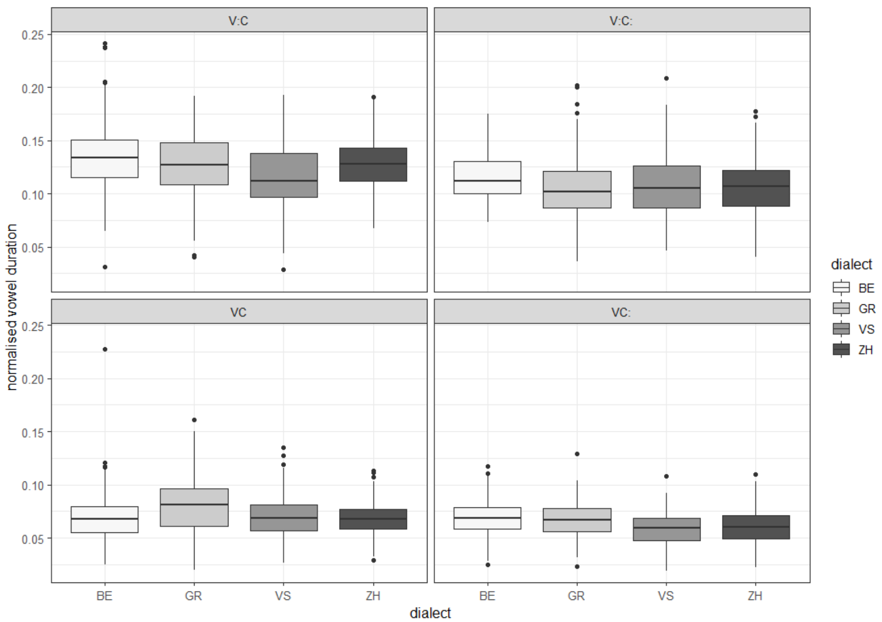

Fig. 2: Normalised ALM vowel durations by speakers' dialect and VC category.

3.1.2 Normalised consonant durations in Alemannic

The ALM consonant durations normalised by utterance length and SD are summarised in Tab. 2 and visualised in Fig. 3. Globally, the size relation for the normalised consonant duration of all four dialects is the following: VːC <

VC < V:C: < VC:. The LMM with *normalised consonant duration* as dependent factor, *dialect* and *VC category* as fixed factors (with interaction term), and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category* shows *VC category* to be a highly statistically significant factor ($F(3,197.07)=127.06$, $p<.001$), while *dialect* is just above the 5% threshold ($F(3,39.99)=2.71$, $p=.058$). The interaction between *dialect* and *VC category* is not statistically significant, thus no Tukey test was performed.

Tab. 2: Normalised ALM consonant durations and SD (in parentheses) by speakers' dialect and VC category.

Category	BE	GR	VS	ZH
V:C	.052 (.017)	.049 (.018)	.048 (.013)	.052 (.017)
V:C:	.104 (.020)	.094 (.020)	.099 (.019)	.095 (.016)
VC	.054 (.018)	.054 (.023)	.050 (.014)	.054 (.016)
VC:	.126 (.029)	.105 (.025)	.113 (.021)	.111 (.023)

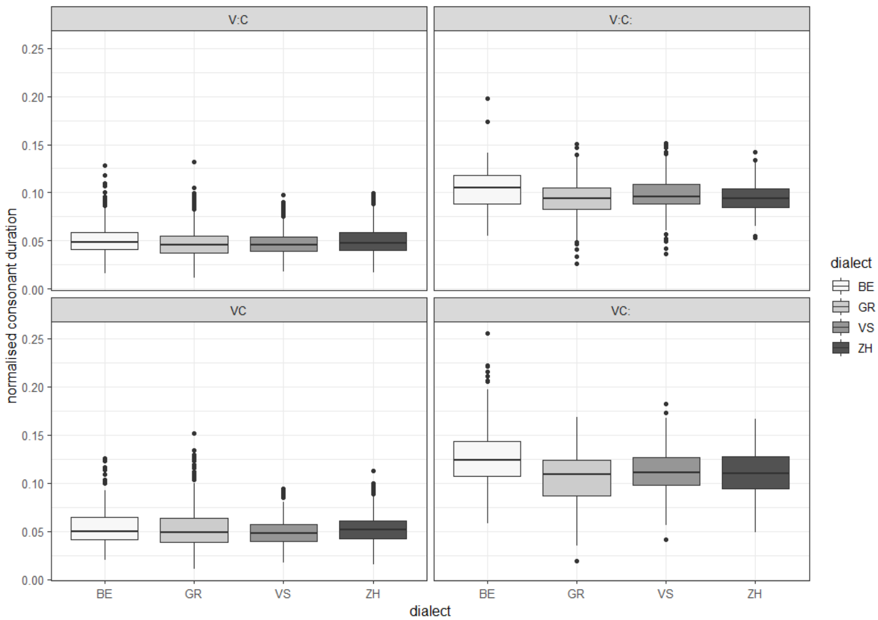

Fig. 3: Normalised ALM consonant durations by speakers' dialect and VC category.

To find out whether the two lenis and the two fortis categories are statistically significantly different from another due to the preceding vowel, additional LMM were performed for each dialect independently with *normalised consonant duration* as dependent factor, *VC category* as fixed factor, and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category*. The results show that *VC category* is a highly statistically significant fixed factor for each dialect (BE: $F(3,30.69)=40.16$, $p<.001$; GR: $F(3,59.88)=29.85$, $p<.001$; VS: $F(3,51.40)=73.78$, $p<.001$; ZH: $F(3,50.44)=47.23$, $p<.001$). Independent post-hoc Tukey tests within each dialect again reveal that the normalised fortis durations in VCː and VːCː are statistically significantly different in the dialects from BE ($p=.007$), and ZH ($p=.040$) but not in the ones from GR ($p=.412$), and VS ($p=.125$). The two normalised lenis durations were not statistically significantly different from one another in any of the four dialects.

3.1.3 PVD in Alemannic

Tab. 3 summarises mean PVDs of the four dialects while Fig. 4 visualises these findings. The LMM with *PVD* as dependent factor, *dialect* and *VC category* as fixed factors (with interaction term), and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category* shows *VC category* to be highly statistically significant ($F(3,196.97)=250.34$, $p<.001$), while *dialect* is not. The interaction term shows that the difference between the VC categories is statistically significantly different amongst the dialects ($F(9,72.58)=3.22$, $p=.002$).

Tab. 3: Mean ALM PVD and SD (in parentheses) by speakers' dialect and VC category.

Category	BE	GR	VS	ZH
VːC	.720 (.064)	.723 (.078)	.706 (.071)	.714 (.071)
VːCː	.527 (.057)	.522 (.095)	.514 (.085)	.524 (.072)
VC	.557 (.082)	.604 (.108)	.580 (.089)	.561 (.081)
VCː	.356 (.066)	.393 (.086)	.342 (.059)	.355 (.075)

The post-hoc Tukey test, however, shows that there are no statistically significant differences among the dialects within the four VC categories. Still, when we compare the four VC categories within the same dialect, there are three instances where no statistically significant difference was observed. Namely, the PVDs of V:C: and VC have a *p*-value above the threshold of *p*=.050 in BE, GR, and ZH. Only the VS PVDs differ statistically significantly (*p*<.001).

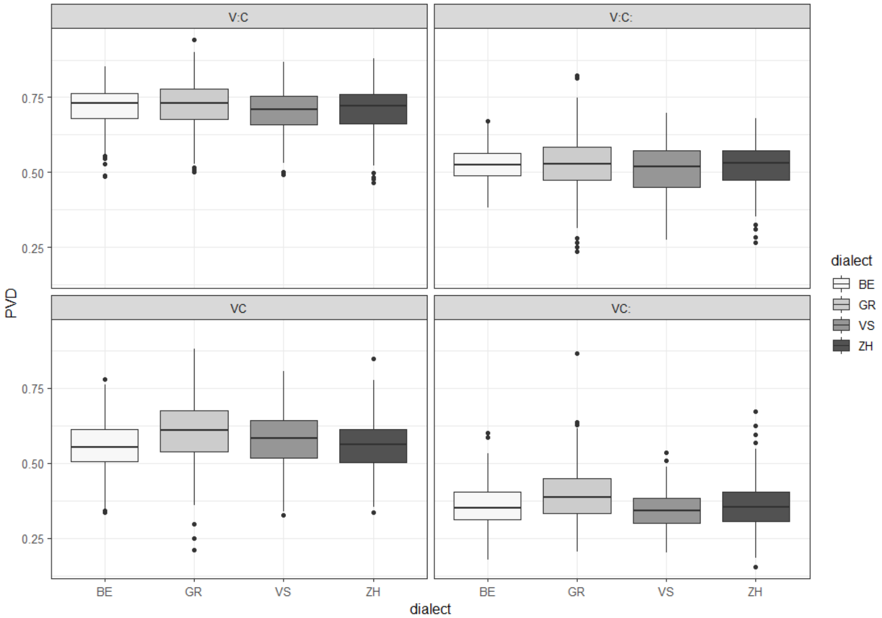

Fig. 4: Mean ALM PVD by speakers' dialect and VC category.

3.2 Swiss Standard German

Moving to the SSG results, commensurate with the ALM section, the normalised vowel and consonant durations will be reported first, followed by the PVD values; finally, the subset of the containing words with nonmatching vowel or consonant quantity in ALM and SSG will be looked at separately.

3.2.1 Normalised vowel durations in Swiss Standard German

The vowel durations normalised by utterance length are summarised in Tab. 4 and visualised in Fig. 5. The LMM with *normalised vowel duration* as dependent factor, *dialect* and *VC category* as fixed factors (with interaction term), and random factors for *speaker* and *target word* (both random intercepts) and *VC category* as a by-speaker random slope reveals *VC category* to be a highly statistically significant factor (F(3,66.01)=154.79, p<.001), while *dialect* is not. The interaction between *dialect* and *VC category*, however, is statistically significant with F(9,31.12)=3.06, p=.010.

Tab. 4: Normalised SSG vowel durations and SD (in parentheses) by speakers' dialect and VC category.

Category	**BE**	**GR**	**VS**	**ZH**
V:C	.101 (.024)	.107 (.025)	.104 (.023)	.108 (.025)
V:C:	.085 (.022)	.091 (.023)	.086 (.022)	.090 (.021)
VC	.056 (.018)	.064 (.019)	.063 (.017)	.062 (.018)
VC:	.052 (.013)	.054 (.013)	.051 (.012)	.053 (.013)

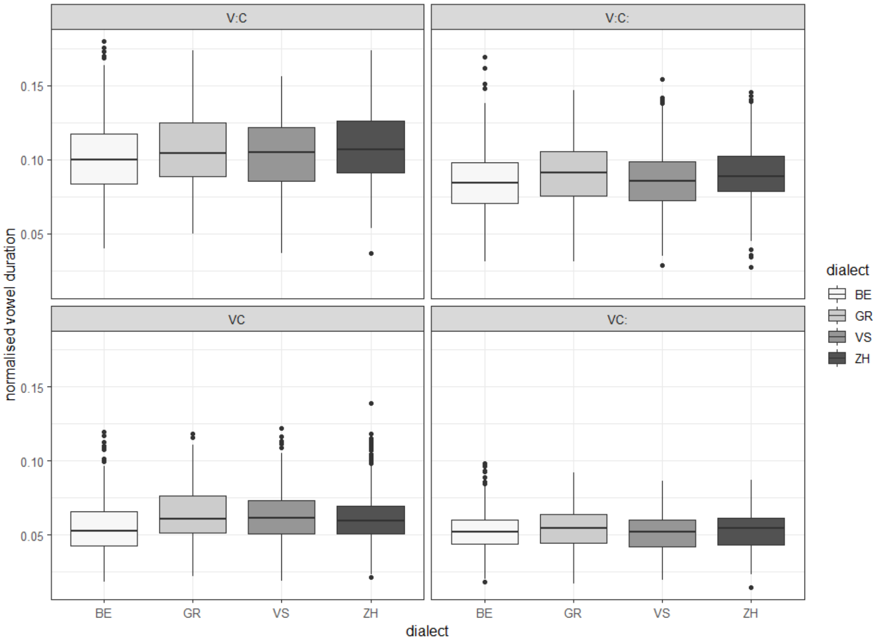

Fig. 5: Normalised SSG vowel durations by speakers' dialect and VC category.

Yet again, the four dialects behave very similarly. The Tukey test for each VC paradigm shows only one pair to be statistically significantly different, namely, the normalised vowel durations of BE and GR in the VC category (p=.037). Comparing the two V: categories within the dialects with one another, BE (p=.037), VS (p=.019), and ZH (p=.005) show statistically significant differences in vowel length between V:C and V:C:. The values for

GR just missed the 5% threshold (*p*=.056). The comparison of the two V categories within each dialect shows no statistically significant difference for any of the speakers' dialect.

3.2.2 Normalised consonant durations in Swiss Standard German

The normalised consonant durations (mean and SD in SSG) by utterance length are summarised in Tab. 5 and visualised in Fig. 6 for each of the four groups of speakers defined by their dialect. The LMM with *normalised consonant duration* as dependent factor, *dialect* and *VC category* as fixed factors (with interaction term), and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category* reveals *VC category* to be highly statistically significant ($F(3,76.87)=67.11$, $p<.001$), while the speakers' *dialect* is not. The interaction missed the $p=.050$ threshold ($F(9,31.47)=2.16$, $p=.054$), so no Tukey test was performed.

A LMM for each dialect independently with *normalised consonant duration* as dependent factor, *VC category* as fixed factors, and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category* reveals *VC category* to be highly statistically significant in each dialect (BE: $F(3,31.12)=14.92$, $p<.001$; GR: $F(3,48.21)=63.55$, $p<.001$; VS: $F(3,41.16)=56.71$, $p<.001$; ZH: $F(3,50.12)=17.18$, $p<.001$). Post-hoc Tukey tests within each dialect independently show that the normalised fortis durations in Vːː and VCː are statistically significantly different in all dialects (BE: $p=.016$; GR: $p=.004$; VS: $p<.001$; ZH: $p=.001$). No dialect shows statistically significant differences for the normalised lenis durations.

Tab. 5: Normalised SSG consonant durations and SD (in parentheses) by speakers' dialect and VC category.

Category	BE	GR	VS	ZH
VːC	.046 (.015)	.049 (.018)	.047 (.016)	.047 (.015)
VːCː	.082 (.024)	.077 (.019)	.085 (.022)	.078 (.023)
VC	.047 (.018)	.048 (.014)	.051 (.017)	.052 (.020)
VCː	.096 (.026)	.091 (.023)	.097 (.021)	.089 (.023)

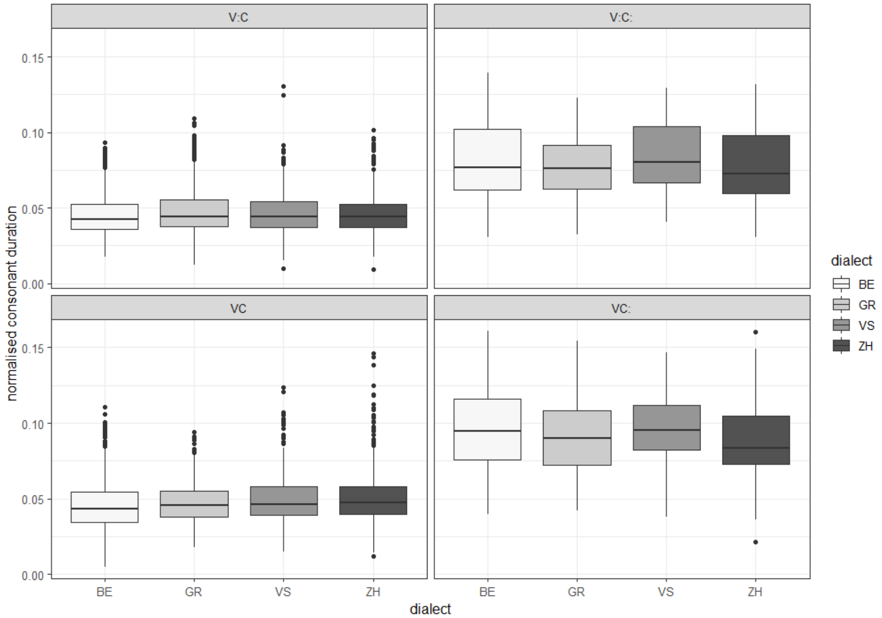

Fig. 6: Normalised SSG consonant durations by speakers' dialect and VC category.

3.2.3 PVD in Swiss Standard German

Tab. 6 summarises mean PVDs and SDs in SSG by their dialect, while Fig. 7 visualises these findings. With *PVD* as the dependent factor, the LMM with *dialect* and *VC category* as fixed factors (with interaction term), and random intercepts for *speaker* and *target word* as well as by-speaker random slopes for *VC category* shows only *VC category* to be highly statistically significant ($F(3,72.16)=211.29$, $p<.001$), while *dialect* as well as the interaction are not.

Tab. 6: Mean SSG PVD and SD (in parentheses) by speakers' dialect and VC category.

Category	BE	GR	VS	ZH
V:C	.685 (.079)	.688 (.085)	.686 (.073)	.697 (.071)
V:C:	.512 (.089)	.541 (.080)	.505 (.085)	.537 (.081)
VC	.548 (.115)	.569 (.099)	.555 (.095)	.547 (.107)
VC:	.358 (.078)	.374 (.079)	.344 (.067)	.377 (.076)

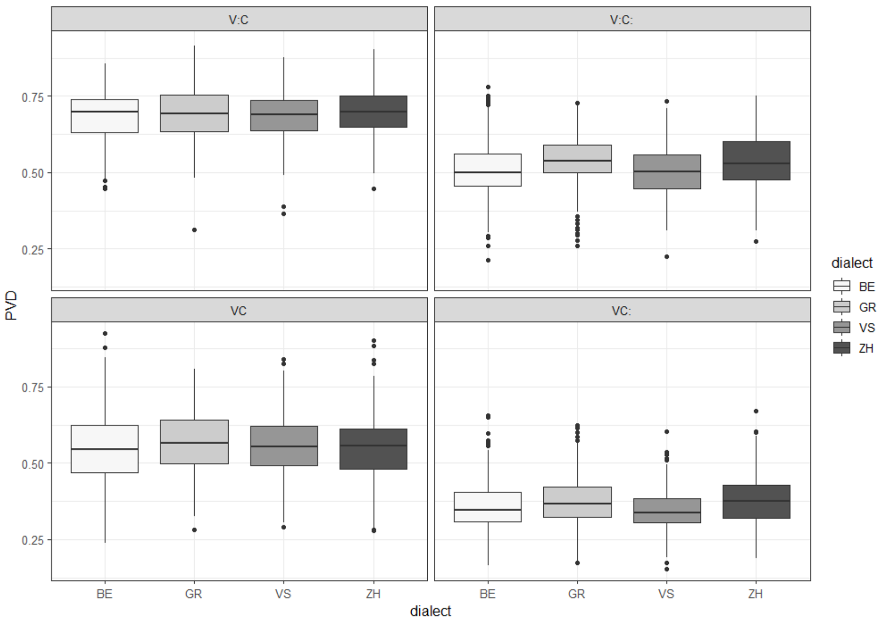

Fig. 7: Mean SSG PVD by speakers' dialect and VC category.

3.3 Quantitative discrepancies between the two varieties

Finally, let us have a look at a subset of SSG words that do not have the same phonological vowel or consonant quantity in ALM in each case. Tab. 7 provides an overview of the V/V: and C/C: distribution in the ALM dialects. Subsequently, the normalised vowel and consonant durations as well as the PVDs of each word are presented independently.

Tab. 7: SSG words that typically have V: or C: and the dialect-specific V/V: and C/C: distribution of the ALM equivalents. In GR, either version might occur, but the underlined version equals the traditional (i.e. prescriptive) pronunciation.

SSG word	SSG	BE	GR	VS	ZH
bade 'to bathe'	V:	V	V:	V	V
Wiese 'meadow'	V:	V	V:	V	V
zielen 'to aim'	V:	V	V	V	V
Kilo 'kilogram'	V:	V	V	V	V

Kino 'cinema'	V:	V	V	V	V
Bude 'den'	V:	V	V:	V	V:
Tube 'tube'	V:	V	V:	V	V:
Bullen 'cops'	C:	C:	C/C:	C:	C
Halle 'hall'	C:	C:[3]	C/C:	C:	C
Hunnen 'Huns'	C:	C:	C/C:	C:	C
Kanne 'jug'	C:	C:	C/C:	C:	C
Pille 'pill'	C:	C:[3s]	C/C:	C:	C

[3] vocalised to [u̯]

3.3.1 Normalised vowel durations in the subset

Tab. 8 summarises the mean values and SDs of the subset's vowel duration normalised by utterance length, while Fig. 8 visualises these results.

Tab. 8: Normalised vowel durations and SD (in parentheses) of the subset words that typically have V: in SSG but dialect-specific vowel quantity (V or V:) in ALM.

SSG word	BE	GR	VS	ZH
bade 'to bathe'	.117 (.021)	.132 (.018)	.122 (.015)	.128 (.017)
Wiese 'meadow'	.103 (.019)	.109 (.017)	.106 (.020)	.115 (.015)
zielen 'to aim'	.083 (.014)	.082 (.010)	.080 (.013)	.090 (.012)
Kilo 'kilogram'	.045 (.011)	.054 (.010)	.048 (.012)	.055 (.015)
Kino 'cinema'	.050 (.013)	.062 (.017)	.051 (.015)	.059 (.014)
Bude 'den'	.086 (.016)	.110 (.019)	.098 (.015)	.102 (.016)
Tube 'tube'	.075 (.015)	.080 (.014)	.075 (.016)	.075 (.015)

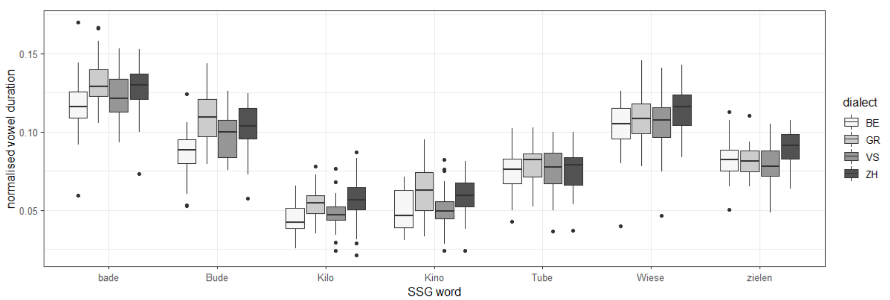

Fig. 8: Normalised vowel durations of the subset of words that typically have V: in SSG but dialect-specific vowel quantity (V or V:) in ALM.

The LMM with *normalised vowel duration* as the dependent variable, *dialect* as a fixed factor and *speaker* as random factor was run for each word independently. Only once did the fixed factor turn out to be statistically significant, namely for *Bude* 'den' (F(3,31)=3.81, p=.020). The dialect p-values for the remaining words were above the 5% threshold (*bade* 'to bathe' F(3,31)=1.67, p=.193; *Kilo* 'kilogram' F(3,32)=2.13, p=.116; *Kino* 'cinema' F(3,32)=2.04, p=.127; *Tube* 'tube' F(3,32.3)=.312, p=.817; *Wiese* 'meadow' F(3,32)=1.37, p=.270; *zielen* 'to aim' F(3,32)=1.57, p=.216).

The post-hoc Tukey test of the word *Bude* shows that the significance for the fixed factor dialect is based on one statistically significant difference between GR and BE with p=.021. Breaking up the data for *Bude* by speaker, we can see that, although there is interspeaker variation, two speakers in particular stand out as depicted in Fig. 9.

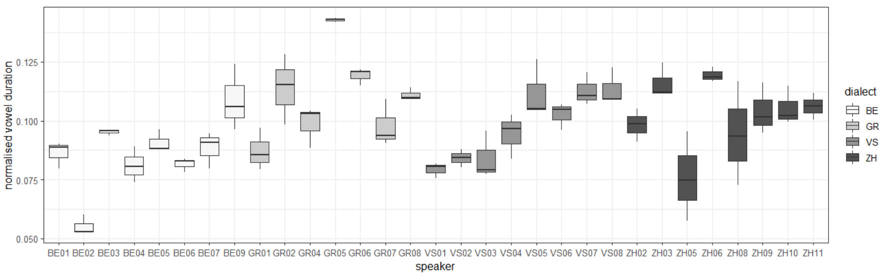

Fig. 9: Normalised vowel durations of the SSG word *Bude* 'den' by speaker.

That is, BE02 shows comparatively low normalised-vowel-duration values and GR05 shows comparatively high ones, while both demonstrated low intraspeaker variation. Lastly, ZH05 shows comparatively low values as well although with a greater amount of intraspeaker variation.

3.3.2 Normalised consonant durations in the subset

Tab. 9 and Fig. 10 present the results for the normalised consonantal durations. As it has been done for the vowels, an independent LMM was run for each word with *normalised consonant duration* as the dependent variable, *dialect* as a fixed factor, and *speaker* as random factor. No statistical significance for *dialect* has been found. The resulting F- and p-values of the words are as follows: *Bullen* 'cops' F(3,32)=2.39, p=.087; *Halle* 'hall' F(3,32)=2.31, p=.095; *Hunnen* 'Huns' F(3,32)=2.11, p=.118; *Kanne* 'jug' F(3,32.3)=2.04, p=.128; *Pille* 'pill' F(3,31.3)=2.34, p=.092.

Tab. 9: Normalised consonant durations and SD (in parentheses) of the subset of words that typically have Cː in SSG but dialect-specific consonant quantity (C or Cː) in ALM.

SSG word	BE	GR	VS	ZH
Bullen 'cops'	.077 (.019)	.062 (.009)	.054 (.009)	.056 (.011)
Halle 'hall'	.086 (.021)	.063 (.011)	.062 (.009)	.058 (.010)
Hunnen 'Huns'	.077 (.019)	.054 (.011)	.052 (.008)	.052 (.012)
Kanne 'jug'	.089 (.022)	.059 (.007)	.053 (.010)	.060 (.007)
Pille 'pill'	.083 (.016)	.045 (.010)	.041 (.012)	.048 (.013)

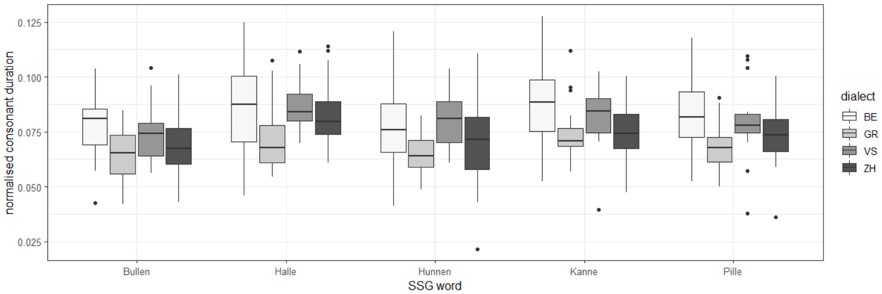

Fig. 10: Normalised consonant durations of the subset of words that typically have Cː in SSG but dialect-specific consonant quantity (C or Cː) in ALM.

3.3.3 PVD in the vowel subset

Tab. 10 summarises the PVD values of the SSG target words with non-corresponding vowel quantity in some ALM dialects and typical SSG. Fig. 11 visualises these findings.

Tab. 10: PVD and SD (in parentheses) of the subset of words that typically have Vː in SSG but dialect-specific vowel quantity (V or Vː) in ALM.

SSG word	BE	GR	VS	ZH
bade 'to bathe'	.76 (.04)	.80 (.05)	.77 (.06)	.77 (.03))
Wiese 'meadow'	.59 (.06)	.58 (.05)	.57 (.07)	.60 (.05)
zielen 'to aim'	.64 (.08)	.63 (.07)	.64 (.05)	.67 (.04)
Kilo 'kilogram'	.51 (.08)	.55 (.08)	.51 (.08)	.55 (.09)
Kino 'cinema'	.56 (.10)	.60 (.08)	.53 (.08)	.57 (.08)
Bude 'den'	.68 (.07)	.75 (.04)	.70 (.07)	.72 (.06)
Tube 'tube'	.65 (.08)	.67 (.05)	.65 (.06)	.66 (.06)

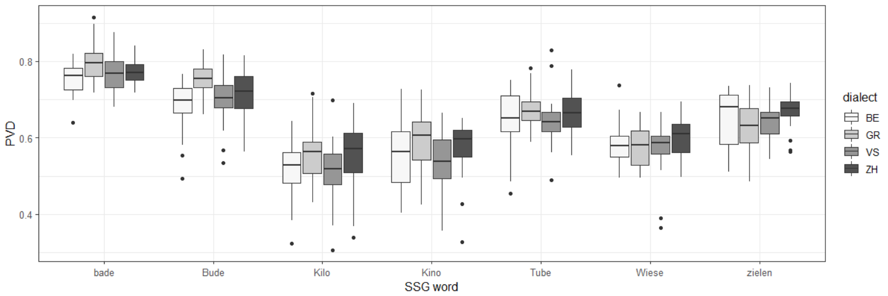

Fig. 11: PVD of the subset of words that typically have Vː in SSG but dialect-specific vowel quantity (V or Vː) in ALM.

Once again, for each word an independent LMM was conducted with *PVD* as the dependent variable, *dialect* as a fixed factor, and *speaker* as a random factor. However, no statistically significant differences according to the speakers' dialects were observed (*bade* 'to bathe' $F(3,31)=2.03$, $p=.130$; *Bude* 'den' $F(3,31)=2.43$, $p=.084$; *Kilo* 'kilogram' $F(3,32)=.94$, $p=.435$; *Kino* 'cinema' $F(3,32)=1.27$, $p=.301$; *Tube* 'tube' $F(3,32.2)=.64$, $p=.593$; *Wiese* 'meadow' $F(3,32)=.45$, $p=.722$; *zielen* 'to aim' $F(3,32)=1.60$, $p=.209$).

3.3.4 PVD in the consonant subset

The PVD values of the SSG words with non-corresponding consonant quantity in some dialects are presented in Tab. 11 and visualised in Fig. 12.

Tab. 11: PVD and SD (in parentheses) of the subset of words that typically have Cː in SSG but dialect-specific consonant quantity (C or Cː) in ALM.

SSG word	BE	GR	VS	ZH
Bullen 'cops'	.42 (.05)	.49 (.06)	.42 (.06)	.45 (.08)
Halle 'hall'	.41 (.06)	.47 (.06)	.42 (.04)	.42 (.07)
Hunnen 'Huns'	.40 (.08)	.45 (.06)	.39 (.05)	.43 (.10)
Kanne 'jug'	.40 (.07)	.45 (.06)	.39 (.05)	.45 (.06)
Pille 'pill'	.36 (.06)	.40 (.06)	.34 (.08)	.39 (.06)

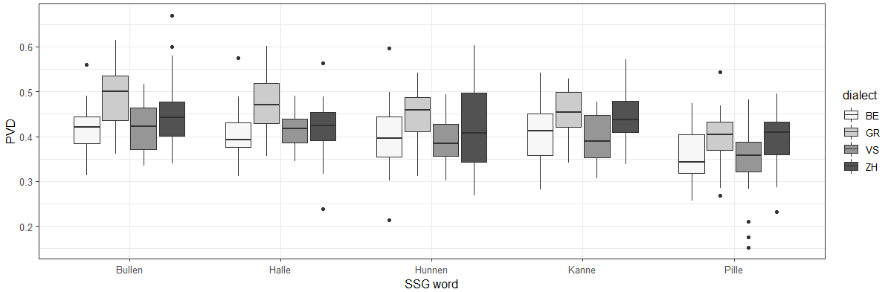

Fig. 12: PVD of the subset of words that typically have Cː in SSG but dialect-specific consonant quantity (C or Cː) in ALM.

In the subset containing the consonants, the LMM with *PVD* as the dependent variable, *dialect* as a fixed factor, and *speaker* as a random factor has been conducted for each target word independently. The results reveal that in two cases, *dialect* is a statistically significant factor for normalised consonant length. Namely for *Bullen* 'cops' ($F(3,32)=3.74$, $p=.021$) and *Halle* 'hall' ($F(3,32)=3.82$, $p=.019$). Otherwise no statistically significant difference amongst the dialects could be identified (*Hunnen* 'Huns' $F(3,32)=1.96$, $p=.134$; *Kanne* 'jug' $F(3,32)=2.61$, $p=.068$; *Pille* 'pill' $F(3,32.12)=1.98$, $p=.137$).

The pairwise Tukey comparison shows that the for *Bullen*, BE and GR are statistically significantly different ($p=.047$). Furthermore, GR and VS misses the threshold of $p=.050$ just minimally ($p=.054$). Breaking up the data by speaker again, interspeaker variation can be observed as is evident in Fig. 13.

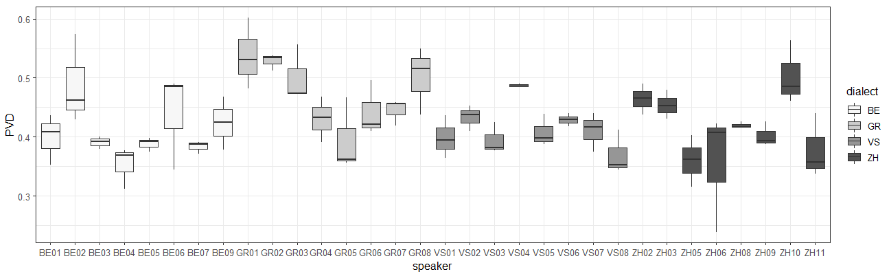

Fig. 13: PVD of the SSG word *Bullen* 'cops' by speaker.

Several speakers show low PVD values, mainly in the dialects of BE and VS (BE01, BE03, BE07, GR06, VS05, VS06, VS08, ZH05). On the other side of the spectrum, GR07, GR08, and ZH03 show comparatively high PVD values, with ZH03 exhibiting the biggest SD.

As for *Halle*, BE and GR differ again statistically significantly (p=.038). Moreover, GR-VS (p=.084) and GR-ZH (p=.092) are very close to the p=.050 threshold as well. To understand these results in more depth, the data were broken up by speaker again as visualised in Fig. 14.

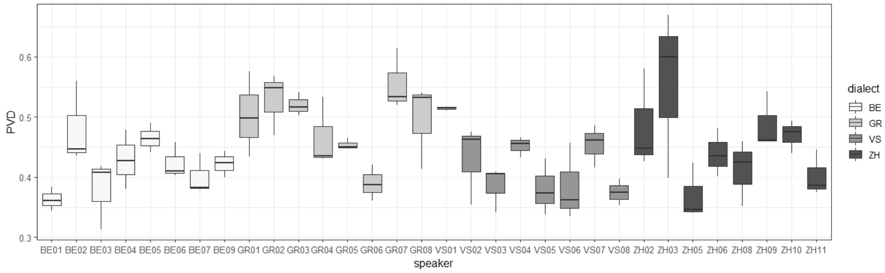

Fig. 14: PVD of the SSG word *Halle* 'hall' by speaker.

GR show the highest PVD values in general, especially GR01, GR02, GR03, and GR08 are comparatively high on the scale. But also BE02, and ZH10 exhibit high values. By contrast, most BE and VS speakers show low values, while some ZH speakers do as well. Especially ZH06 shows low values and great variation.

4 Discussion

Starting with a couple of methodological remarks, the focus will shift towards the discussion of the results regarding vowel durations, consonant durations and PVD in both the ALM dialects and the corresponding SSG varieties. Finally, a comparison of the two varieties will be presented while elucidating in what way they interact.

4.1 Methodological remarks

To begin with, a factor that may have affected the data acquired is education. It has been reported for quite a long time that more educated Swiss speakers pronounce SSG words closer to the way in which they are pronounced in GSG (Rohrer 1973; Löffler 1991; Hove 2002). As only three of the 32 participants did not have a university degree, and out of these three participants, only one did not go to some sort of college at some point, the results of this study might have shown more pronounced ALM inferences on SSG if more people with less education had been included. Specifically, it could be that the effects found for ALM and SSG word equivalents with nonmatching quantity might have been more clearly measurable and that the effects would have been more statistically significant.

Moreover, although this point is notoriously hard to measure, we do not know much about the speakers' language aptitude and its role in SSG pronunciation. The possibility exists that the speakers do have a strong metalinguistic awareness that allows them to separate the ALM quantity system from the SSG one both phonetically and phonologically. To avoid priming effects regarding pronunciation, the purpose of the study was not disclosed to the speakers prior to recording them. When they were asked after the recording whether they had found out what the aim of the experiment was, none of them guessed correctly. Also, speakers of GSG (i.e. *Bühnendeutsch*) rather than SSG were excluded from the analysis.

Lastly, the phonological environment needs to be mentioned as a factor to influence a sound's duration as well. In fact, the duration of a vowel can vary depending on its segmental context (Laver 1994: 445–447). Lehiste (1970: 20) states that a vowel's duration is affected by the amount of movement that the articulators must do to enunciate the subsequent consonant. If the movement is greater, the vowel will be longer. Unfortunately, it was not possible for the words used in this study to be controlled for a matching phonological environment between the dialects as due to their phonotactic restrictions, sometimes only a few words exist in certain contexts. For instance, VS ALM [ˈluːpə] 'magnifying glass' could not be matched among the dialects since VS ALM /uː/ turned into [yː], and the equivalents of the other dialects are pronounced with V and no other word with a similar phonetic structure could be found. However, it is questionable whether the phonological environment of the target sounds affected the measurements substantially. Nevertheless, to be able to compare the quantity and duration properties of the ALM dialects even more precisely, it would be useful to control for the phonological environment in future research as well.

In conclusion, there are certain restrictions that might have affected the outcome of the study to an unknown degree such as the level of education or difficult-to-measure language aptitude differences. Nevertheless, despite these caveats, some effects have been found, e.g. statistically significant effects for words with nonmatching quantity in ALM and SSG. Future research will have to show to what extent these caveats influence the SSG performance of Swiss speakers.

4.2 Vowel and consonant quantity in Alemannic

This section will address RQ2, namely how vowel and consonant quantity are implemented in the four dialects. Beginning with the discussion of the vowel and consonant durations, the section will end with the PVD values.

4.2.1 Vowel and consonant durations in Alemannic

Let us start with some general observations. Although the differences are not statistically significant in each case, the results show that vowels are shorter before Cː, except in BE, where the vowel in VCː is 0.1% longer than the vowel in VC. The finding that vowels are shorter before fortes and longer before lenes is compatible with what Peterson and Lehiste (1960) have found for English. Similar results have also been reported by Elert (1964) for Swedish, and Navarro (1916) for Spanish. This would suggest that phonetically there are four vowel categories in ALM as Vː before lenis and Vː before fortis were statistically significantly different in BE (with a difference of 1.8%), GR (2.3%), and ZH (2.1%), and for V this was true for VS (1.0%). Furthermore, the results suggest that the fortes in VCː and VːCː are only statistically signifycantly different in BE and ZH with a tendency in VS, whereas GR shows the most similar fortes and lenes after Vː. This will be discussed in further detail when the findings for GR are presented. The important insight is, however, that it is justified to talk about three phonetic consonant quantities in ALM, namely lenis (VC and VːC), fortis (VːCː), and extrafortis (VCː). This last distinction has not been confirmed in all dialects, meaning that the results suggest there exist dialects with only two phonetic categories. It thus makes most sense to assume two phonological quantity categories in the sense of Kraehenmann (2003), with the possibility to have three distinct phonetic quantity categories, as proposed by Ham (2001).

Let us zoom into the four ALM dialects individually. BE shows a tendency to produce both the longest vowels as well as the longest consonants although this is not always the case (e.g., the V in the VC category and the lenes in VC and VːC did not abide by this). Furthermore, BE also shows the most extreme outliers, which proved to be no pronunciation error when examined individually. These outliers were especially salient in VC and VːC vowels, as well as in all fortis consonants. This observation seems to be consistent with Leemann's finding (2017: 92), where BE showed the slowest articulation rate in the data collected with the crowd-sourced iOS application *Dialäkt Äpp*. However, what is surprising is that this not only holds true for absolute duration, but also for normalised duration, where articulation rate is controlled for. This is even more surprising given that the mean absolute utterance duration in BE did not turn out to be longer than the ones of the other dialects. In other words, it appears that not only the articulation rate but also the implementation of vowel and consonant length in BE are calibrated in a way that they grant stressed syllables more prevalence by means of duration, while unstressed syllables seem to have a smaller temporal share. This could be one reason why BE is stereotypically perceived as a slow dialect (Leemann & Siebenhaar 2007, 2010).

Regarding GR, this study provides further evidence to the claim by Eckhardt (1991: 36) that the quantity differences appear to be changing, especially in the VC category. GR did indeed show the longest mean normalised vowel duration value amongst the four. The fact that it also shows the highest amount of variation (SD of 2.4%) supports this finding only further. A possible explanation for this is the word *mina* 'my', which some speakers produced with a Vː, even though prescriptively it should be short. Furthermore, the vowel in the word *Kino* 'cinema' seems to be pronounced comparatively long as well as evident in Fig. 8. There was, however, quite a lot of inter- and intraspeaker variability observed for this word. While the other words in the VC category appeared to be slightly more stable, some still tended to have a flexible phonological vowel quantity. This might be due to many dialects as well as standard German diachronically (in the MHG period) having undergone vowel lengthening in an open syllable (Marti 1985b: 60). Thus, the vowel in that type of syllable structure might be particularly prone to being lengthened, especially when GSG has Vː in its translated equivalents. The lenis consonant in the VC combination might facilitate a longer vowel as well, as vowels tend to be longer before lenis consonants (Schmid 2004: 96), a finding that was also verified by the results of this study. Another factor that might contribute to the vowel lengthening in GR is Chur's proximity to the Italian-speaking area, considering that in Italian "[s]tressed vowels are lengthened in word-internal open syllables when they occur at the end of the intonational phrase (thus including isolated words) or under emphasis" (Bertinetto & Loporcaro 2005: 136). As the canton of Grisons, of which Chur is the capital, borders Italy and is the only Swiss canton to have three cantonal languages, amongst which Italian, the resulting language contact might promote the syllable lengthening phenomenon, even though the degree to which this occurs cannot be precisely determined. Regarding the consonants, two young female speakers behaved in a way that suggests GR loses the phonological distinction between what was traditionally transcribed as /z̥/, i.e. the lenis phoneme, and /s/, the fortis phoneme. This became particularly apparent in the word *biisse* 'to bite', which these two female speakers pronounced more as [ˈb̥iːz̥ə] rather than [ˈb̥iːsːə], possibly changing the meaning to *Biise* 'northerly wind'. I directed the attention of the participants to this phenomenon after the recording session had finished, and they confirmed to their surprise that the two words *biisse* and *Biise* can be homophonous to them.

The VS dialect, in contrast, was the only one to show two separate phonetic categories for V, in that short vowels were statistically significantly longer before lenes than before fortes. In return, it was also the only dialect not to have two separate categories for Vː's before fortes and lenes. Regarding consonants, VS speakers behave very similarly to speakers of the other dialects in that they do not show any VS-specific characteristics. However, it is questionable to what degree this is an important finding as the differences between the dialects within the two Vː categories were independently not statistically significant. The same can be said about the ZH dialect, where nothing unusual was observed; rather, the mean vowel and consonant durations are very much resembling the mean durations of the other dialects.

In conclusion, the only remarkable aspect about the BE dialect is that it showed the longest stressed syllables in relative terms. Moreover, as reported by Eckhardt (1991), further evidence regarding a quantity shift in the GR dialect has been found. The phonological quantity system of the four dialects is indeed a shared one. Phonetically, there are small interdialectal differences, but this does not change the fact that the structural pattern of vowel and consonant length is the same.

4.2.2 PVD in Alemannic

When we look at the PVD distribution by category, it becomes yet again apparent that all dialects behave very similarly, suggesting that the consonantal duration patterns are indeed the same amongst the dialects. As Schmid et al. (2019) have shown when comparing the PVD of two generations of dialect speakers from Munich (Germany), Vienna (Austria), and ZH, only the Swiss dialect showed diachronic stability between the 10 older speakers (aged >50) and the 10 younger speakers (aged <30). Bavarian dialect speakers from Vienna tended to shorten VːCː vowels and lengthen VC vowels, while the younger Bavarian dialect speakers from Munich shifted away from the traditional system stilly applied by the older speakers where only VCː and VːC are phonotactically allowed. In the Swiss system, there is thus less variation on the phonological quantity level than expected. Though the interaction turned out to be of statistical significance, this was mainly due to this one instance (i.e. VS VC and VːCː), without which a statistically significant interaction term would have been very unlikely. Therefore, three broad categories can be identified: (1) VːC, clustering close to 72% PVD (2) VCː – the extrafortes – clustering at about 36% PVD, and (3) VːCː and VC together, clustering both around 55% PVD. These values are very close to Ham's (2001: 176) BE data based on disyllabic words, where VːC words had a PVD of 68%, VCː words 32%, VːCː words 55%, and VC words 54%. This suggests that the PVD values are indeed rather stable.

4.3 Situation in Swiss Standard German

This section contrasts the four regional varieties of standard German in order to answer RQ3, which deals with how vowel and consonant quantity are implemented in SSG. Commensurate with the ALM section, the discussion moves from vowel and consonant durations to PVD, subsequently looking at the subset of words whose equivalents in ALM and SSG have nonmatching vowel or consonant quantity.

4.3.1 Vowel and consonant durations and PVD in Swiss Standard German

Compared to the ALM results, the data suggest that the SSG varieties produced are even more similar regarding normalised vowel and consonant duration. While the interaction was statistically significant for normalised vowel duration, this was mainly due to the differences between BE and GR in the VC category. BE seems to fall a bit out of line by showing comparatively short vowel durations. This can possibly be explained by the fact that Bernese did not partake in the MHG open syllable vowel lengthening (Marti 1985b: 29). Paired with GR's tendency in ALM to lengthen open syllables (Eckhardt 1991), this could explain the statistically significant difference between the two as their tendencies are diverging. With regards to Vː, almost all dialects do show two separate categories before fortes and lenes. While the statistical analysis clearly supports this claim for BE (difference of 1.6%), VS (1.8%), and ZH (1.8%), the mean of the two Vː categories in GR (1.6%) are only almost statistically significantly different to the extent that it is justified to talk about a very strong tendency with p=.056, providing more evidence that there are more than two phonetic durational vowel categories. Nevertheless, an important finding is that the four regional varieties of SSG do indeed behave very similarly.

Moving on to the discussion of the consonants, it becomes yet again apparent that the four SSG varieties have the same consonant categories. In all the varieties consonant durations are the same in the VC and VːC clusters, yet they are different in the VCː and VːCː sequences. This supports Ham's (2001) claim of there being three categories. As for PVD, given that the vowel and consonant durations were relatively similar, it is of no surprise to find out that the PVDs of the four SSG varieties are not statistically significantly different from one another. Rather, once again three broad PVD categories can be identified here as well: (1) VːC, which builds a cluster around 69% PVD (2) VCː, which clusters approximately around 36% PVD, and finally (3) VːCː and VC together, clustering both around 54% PVD.

In conclusion, the results show that the SSG varieties corresponding to the four dialects have striking similarities in normalised vowel and consonant duration as well as in PVD. This finding suggests that the four SSG varieties do not only share the same quantity patterns, but also the same phonetic implementation of this system.

4.4 Alemannic and Swiss Standard German correlations

Finally, the last section will try to answer RQ4, i.e. in what way the ALM quantity system influences the way in which SSG is spoken. Specifically, it will deal with the question whether the differences found between the four SSG varieties are the same as the ones found in the corresponding four dialects.

Comparing the results of the normalised vowel durations in the dialects with the ones in SSG, one must conclude that no clear interaction can be seen. Although there are instances when the same differences were found both in ALM as well as in SSG, this happened only twice, namely for BE and ZH between VːC and VːCː. All the other statistically significant differences were only found in either the dialect or the standard variety. Therefore, one must conclude that a correlation between ALM and SSG regarding normalised vowel duration is weak at best. When the normalised consonant durations are considered, the situation presents itself even more extremely.

Neither in ALM nor in SSG did the LMM confirm dialect to be a statistically significant factor, indicating that all dialects behaved similarly. Thus, normalised consonant duration in general cannot provide any evidence whatsoever as to where a specific speaker comes from. As for PVD, with one exception, i.e., VS VC and Vː Cː, the values are all the same, meaning that no dialect-specific behaviour exists. This as well provides evidence for the claim that it is not possible to infer the ALM dialect based on the speaker's SSG realisations of vowel and consonant length.

In conclusion, when looking at the quantity system from a general, i.e. structural point of view, no idiosyncratic dialect interferences can be identified in SSG. To be able to verify RQ4, one must zoom in further and look at the word level, which the next section is concerned with.

4.4.1 Words with nonmatching phonological quantity in Alemannic and typical Swiss Standard German

Whilst overall, no clear dialect-specific identifiers in SSG are found with regards to vowel and consonant length, having a look at words with nonmatching quantity in ALM and typical SSG may prove to be of help. Even though only some of the words scrutinised showed statistically significant duration differences, it is fair to say that there exists at least a tendency for dialects whose ALM equivalent has a phonologically short vowel or consonant to produce the SSG equivalent with a shorter Vː or Cː. Based on the data collected, it seems that the twelve words with nonmatching consonant quantity show a greater sensitivity to duration effects. While the seven words whose vowels were scrutinised showed one instance of statistical significance for the normalised vowel duration as well as PVD (7%), another five instances of *p*-values between .050 and .200 (36%), and eight instances of *p*-values above .200 (57%), the five words whose consonants were scrutinised showed two instances of statistical significance (20%), and eight with *p*-values between .050 and .200 (80%), while no *p*-values above .200 were observed. This suggests that even though the data are limited, the tendency to have dialect interference seems to be stronger when it concerns consonants.

There are a couple of caveats, however. First, these interferences seem to be lexically bound. For instance, significant differences in vowel length were found for *Bude* [ˈb̥uːd̥e], yet not for *Tube* [ˈtʰuːb̥e] despite the two words being phonotactically very similar in both ALM and SSG. A possible explanation for this phenomenon could be that *Bude* begins with an unaspirated lenis, and *Tube* with an aspirated fortis. Whether the word-initial consonant being lenis or fortis affects the duration of the subsequent vowel, or whether aspiration blocks vowel shortening cannot be assessed based on the insights provided by this study. It could very well be that both, either, or none of them influences duration. As aspiration plays only a minor role in ALM (Ladd & Schmid 2018; Schifferle 2010), words containing it in SSG might be more readily identified as standard words, which decreases the likelihood of dialect interference. It could also be the case that the likelihood of ALM interferences in SSG decreases if a minimal pair exists between the two resulting words in SSG as, e.g., for [ˈv̥id̥ər] 'ram' and [ˈv̥iːd̥ər] 'again', which are homophonous in ALM. It might well be the case that less durational variation resulting in a perceived quantitative difference in SSG occurs if misunderstandings take place. To fully understand this phenomenon, more research is needed, which exceeded the scope of this study, however.

A further point to keep in mind is that even if dialect interference occurs, this effect is possibly observable in all dialects with nonmatching phonological quantity between ALM and SSG. Therefore, the interference might be less dialect-specific per se. Consequently, multiple quantity analyses will have to be done, which will then have to be compared to a reference corpus to narrow down which dialect a SSG speaker has. However, as the interferences seem to be word-specific, it might well be that the inference from SSG does not accurately portray the ALM quantity system, which could leave the analyst with inadequate results.

Lastly, while general dialect behaviour could be identified, there was also a great deal of interspeaker variation. Although some speakers did indeed show dialect interferences, e.g., BE02 who showed very low normalised-vowel-duration values for *Bude*, other speakers of the same dialect, e.g. BE09, did not show any effects and had higher normalised vowel durations than e.g. GR04, who did not show any dialect interference. The same is true for *Bullen* und *Halle*, where general dialect behaviour can be seen but on the speaker level there is a lot of noise. Given this, inferring the dialect may be impossible as it could very well be that a speaker articulates some words with nonmatching vowel or consonant quantity with dialect interference, and some without. This could lead the investigator astray and distort the conclusion of the dialect localisation. It is thus imperative to understand the shortcomings of such an analysis. The topic of interspeaker variation will be discussed in more detail in a future publication (Zihlmann under review).

In conclusion, the final answer to RQ4 is a ‘yes, but’. While ALM quantity does indeed seem to influence SSG quantity, the influence mainly occurs in words that have nonmatching quantity in the two varieties rather than generally. Yet, there is no guarantee that this interference occurs even at the word-level as it seems to be rather speaker-specific.

5 Conclusion and suggestions for future research

This contribution is the first study in which the same speakers have been systematically analysed speaking both their respective ALM dialect and SSG variety to assess how the two varieties interact. The results do indeed permit to answer the four RQs. Firstly, regarding how vocalic and consonantal durational contrasts are implemented in the four ALM dialects (RQ2), this study has found evidence that although there are phonetic differences amongst the four dialects, the quantity patterns are shared. In other words, BE might use V where VS uses Vː or vice versa, but the phonological categories they implement are the same. The study also provides evidence for there being more than two phonetic vowel categories, i.e. short and long, although it is questionable whether these differences are perceptually salient. Regarding the consonants, three distinct phonetic consonant categories, i.e. lenis, fortis, and extrafortis, could be confirmed. The latter of which is a fortis after V, which is congruent with Ham’s (2001) claims for the BE consonant system. For simplicity’s sake, however, it makes most sense to group those three phonetic categories in two phonological consonant quantity categories, i.e. lenis and fortis, as claimed by Kraehenmann (2003). The study has also found that vowels tend to be shorter before fortes. Moreover, the PVD values can be grouped in three categories, (1) VːC, (2) VCː, and (3) VC/VːCː (i.e., vowel-consonant sequences with equal quantities). The situation regarding the way in which vocalic and consonantal durational contrasts are implemented in SSG (RQ3) presents itself similarly. On average, it has become clear that the ALM system is used when speaking SSG as the three phonetic consonant quantity categories and three, possibly also four, phonetic vowel quantity categories found in ALM can also be identified. The PVD values are thus similar as well. However, and this is an important finding of the study, when isolated words are considered, where either the phonological vowel or consonant quantity is different between ALM and SSG, statistically significant dialect inferences may occur. That is, the duration of a typical Vː in a SSG word is occasionally shortened in dialects that have a typical V in the word's ALM equivalent. The same effect has been found for words with non-matching phonological consonant quantity in ALM and SSG. Nevertheless, these interferences are both lexically bound and speaker-specific. The question whether a speaker's ALM dialect influences the way in which they speak SSG (RQ4) can thus be answered positively. In conclusion, keeping the insights of RQ2–4 in mind, RQ1 as to whether a dialect of a speaker can be inferred by analysing their spoken SSG regarding V and C duration must thus be answered with 'no'. While there is a minor interaction between the two varieties, the effects are not dialect-specific but they are possibly shared by all the dialects that show a vowel- or consonant-quantity mismatch between a SSG word and its ALM equivalent.

Thus, vowel and consonant durations in SSG alone are insufficient to determine a speaker's dialect, so additional phonetic cues must be analysed. For instance, future research should include acoustic vowel-quality analyses. These kinds of effects have been found before (e.g. Hove 2001), however without considering the same speakers in ALM and SSG. Finally, possible differences can occur also on the prosodic level. As the dialects have rather distinct intonational and rhythmic patterns (see Leemann et al. 2014a, 2018), they could influence the way SSG is spoken as well.

Acknowledgements

This study was funded by the Swiss National Science Foundation (SNSF), grant Nr. 164377. I would like to thank Sandra Schwab especially but also Bodo Winter (University of Birmingham) and Thomas Milic, who all helped me with the statistical analysis. A big thank you also goes to Marie-Anne Morand and Seraina Nadig, who supported me during the arduous work of manually correcting the segment boundaries of the 16,000 sentences I have recorded. Moreover, without Markus Jochim (LMU Munich), the data analysis would have been way less efficient, so I would like to thank him for sharing his scripting expertise. I would also like to thank the people who assisted me during the word-brainstorming process, namely Christa Schneider (University of Bern) for BE, Oscar Eckhardt (Grisons Institute for Cultural Studies) for GR, Sandro Bachmann for VS, and Stephan Schmid for ZH. I also very much appreciate the help of the Phonogram Archives of the University of Zurich for providing me with the material on which Fig. 1 is based. Finally, I would like to express my gratitude towards Francis Nolan and Brechtje Post with their Phonetics Laboratory team of the University of

Cambridge, as well as Juraj Šimko (University of Helsinki), who gave me valuable inputs during the final phase of the project.

References

Ammon, Ulrich, Hans Bickel, Alexandra N. Lenz (eds.). 2016. *Variantenwörterbuch des Deutschen*, 2nd edn. Berlin & Boston: De Gruyter.

Bates, Douglas, Marin Mächler, Ben Bolker & Steve Walker. 2015. Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software* 67(1). 1–48. doi:10.18637/jss.v067.i01

Berger, Jakob. 1910. *Die Laute der Mundarten des St. Galler Rheintals.* Frauenfeld: Huber & Co.

Bertinetto, Pier Marco & Michele Loporcaro. 2005. The sound pattern of Standard Italian, as compared with the varieties spoken in Florence, Milan and Rome. *Journal of the International Phonetic Association* 35(2). 131–151. doi:10.1017/S0025100305002148

Bigler, Jürg. 2007. *Die Vokalsysteme von sechs Schweizer Stadtdialekten* (Unpublished licentiate thesis). University of Bern, Switzerland.

Boesch, Bruno. 1957. *Die Aussprache des Hochdeutschen in der Schweiz.* Zurich: Schweizer Spiegel.

Christen, Helen, Manuela Guntern, Ingrid Hove & Marina Petkova. 2010. *Hochdeutsch in aller Munde. Eine empirische Untersuchung zur gesprochenen Standardsprache in der Deutschschweiz.* Stuttgart: Steiner.

Dieth, Eugen. 1938. *Schwyzertütschi Dialäktschrift. Leitfaden einer einheitlichen Schreibweise für alle Dialekte. Nach den Beschlüssen der Schriftkommission der Neuen Helvetischen Gesellschaft (Gruppe Zürich)*. Zurich: Orell Füssli.

Dieth, Eugen & Rudolf Brunner. 1943. Die Konsonanten und Geminaten des Schweizerdeutschen experimentell untersucht. *Romanica Helvetica* 20. 736–762.

Draxler, Christoph & Klaus Jänsch. 2004. SpeechRecorder – a Universal Platform Independent Multi-Channel Audio Recording Software. *Proceedings of LREC.* 559–562.

Eckhardt, Oscar. 1991. *Die Mundart der Stadt Chur*. Zurich: Verlag des Phonogrammarchivs der Universität Zürich.

Eckhardt, Oscar. 2016. *Alemannisch im Churer Rheintal.* Zeitschrift für Dialektologie und Linguistik, Beihefte 162. Stuttgart: Franz Steiner.

Elert, Claes-Christian. 1964. Phonologic studies of quantity in Swedish. PhD Thesis at the University of Stockholm. In Ilse Lehiste. 1970. *Suprasegmentals.* Cambridge, MA: The MIT Press.

Enderlin, Fritz. 1913. *Die Mundart von Kesswil im Oberthurgau.* Frauenfeld: Huber & Co.

Enstrom, Daly & Sonja Spörri-Bütler. 1981. A voice onset time analysis of initial Swiss German stops. *Folia Phoniatrica* 33. 137–150.

Fleischer, Jürg & Stephan Schmid. 2006. Zurich German. *Journal of the International Phonetic Association* 36. 243–255.

Ferguson, Charles. 1959. Diglossia. *Word* 15. 325–340.

Fischer, Ludwig. 1960. *Luzerndeutsche Grammatik und Wegweiser zur guten Mundart.* Zurich: Schweizer Spiegel.

Fulop, Sean A. 1994. Acoustic correlates of the fortis/lenis contrast in Swiss German plosives. *Calgary Working Paper in Linguistics* 16. 55–63.

Haas, Walter. 2000. Die deutschsprachige Schweiz. In Hans Bickel & Robert Schläpfer (eds.), *Die viersprachige Schweiz,* 2nd edn. 57–138. Aarau: Sauerländer.

Haas, Walter & Ingrid Hove. 2009: Die Standardaussprache in der deutschsprachigen Schweiz. In Eva-Maria Krech, Eberhard Stock, Ursula Hirschfeld & Lutz Christian Anders (eds.), *Deutsches Ausspracheswörterbuch*, 259–277. Berlin & New York: De Gruyter.

Ham, William. 2001. *Phonetic and phonological aspects of geminate timing.* London: Routledge.

Hotzenköcherle, Rudolf. 1984. *Die Sprachlandschaften der deutschen Schweiz.* Aarau: Sauerländer.

Hotzenköcherle, Rudolf, Robert Schläpfer & Rudolf Trüb (eds.). 1986. *Dialektstruktur im Wandel.* Aarau: Sauerländer.

Hove, Ingrid. 2002. *Die Aussprache der Standardsprache in der deutschen Schweiz.* Berlin & Boston: Max Niemeyer.

Hove, Ingrid. 2008a. Zur Unterscheidung des Schweizerdeutschen und der (schweizerischen) Standardsprache. In Helen Christen & Evelyn Ziegler (eds.), *Sprechen, Schreiben, Hören – Zur Produktion und Perzeption von Dialekt und Standardsprache zu Beginn des 21. Jahrhunderts,* 63–82. Wien: Praesens.

Hove, Ingrid. 2008b. Gesprochene Standardsprache im Deutschschweizer Alltag. Erste Ergebnisse eines Forschungsprojekts. In Helen Christen & Evelyn Ziegler (eds.), *Sprechen, Schreiben, Hören – Zur Produktion und Perzeption von Dialekt und Standardsprache zu Beginn des 21. Jahrhunderts,* 83–100. Wien: Praesens.

Iivonen, Antti. 1994. Zur gehobenen regionalen phonetischen Realisierung des Deutschen. In Wolfgang Viereck (ed.), *Verhandlungen des Internationalen Dialektologenkongresses Bamberg, 3, Regionalsprachliche Variation, Umgangs- und Standardsprachen. Zeitschrift für Dialektologie und Linguistik, Beiheft, N.F. 76,* 311–330.

Jochim, Markus & Felicitas Kleber. 2017. What do Finnish and Central Bavarian have in common? Towards an acoustically based quantity typology. *Proceedings of Interspeech*. 3018–3022.

Jochim, Markus, Felicitas Kleber, Nicola Klingler, Michael Pucher, Stephan Schmid & Urban Zihlmann. 2018. *Measuring the Role of Hypoarticulation in a Sound Change in Progress in Southern German*. Oral presentation at the 14th Phonetik und Phonologie im deutschsprachigen Raum (P&P 14), Vienna, Austria.

Keller, Rudolf Ernst. 1961. *German Dialects.* Manchester: Manchester University Press.

Kisler, Thomas, Uwe Reichel & Florian Schiel. 2017. Multilingual processing of speech via web services. *Computer Speech & Language* 45. 326–347.

Kleber, Felicitas. 2017. Complementary length in vowel-consonant sequences: acoustic and perceptual evidence for a sound change in progress in Bavarian German. *Journal of the International Phonetics Association* 50(1). 1–22.

Klingler, Nicola, Felicitas Kleber, Markus Jochim, Michael Pucher, Stephan Schmid & Urban Zihlmann. 2019. Temporal organization of vowel plus stop sequences in production and perception: evidence from the three major varieties of German. *Proceedings of ICPhS*. 825–829.

Kluge, Friedrich & Elmar Seebold. 2011. *Etymologisches Wörterbuch der deutschen Sprache*, 25th edn. Berlin & Boston: De Gruyter.

Kohler, Klaus. 1979. Dimensions in the perception of fortis and lenis plosives. *Phonetica* 36. 332–343.

Kraehenmann, Astrid. 2001. Swiss German stops: Geminates all over the word. *Phonology* 18. 109–145.

Kraehenmann, Astrid. 2003. *Quantity and prosodic asymmetries in Alemannic: Synchronic and diachronic perspectives*. Berlin: De Gruyter.

Ladd, Robert D. & Stephan Schmid. 2018. Obstruent voicing effects on F0, but without voicing: Phonetic correlates of Swiss German lenis, fortis, and aspirated stops. *Journal of Phonetics* 71. 229–248.

Ladefoged, Peter & Ian Maddieson. 1996. *The Sounds of the World's Languages.* Cambridge: Blackwell.

Lahiri, Aditi & B. Elan Dresher. 1999. Open Syllable Lengthening in West Germanic. *Language* 75(4). 678–719. doi:10.2307/417730

Laver, John. 1994. *Principles of Phonetics.* Cambridge: Cambridge University Press.

Leemann, Adrian. 2017. Analyzing dialectal variation in articulation rate using crowdsourced speech data. *Journal of Linguistic Geography*. 76–96.

Leemann, Adrian, Volker Dellwo, Marie-José Kolly & Stephan Schmid. 2014a. Disentangling sources of rhythmic variability between dialects. *Proceedings of Speech Prosody*. 693–697.

Leemann, Adrian, Marie-José Kolly & Volker Dellwo. 2014b. Speaker-individuality in suprasegmental temporal features: Implications for forensic voice comparison. *Forensic Science International* 238. 59–67.

Leemann, Adrian, Marie-José Kolly, Francis Nolan & Yang Li. 2018. The role of segments and prosody in the identification of a speaker's dialect. *Journal of Phonetics* 68. 69–84.

Leemann, Adrian & Beat Siebenhaar. 2007. Intonational and temporal features of Swiss German. *Proceedings of the ICPhS*. 957–960.

Leemann, Adrian & Beat Siebenhaar. 2008. Perception of Dialectal Prosody. *Proceedings of Interspeech*. 524–527.

Leemann, Adrian & Beat Siebenhaar. 2010. Statistical modeling of F0 and timing of Swiss German dialects. *Proceedings of Speech Prosody*. 11–14.

Lehiste, Ilse. 1970. *Suprasegmentals.* Cambridge, MA: The MIT Press.

Lenth, Russell V. 2016. Least-Squares Means: The R Package lsmeans. *Journal of Statistical Software* 69(1). 1–33. doi:10.18637/jss.v069.i01

Löffler, Heinrich. 1991. *Linguistische Grundlagen. Eine Einführung unter besonderer Berücksichtigung Schweizer Verhältnisse.* Aarau, Frankfurt a. M. & Salzburg: Studienbücher Sprachlandschaft 3.

Marti, Werner. 1985a. *Bärndütschi Schrybwys. Ein Wegweiser zum Aufschreiben in berndeutscher Sprache,* 2nd edn. Bern: Francke.

Marti, Werner. 1985b. *Berndeutsch-Grammatik*. Bern: Francke.

Moulton, William G. 1986. *Sandhi in Swiss German dialects.* In Henning Andersen (ed.), *Sandhi phenomena in the languages of Europe,* 385–392. Berlin: De Gruyter.

Navarro, Tomás. 1916. Cantidad de las vocales accentuadas. *Revista de Filologia Espanola* 3. In Ilse Lehiste. 1970. *Suprasegmentals,* 387–408. Cambridge, MA: The MIT Press.

Panizzolo, Paola. 1982. *Die schweizerische Variante des Hochdeutschen.* Deutsche Dialektgeographie 108. Marburg: Elwert.

Peterson, Gordon E. & Ilse Lehiste. 1960. Duration of syllable nuclei in English. *Journal of the Acoustical Society of America* 32. 693–703.

R Core Team 2019. *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. Retrieved from https://www.R-project.org/

Rash, Felicity. 1998. *The German Language in Switzerland – Multilingualism, Diglossia and Variation*. Bern: Peter Lang.

Rohrer, Carl. 1973. *Der Konjunktiv im gesprochenen Schweizer Hochdeutschen. Analyse von Radiogesprächen.* Frauenfeld & Stuttgart: Studia linguistica Alemannica 3.

Schiel, Florian. 1999. Automatic Phonetic Transcription of Non-Prompted Speech. *Proceedings of the ICPhS.* 607–610.

Schifferle, Hans-Peter. 2010. *Zunehmende Behauchung. Aspirierte Plosive im modernen Schweizerdeutsch*. In Helen Christen (ed.), *Alemannische Dialektologie: Wege in die Zukunft*, 43–55. Stuttgart: Steiner.

Schmid, Stephan. 2004. Zur Vokalquantität in der Mundart der Stadt Zürich. *Linguistik Online* 20(3). doi: http://dx.doi.org/10.13092/lo.20.1065

Schmid, Stephan. 2019. Wie viele Typen von Plosiven gibt es in schweizerdeutschen Dialekten? *Presentation at Workshop in Gedenken an Sylvia Moosmüller.* Vienna, 8th April 2019.

Schmid, Stephan, Markus Jochim, Nicola Klingler, Michael Pucher, Urban Zihlmann & Felicitas Kleber. 2019. *Vowel and consonant quantity in southern German varieties: typology, variation, and change.* Oral presentation at the 3rd Phonetics and Phonology in Europe conference (PaPE 2019), Lecce, Italy.

Seiler, Guido 2005. Open Syllable Shortening in Bernese German. *Proceedings of the 31st Annual Meeting of the Berkeley Linguistics Society: General Session and Parasession on Prosodic Variation and Change*. 477–488.

Siebenhaar, Beat 1994. Regionale Varianten des Schweizerhochdeutschen. Zur Aussprache des Schweizerhochdeutsche in Bern, Zürich und St. Gallen. *Zeitschrift für Dialektologie und Linguistik* 66(1). 31–65.

Siebenhaar, Beat & Alfred Wyler. 1997. *Dialekt und Hochsprache in der deutschsprachigen Schweiz,* 5th edn. Zurich: Edition "Pro Helvetia".

Sievers, E. 1876. *Grundzüge der Lautphysiologie zur Einführung in das Studium der Lautlehre der indogermanischen Sprachen*. Leipzig: Breitkopf und Härtel.

Streiff, Catharina. 1915. *Die Laute der Glarner Mundarten.* Frauenfeld: Huber & Co.

Ulbrich, Christiane. 2002. A Comparative Study of Intonation in Three Standard Varieties of German. *Proceedings Speech Prosody*. 671–674.

Ulbrich, Christiane & Horst Ulbrich. 2007. The Realisation of /r/ in Swiss German and Austrian German. *Proceedings of the ICPhS.* 1761–1764.

Vetsch, Jakob. 1910. *Die Laute der Appenzeller Mundarten.* Frauenfeld: Huber & Co.

Wanner, Georg. 1941. *Die Mundarten des Kantons Schaffhausen: Laut- und Flexionslehre.* Frauenfeld: Huber & Co.

Weber, Albert. 1987. *Zürichdeutsche Grammatik*. Zurich: Hans Rohr.

Werlen, Iwar. 1977. Lautstrukturen des Dialekts von Brig im Schweizerischen Kanton Wallis. *Zeitschrift für Dialektologie und Linguistik, Beihefte 23*. Wiesbaden: Franz Steiner.

Wiget, Wilhelm. 1916. *Die Laute der Toggenburger Mundarten.* Frauenfeld: Huber & Co.

Willi, Urs. 1996. Die segmentale Dauer als phonetischer Parameter von 'fortis' und 'lenis' bei Plosiven im Zürichdeutschen. Eine akustische und perzeptorische Untersuchung. *Zeitschrift für Dialektologie und Linguistik, Beiheft 92*. Stuttgart: Franz Steiner.

Winkelmann, Raphael, Jonathan Harrington & Klaus Jänsch. 2017. EMU-SDMS: Advanced Speech Database Management and Analysis in R. *Computer Speech & Language* 45. 392–410.

Winteler, Jost. 1876. *Die Kerenzer Mundart des Kantons Glarus in ihren Grundzügen dargestellt.* Leipzig: Winter.

Wipf, Elisa. 1910. *Die Mundart von Visperterminen im Wallis*. Frauenfeld: Huber & Co.

Zihlmann, Urban. Under review. Speaker-individuality in Swiss Standard German consonant quantity, vowel quality, and temporal variables (working title).