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On the tail of the Scottish Vowel Length Rule in Glasgow

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One of the most famous sound features of Scottish English is the short/long timing alternation of /i u ai/vowels, which depends on the morpho-phonemic environment, and is known of as the Scottish Vowel Length Rule (SVLR). These alternations make the status of vowel quantity in Scottish English (quasi-)phonemic but are also susceptible to change, particularly in situations of intense sustained dialect contact with Anglo-English. Does the SVLR change in Glasgow where dialect contact at the community level is comparably low? The present study sets out to tackle this question, and tests two hypotheses involving (1) external influences due to dialect-contact and (2) internal, prosodically-induced factors of sound change. Durational analyses of /i u a/ were conducted on a corpus of spontaneous Glaswegian speech from the 1970s and 2000s, and four speaker groups were compared, two of middle-aged men, and two of adolescent boys. Our hypothesis that the development of the SVLR over time may be internally constrained and interact with prosody was largely confirmed. We observed weakening effects in its implementation which were localised in phrase-medial unaccented positions in all speaker groups, and in phrase-final positions in the speakers born after the Second World War. But unlike some other varieties of Scottish or Northern English which show weakening of the Rule under a prolonged contact with Anglo-English, dialect contact seems to be having less impact on the durational patterns in Glaswegian vernacular, probably because of the overall reduced potential for a regular, everyday contact in the West given the different demographies.

On the tail of the Scottish Vowel Length Rule in Glasgow

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Abstract

One of the most famous sound features of Scottish English is the short/long timing alternation of /i ʉ ai/vowels, which depends on the morpho-phonemic environment, and is known of as the Scottish Vowel Length Rule (SVLR). These alternations make the status of vowel quantity in Scottish English (quasi-)phonemic but are also susceptible to change, particularly in situations of intense sustained dialect contact with Anglo-English. Does the SVLR change in Glasgow where dialect contact at the community level is comparably low? The present study sets out to tackle this question, and tests two hypotheses involving (1) external influences due to dialect-contact and (2) internal, prosodically-induced factors of sound change. Durational analyses of /i ʉ a/ were conducted on a corpus of spontaneous Glaswegian speech from the 1970s and 2000s, and four speaker groups were compared, two of middle-aged men, and two of adolescent boys. Our hypothesis that the development of the SVLR over time may be internally constrained and interact with prosody was largely confirmed. We observed weakening effects in its implementation which were localised in phrase-medial unaccented positions in all speaker groups, and in phrase-final positions in the speakers born after the Second World War. But unlike some other varieties of Scottish or Northern English which show weakening of the Rule under a prolonged contact with Anglo-English, dialect contact seems to be having less impact on the durational patterns in Glaswegian vernacular, probably because of the overall reduced potential for a regular, everyday contact in the West given the different demographies.

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1 Introduction

Language evolves over time. While the concept of time is central to all questions of the research enterprise into language change, and methodologies ("apparent time" vs. "real time")[1] have been developed to reflect this (e.g. Labov 1994), the impact of the temporal organisation of language itself has not very often been appreciated in studies of variation and change. For this reason, the patterns of speech timing and its development over time is at the centre of the present study.

We investigate the famous Scottish Vowel Length Rule in a distinctive variety of Scottish English, Glaswegian vernacular, by combining empirical evidence from two methodological approaches, real- and apparent-time sampling of unscripted speech corpora, and use information about prosodic structure that influences segmental timing to illuminate patterns of variation and change of this feature for this community. Glasgow, unlike some other places in Scotland, has relatively little everyday contact with Anglo-English and might be expected to be less influenced by its prevalent timing constraints, known as the Voicing Effect. Previous studies demonstrated an erosion of the Scottish Vowel Length Rule in favour of the Voicing Effect in some varieties of Scottish English where a prolonged contact with Anglo-English has changed the timing patterns in many, if not all, speakers. We concentrate on durational analyses of the vowels /i ʉ a/ produced by a group of sixteen male speakers in total (adolescent and middle-aged), who were recorded either in the 1970s or in the 2000s. The results of the analyses are discussed with respect to the internal, prosody-related, and the external, contact-driven, factors potentially shaping the implementation of the Scottish Vowel Length Rule across

[1]Both methodological approaches seek to unveil patterns of language evolution but capture the historical flow of time very differently: while apparent-time studies sample speakers of younger and older generations at a single point in time and infer language change through cross-generational comparisons, real-time studies collect longitudinal data with samples taken at different time points, thus allowing for direct insights into the historical development of linguistic variables. According to Labov (1994) and many others, strongest evidence for change can be obtained through a combination of these two methods in one study.

time. Our results indicate that the Rule seems to interact with sentence-level prosody and may be changing over time under the influence of prosodic timing, but only very little evidence was found for a contact-induced change. We offer potential explanations of these findings, taking into account historical and demographic circumstances of Glasgow.

1.1 Vowel timing in Scottish English

The role of vowel duration in the phonological system of Scottish English has been described as *quasi-phonemic* (Scobbie, Hewlett and Turk 1999; Scobbie and Stuart-Smith 2008) since in contrast to other varieties of English where duration plays a rather minor role in cueing the phonemic tense/lax distinction (Wells 1982), Scottish English[2] exhibits a (modest) list of minimal pairs, such as *crude* vs. *crewed, brood* vs. *brewed*, with duration (here, [ʉ] vs. [ʉː]) being a distinctive feature. These minimal pairs come about due to a timing process known as the *Scottish Vowel Length Rule* or Aitken's Law (e.g. Aitken 1981; Carr 1992; Lass 1974; McClure 1977; McMahon 1991; Scobbie, Hewlett and Turk 1999). The rule describes a feature of syllables bearing the primary lexical stress to have long vowel allophones before voiced fricatives (as in *br<u>ea</u>the*), /r/ (as in *b<u>ee</u>r*) and morpheme boundaries (as in *b<u>ee</u>##, bee#hive* or *b<u>ee</u>#s*). Short allophones occur in all other contexts. The rule was first explicitly stated by Aitken in 1962 (hence its alternative name), describing its impact on the historical and contemporary vowel phonologies of Scots dialects (see also Aitken/Macafee 2002), although its effects had been occasionally noted in earlier studies on Scots and varieties of Scottish English (see McMahon 1991, 2000 for a historic overview).

The set of vowels affected by the Scottish Vowel Length Rule (henceforth SVLR) historically comprised all underlyingly tense vowels (i.e. /i ʉ e o ɔ a/, cf. McMahon 1991, 2000) and some diphthongs (most notably /ai/ and perhaps /ɔi/ but not /aʉ/, Lass 1974; Carr 1992). In

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[2] By 'Scottish English' we refer to the range of varieties existing along the Scottish English continuum, which share the 'basic Scottish vowel system' (Scobbie, Hewlett and Turk 1999: 232-3). Although the SVLR is often discussed as typically Scottish, it has its own history in Northern English varieties as well (see discussion in Agutter 1988; Llamas et al. 1999; Milroy 1995; Watt and Ingham 2000).

contemporary Scottish English, dialects are known to differ with respect to their vowel sets serving as SVLR-input (Aitken 1981; Johnston 1997; McMahon 2000; Wells 1982). An implicational hierarchy seems to suggest that the likelihood of a vowel to be subject to the SVLR and the vowel's intrinsic duration are negatively correlated (cf. McMahon 2000:171). Intrinsically short high vowels /i ʉ/ are the most common SVLR-candidates and only some dialects apply SVLR to the mid /e o/. In contrast, intrinsically long low vowels /a ɔ/ undergo SVLR very rarely and are consistently long in most dialects. In Glaswegian Vernacular, the variety studied here, Scobbie, Hewlett and Turk (1999) were only able to establish durational evidence for the SVLR in /i ʉ/ and /ai/.

Furthermore, the SVLR interacts not only with intrinsic vowel duration. The segmental conditioning of the rule overlaps with the so-called Voicing Effect (henceforth VE), the phonetic lengthening of a vowel before monosyllabic voiced consonants observed in many varieties of English and many other languages (e.g. Chen 1970; House and Fairbanks 1953; Keating 1985, Port, Al-Ani and Maeda 1980; Summers 1987; Umeda 1975). In this respect, the genuine peculiarity of Scottish English lies in the fact that some voiced consonants (i.e. laterals, nasal and oral stops) condition shortening of tense vowels which are long in those contexts in the overwhelming majority of English varieties. The morphological conditioning of the SVLR, on the other hand, fully aligns with the prosodic timing effect of finality within prosodic constituency for other varieties of English (e.g. Beckman and Edwards 1990; Wightman et al 1992; see also Scobbie, Hewlett and Turk 1999 and section 1.3). The structural constraints on timing effects comparing Scottish and Anglo-English varieties are summarised in Table 1.

Table 1: Environments constraining durational allophony in varieties of British English.

Constraint	Examples	Scottish English	Anglo-English
Voiceless consonants	*beat, greet* *brute, cute*	short allophones	short allophones
Voiced (oral and nasal) stops and /l/	*bead, bean, beal* *brood, broom, gruel*	short allophones	long allophones
Voiced fricatives and /r/	*tease, beer* *bruise, smooth, cure*	long allophones	long allophones
Morpheme boundaries	*bee, bees, bee's* *agree, agreed* *brew, brews, brewed*	long allophones	long allophones

Interestingly, our current understanding of the SVLR (at least in Scotland) largely rests on studies which have analysed Standard Scottish English from middle-class informants (see Scobbie, Hewlett and Turk 1999: 242-3), and on acoustic analyses of citation forms comprising either of structured word lists or of words embedded in carrier phrases (e.g. Carr 1992; Hewlett, Matthews and Scobbie 1999; McClure 1977; Milroy 1995; Scobbie, Hewlett and Turk 1999; Watt and Ingham 2000; Scobbie 2005; Llamas, Watt, French and Roberts 2011). Moreover, the choice of words for these investigations included mostly monosyllables or polysyllables with ultimate stress; the place of articulation investigated has also been overwhelmingly coronal (Scobbie, Hewlett and Turk 1999: 244). While careful experimental control is indeed an important way of understanding sound structures of language (Xu 2010; Scobbie, Hewlett and Turk 1999:235), we were interested in expanding our appreciation of the SVLR by considering this feature across the lexicon, i.e. in words of different structures in naturally-occurring conversational vernacular speech recorded from speakers of different ages and at different points in time. Working with speech data of this kind was also useful because we could consider the extent to which the SVLR in Glaswegian vernacular might have been affected over time by a large range of factors, including the prosody of natural talk. In this way, our sociolinguistic spontaneous speech data was not so much of a problem (Scobbie, Hewlett and Turk 1999:235), but rather provided an opportunity for an enhanced view of the phonetic and phonological patterning at work (Scobbie 2005; Scobbie and Stuart-Smith 2012).

1.2 Dialect contact and the SVLR

As shown in Table 1, the SVLR conditions exhibit a higher level of complexity in comparison to Anglo-English, since their segmental constraints include a detailed specification for the manner of articulation in addition to the more general [±voice] feature operative in Anglo-English. It is therefore not surprising that the SVLR has been observed to be subject to sound change in situations of dialect contact (Gregg 1973; Hewlett, Matthews and Scobbie 1999; Trudgill 1986). Two independent lines of evidence suggest that if Scottish English comes into contact with other varieties of English, its timing constraints are superseded by those of the VE. Historically, the development of the phenomenon known as “Canadian Raising” (i.e. centralisation of the vowel onset in diphthongs [ai ~ əɪ] vs. [au ~ əʊ] before voiceless consonants) is sometimes explained as a result of the contact between Anglo-English dialects which had lengthening due to VE, and those from Scotland and Ireland which had SVLR-related patterning of quantity and quality in diphthongs (at least /ai/, see Gregg 1973; Trudgill 1986). According to the “Contact, Focusing and Reallocation” hypothesis proposed by Trudgill (1986:157-161), learners of English in Canada were presented with a complex allophonic variation from which two variants of each phoneme were selected (“focused”) and consistently attributed to different phonological environments (“reallocated”) in line with “natural phonetic tendencies”, quite possibly the systematicity of the VE-constraints.

The historical explanations find further support in synchronic evidence. For example, Hewlett, Matthews and Scobbie (1999) showed that children of English-speaking parents in Edinburgh can fully acquire SVLR-patterning only if at least one of their parents speaks a Scottish accent. Children whose parents are not native to Scotland produce SVLR-allophony less consistently or even not at all. Instead, their productions exhibit a more pronounced VE. Similarly, Scobbie (2005)’s study, based in Shetland, found that young adults whose parents were from Shetland or Scotland largely showed the expected SVLR durations. This was also the case for male speakers whose parents were from England, but young women with English parents showed an English pattern of high VE and low morphological conditioning. Interestingly, both studies (Hewlett, Matthews and Scobbie 1999; Scobbie 2005) contained data from speakers who showed an ‘intermediate pattern’, i.e. durational patterns lying between the Scottish and English systems. This evidence suggests that weakening of the SVLR, and shifting towards VE, under dialect contact may be gradient processes.

Further south, in the English border town of Berwick-upon-Tweed, lying between Scotland and England, where the influence from both Scottish and Anglo-English varieties is relatively high, a similar speaker-specific trade-off between the SVLR and VE-conditioning has been found: Watt and Ingham (2000) investigated data from older (57-65 y.o.) and younger speakers (17-24 y.o.) and showed that in the young group, especially in girls, SVLR was weakening to give way to a stronger VE. Milroy (1995) analysed quantity and quality of the SVLR-diphthong /ai/ in the Tyneside dialect of English spoken in Newcastle and found robust patterns in line with the SVLR in the older speakers whereas his young (again, most notably female) speakers hardly differentiated between SVLR and VE-constraints. Despite this finding, Milroy was reluctant to infer an ongoing loss of the rule in the whole community but concluded that the SVLR alternations in /aɪ/ might signify a change-in-progress potentially leading to a gradual loss of SVLR in Tyneside English.

Admittedly, the covariance of durational as well as spectral allophony in the SVLR-conditioning of /ai/ (long [ɑe] vs. short [ʌi]) creates a special status for this vowel with regard to the monophthongs /i ʉ/, which vary exclusively in quantity. The diphthong may remain susceptible to SVLR but develop vowel quality instead of a quantity contrast over time (cf. Scobbie, Turk and Hewlett 1999; Scobbie and Stuart-Smith 2012). Not many studies, however, have addressed the allophony of the SVLR-monophtongs in apparent time and, to our knowledge, real-time evidence has not yet been considered. Llamas, Watt, French and Robert (2011) analysed productions of /i u ai/ from Tyneside male speakers of different ages (25–68 y.o.) but could not provide an empirical support for the gradual loss of the SVLR since there was a lot of individual variability, and many of the young speakers in their sample produced long vowels according to SVLR while some older speakers had a consistent VE-effect.

The conditions for contact with Anglo-English in the varieties in which the SVLR appears to be weakening vary from being a traditional dialect area of English (Tyneside; Milroy 1995), to a border dialect area between English and Scottish English with a prolonged history of sustained contact (Berwick; Watt and Ingham 2000), to the Scottish Standard English of Edinburgh (Hewlett, Matthews and Scobbie 1999), the city in Scotland that shows the highest proportion of residents born in England (9.5% in Census 2001; 12% in Census 2011). In contrast, Glasgow has half that number of residents born in England (4.24% in Census 2001; 4.8% in Census 2011). Here, Scobbie, Hewlett and Turk (1999) found that speakers from an age- and socially-stratified sample all showed robust SVLR-patterns in /i ʉ ai/. Subsequent, more detailed comparison of demographic evidence for Glasgow and Edinburgh led the authors to predict that middle-class (MC) speakers of Standard Scottish English (SSE) in Edinburgh would be *"further along the continuum towards RP as a result of the greater exposure of the Scottish MC to MC Anglo-English models"* (Scobbie, Hewlett and Turk. 1999:242).

This prediction assumes that the overall relative degree of dialect contact experienced in communities will moderate linguistic outcomes through more or less frequent opportunities for interactions with speakers of Anglo-English. It also presumes concomitant differences in the influence of active and passive mobility (e.g. Britain 2010) and community network structures (more 'open' vs. 'closed', e.g. Milroy and Gordon 2008; Milroy and Milroy 1985). Working-class Glaswegian communities, with much smaller English-born populations and close-knit networks, thus present less overall potential for dialect contact and any impact resulting from it, and hence greater retention of complex dialect forms like the SVLR. But the question still remains, what, if any, is the impact of contact with Anglo-English at the level of individual Glaswegian vernacular speakers. After all, the recent investigation of the diffusing innovations TH-fronting and L-vocalization, typical of London English, in the speech of Glaswegian adolescents in the same or similar communities, showed that low (largely passive) mobility does contribute to some regression models, albeit not very strongly (Stuart-Smith et al 2013). We explore the possible role of dialect contact in leading to weakening of the SVLR, and incursion of the VE for our sample through the *Dialect Contact Hypothesis* below (section 1.4).

1.3 Vowel quantity, prosody and sound change

In addition to phonemic (or quasi-phonemic) quantity alternations, various linguistic factors are known to affect vowel duration. Among them, influences of the prosodic hierarchy are not only well studied (e.g. Beckman and Edwards 1990; Berkovits 1994; Whitman et al. 1992) but have also been suggested to induce system-internal sound-changes (e.g. Beckman, de Jong, Jun and Lee 1992; Jacewicz, Fox and Salmons 2006, Nakai 2013). While Beckman et al. (1992) explain how an increased articulatory overlap and truncation of gestures in prosodically weak positions may lead to long-term sound changes of the lenited type, Jacewicz, Fox and Salmons (2006) argue that chain shifts take their origin in syllables that carry an increased prosodic emphasis. Both proposals are rooted in Ohala's (1981, 1989) idea that sound change arises due to listener's misinterpretation of synchronic phonetic variation present in any acoustic signal. Once the information about the context of occurrence becomes dissociated from the contextually modified sound, the variant will start to spread to other environments, and the sound change sets off. Recent research has demonstrated that listeners in fact compensate for the coarticulatorily-induced variability of sounds unless there is a sound-change in-progress when the perceptual compensation mechanisms are only weakly at play (e.g. Harrington, Kleber and Reubold 2008). Nakai (2013) applied Ohala's sound change principle to the explanation of the cross-linguistically prevalent neutralisation of phonemic quantity distinctions in phrase-final positions, thus providing further arguments and evidence for the central role prosody plays in sound change.

Prosodic accounts of sound change give a particular importance to the two prosodic factors, prominence and phrasal position, which are also the core contributors to the durational patterning of vowels. First of all, a substantial lengthening of segments has been observed in constituent-final positions within the prosodic hierarchy (final in morphemes, prosodic words, feet and particularly prosodic phrases, e.g. Beckman and Edwards 1990; Berkovits 1994; Whitman et al. 1992). In this respect, SVLR partly overlaps with prosodic timing effects since the presence of a following word or morpheme boundary conditions lengthening of SVLR-vowels (and Anglo-English varieties also show lengthened vowels in these positions; Scobbie, Hewlett and Turk 1999). Final lengthening to demarcate high-level prosodic constituency is very widely spread across languages including those with phonemic quantity contrasts (e.g. Remijsen and Gilley 2008; Nakai et al. 2012), and is thus considered a putative universal (Nakai 2013). Accordingly, we could expect this type of lengthening to be observable both in SVLR- and non-SVLR vowels of Scottish English.

Furthermore, the presence of a phrasal prominence is also known to cause lengthening which is primarily located in the stressed vowel of the syllable under accentuation (e.g. Beckman and Edwards 1992; Crystal and House 1988; Harrington, Fletcher and Beckman 2000; Turk and White 1999). In contrast to the commonly observed phrase-final lengthening effect, however, there is a lot of cross-linguistic variability with respect to the prominence-related lengthening (Beckman 1992) with some languages showing very little or no additional lengthening under accentuation (e.g. Fletcher and Evans 2002; Ortega-Llebaria and Prieto 2007).

In languages without phonemic quantity distinction (like many varieties of English), lengthening effects due to prominence and finality have often been shown to cumulate in a linear fashion (e.g. Cummins 1999; Umeda 1975). In contrast, the implementation of the two types of prosodic timing effects is less straight-forward in languages with a phonemic vowel quantity where the segmental and prosodic timing may interact in complex ways**.** Myers and Hansen (2007) reviewed historical evidence, phonological descriptions and phonetic studies for a total of 35 quantity languages from different families (e.g. Hawaiian, Lithuanian, Oromo, Tagalog, Quebec French), and concluded that in all of them, there was a strong tendency for a phonemic quantity neutralisation towards the short phoneme in phrase- or utterance-final positions. That is, the post-lexical prosody may set limitations to the implementation of phonological contrasts involving duration, and serve as a trigger of sound change in the long run (Myers and Hansen 2007). On the other hand, prosodic timing effects can also be shaped by phonemic quantity alternations. For example, some languages have been observed to restrictively regulate the non-phonemic use of duration and to limit the amount of accentual and utterance-final lengthening (e.g. Dinka: Remijsen and Gilley 2008, Finnish: Nakai et al. 2012, Hungarian: White and Mády 2008). In these cases, the high functional load of duration at the level of the phonological system outweighs the lengthening effects at the level of prosodic hierarchy, possibly due to language-specific ceiling effects on duration that aim to preserve the perceptual discriminability of short vs. long phonemes (cf. Meister and Meister 2011; Nakai et al. 2012).

Since little is known about a potential interaction of prosodic timing and SVLR, given that previous studies have considered only citation forms in lists or in carrier sentences, evidence is required to fully understand the SVLR-patterning in conjunction with prosodic timing and any potential development over time. An empirical question, then, is whether or not the multiple demands on durational cuing can act as system-internal forces to set off a change.

1.4 Research focus and hypotheses

The present study draws upon real- and apparent-time evidence for the development of the SVLR in Glaswegian Vernacular. In contrast to previous investigations of this phenomenon, we examine timing relations arising from spontaneous speech. This enables us to offer some new perspectives on an otherwise well-established phenomenon, by considering it in naturally-occurring conversational speech, as opposed to citation forms or sentences, and in working-class, vernacular speakers, as opposed to middle-class, Standard Scottish English speakers. Additionally, we look at speakers of two generations, recorded at two different points in time.

We concentrated on the SVLR-monophthongs /i ʉ/ only as the durational allophony of /ai/ also involves vowel quality alternations (Scobbie, Hewlett and Turk. 1999). Alongside /i ʉ/, we included the non-SVLR vowel /a/. Given the implicational hierarchy proposed for Scottish varieties (McMahon 2000:171), we could not expect SVLR in Glasgow to operate on this vowel even in the 1970s. However, the development of its durational constraints is relevant for our understanding of the VE-status in Scottish English. If Glasgow Vernacular was to develop the typologically more common VE as a part of the grammar, /a/ could be one of the first vowels to develop the VE-patterning since /a/ is considered to be the rarest SVLR-candidate across all dialects of Scottish English (Aitken 1981; Johnston 1997; McMahon 2000; Wells 1982). We assume that the two types of constraints (i.e. both SVLR and VE) can operate on different vowel sets during an intermediate stage before a change sets off and erodes the SVLR-constraints from the original system. The *Dialect Contact Hypothesis* (DCH) therefore predicts that if there are patterns consistent with change, and if these are linked with dialect contact, we may expect Glaswegian vernacular to show some increase in the VE which should first start to be visible in the open vowel, and also in speakers who had experienced more exposure to Anglo-English varieties due higher levels of dialect contact.

The DCH is primarily based on the evidence suggesting that an externally-triggered erosion of the SVLR exploits its interaction with the VE and regularises the durational allophony towards a systematic use of [±voice] constraint operative in Anglo-English and many other varieties of English (Gregg 1973; Hewlett, Matthews and Scobbie 1999; Trudgill 1986). At the same time, we note that the relatively smaller contact demography of working-class Glaswegian communities with respect to those studied to date, together with their closer and denser network structures and more endocentric attitudes, may also act as a brake on such levelling (Scobbie, Hewlett and Turk 1999; Andresen 1988; see 1.2). Moreover, it is quite important to note that although the VE has been frequently documented in many varieties of English and in other European languages (e.g. Chen 1970), it is far from being universal, and cannot be accounted for by physiological factors of speech motor control (Keating 1985; Ohala 1983) and is assumed to be actively controlled by the speaker (Solé 2007). Not all languages, not even all varieties of English, show a clear voicing effect (e.g. Polish, Czech, Saudi Arabic, discussed in Keating 1985; North American English speakers from Maine, Tauberer and Evanini 2009), hence its development in Glasgow Vernacular cannot be plausibly assumed to be driven by a system-internal process.

We further expect SVLR to interact with prosodic timing effects, similar to other quantity languages (cf. Myers and Hansen 2007; Remijsen and Gilley 2008; Nakai et al. 2012; Nakai 2013; White and Mády 2008). A combination of accentual, phrase-final and quantity-related lengthening is likely to reach a durational ceiling, causing one of the linguistic functions to be less prominently demarcated by duration (Nakai 2013). If patterns consistent with change are found for SVLR, these may result from a system-internal restructuring that involves influences from the prosodic timing phenomena like accentuation and phrase-final lengthening. Given the *quasi*-phonemic status of SVLR, Scottish English can be hypothesised to pattern with, or develop a tendency towards, the majority of languages which show a quantity neutralisation in phrase-final positions (see overview in Myers and Hansen 2007), prioritising prosodic lengthening over SVLR. Accordingly, the *Prosodic Timing Hypothesis* (PTH) predicts to find SVLR-weakening primarily in phrase-final and/or nuclear positions of prosodic phrases.

The alternative scenario is, however, also within the scope of possibilities. Under the alternative view, the role of SVLR in the linguistic system of Scottish English is crucial, leading to its dominance over high-level prosodic functions and a stable demarcation of SVLR-contrasts at the expense of accentual lengthening in phrase-final positions (e.g. Nakai et al. 2012). Being the first study to unveil a potential interaction of the SVLR with the high-level prosody, we were unable to predict a clear direction in the timing patterns. Clearly though, whatever these patterns may be, they could not be assumed to arise through the dialect contact, given that Anglo-English does not utilise quantity for its phonemic vowel distinctions (Wells 1982). The magnitude of prosodic timing effects varies across accents of British English, resulting in different impressions of rhythm even in speech communities who have high levels of daily contact (Rathcke and Smith 2015).

The next section describes the method of the empirical study to test the above predictions using combined evidence from real and apparent time.

2 Method

2.1 Corpora and speakers

This study draws on the *Sounds of the City* corpus, a private, force-aligned, electronic corpus of spontaneous speech available for academic researchers, to date covering one hundred years of Glaswegian Vernacular in apparent- and real-time. The corpus is constructed from existing recordings of different kinds, all of spontaneous speech, and includes oral history and sociolinguistic interviews, casual conversations and TV/radio broadcasts. All recordings are of variable duration, ranging between minimally 1 and maximally 50 minutes. With a total duration of approximately 60 hours, the corpus currently comprises of approximately 700,000 tokens produced by 143 speakers. The corpus storage is managed online via LABB-CAT software which allows orthographic and phonemic searches across time-aligned transcripts of the corpus recordings (Fromont and Hay 2012).

In this paper, we present results from recordings of sixteen male speakers made in the 1970s and the 2000s (abbreviated as "70" and "00" in the group codes below), on average of half an hour in duration (or 12-15 min pure talking time per speaker). The 1970s-corpus consists of sociolinguistic interviews between a fieldworker and an informant (Macaulay 1977) whereas the 2000s-corpus contains conversations among self-selected pairs of friends (Stuart-Smith 2006; Stuart-Smith et al 2013). Here we concentrated on the data from male teenage (10-15 y.o.) and adult (40-55 y.o.) speakers recorded in the two decades, i.e. our analyses compared four speaker groups: middle-aged men (70M and 00M) born in the 1920s and 1950s-range respectively, and two of adolescent boys (70Y and 00Y) born in the 1960s and 1990s.[3] Each group was represented by four speakers.

The amount of every speaker's personal contact with Anglo-English varieties was described as either high or low. Travels to and prolonged stays in England were covered in all sociolinguistic interviews conducted by Ronald Macaulay. Accordingly, three speakers could be identified as high contact: *70M-m3* (who had been a sailor with the Merchant Marines and spent six years abroad from age 14 up to 20), *70Y-m1* and *70Y-m4* (who spent long holidays or lived in England – Blackpool, Leeds). In the socio-economic questionnaires collected after the 00Y-recordings had taken place, two speakers of this group (*00Y-m3* and *00Y-m5*) reported to have frequently stayed in various places in England (London, Manchester, Newcastle). No data of this kind were available for the speakers of the 00M-group, as none of them mentioned travels to England, or even outwith the local area, at any point of their conversation. This was in contrast to other speakers recorded in the same way at the same time, such as their female counterparts, whose speech is not analysed in this study. All speakers of this group were coded as low contact; this was further supported by the general demographic profile of the area in which these speakers

[3] The exact birthdates of some informants are not known, so for the purposes of this and other analyses, we assume that speakers from each generation belong to a 'decade of birth', which is expressed with a whole number as a shorthand.

were born and had lived consistently since birth, which is characterised by very low inward and outward mobility (Stuart-Smith et al 2013). In sum, 5 out of 16 speakers (~31%) could be identified as high-contact according to this approach.[4]

2.2 Data annotation

Using LABB-CAT search routines, we extracted all prominent tokens containing /i ʉ a/ totalling N=1520. We excluded all tokens with a postvocalic /r/ given ongoing derhoticisation in Glasgow vernacular (e.g. Lawson et al 2011). The potential interaction of two sound changes in progress deserves a study in its own right, and will not be further addressed here.

Data segmentation, coding and labelling was carried out manually by a fully-trained phonetician (first author) using EMU-software which allows to create hierarchically and sequentially organised speech databases for searches and analyses (Cassidy and Harrington 2001; Harrington 2010). A protocol of segmentation and labelling was developed to ensure consistency across the dataset, and included both acoustic and auditory information, following the guidelines in Peterson and Lehiste (1960). All tokens were coded with respect to three aspects: global prosodic realisation, local environments causing timing alternations (SVLR, VE) and word-level information (see Table 2 for a summary).

First of all, the annotation distinguished three levels of prominence describing the relative weight and prosodic realisation of a lexically stressed syllable in each given phrasal context[5]: metrical stress, pitch-accent and nuclear accent. Metrical stress was labelled in primary

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[4] As rightly pointed out by an anonymous reviewer, an alternative way of coding the levels of contact may include a three-way distinction between "high", "low" and "unknown" (the latter label applied whenever the participant did not explicitly state how often they had been in contact with Anglo-English speakers). There is a merit in this approach to data coding as it does not rely on any inductive assumptions about the speakers. A major shortcoming is, however, a sample reduction which can go far beyond negligible in real-time corpora like ours, compiled from a diverse range of recordings, frequently lacking much detailed socio-linguistic information about the speakers.

[5] Our original notation also included the fourth, highest level of prominence, an emphatic accent (e.g. Ladd and Morton 1997; see also Jacewicz, Fox and Salmons 2006). However, there were only few cases of emphatic accentuation across the whole dataset. Since low numbers did not allow for any conclusive statements about the impact of an emphatic accent on vowel duration, we collapsed "emphatic" with "accented" or "nuclear" as appropriate.

stressed syllables which showed metrical prominence (Hayes 1995; Liberman and Price 1977) but did not carry a pitch accent. The difference between accented and nuclear syllables was defined with respect to their relevance within prosodic phrase: nuclear accents, often considered as having an especially high status in the information structure of an utterance (e.g. Féry and Krifka 2008), were usually the last (but not necessarily phrase-final) prominences of the phrase. The percentage of nuclear accents realised in final vs. non-final positions was well balanced across the dataset (47% vs. 53% of tokens, respectively). There was also a certain amount of post-nuclear stress realised in phrase-final syllables (14%).

Phrasal position was further specified as either medial or final (i.e. the very last syllable) in an intonational phrase[6] (cf. Lehiste 1977; Oller 1973; Scott 1982; Whiteman et al. 1991). This protocol ensured that two lengthening sources – i.e. those involved in the demarcation of the prominence vs. boundary-related effects - were disentangled and could be analysed independently (cf. Nakai et al., 2012; Price et al., 1991; White and Turk 2010).

For each target syllable containing /i/ and /ʉ/, we coded the SVLR-contexts as *short* vs. *long* (plus *morphemic/phonemic* conditioning for long SVLR-vowels) and the VE-contexts as *short, long* vs. *unspecified*. The VE specification as *short* or *long* was applied only in words which had tauto-morphemic consonants following the target vowel. The voicing decision was made under consideration of the consonants' phonemic (not the actual phonetic) voicing status. In cases of an intervening morphemic boundary, VE was annotated as *unspecified*. Given that our study drew upon a corpus of spontaneous speech, this additional label was needed in order to account for many tokens which had an intervening morphemic boundary where VE could not be assumed to apply. Please note that cases coded as *unspecified* overlapped to 100% with cases which were coded as *morphemic* conditioning of the SVLR. The overlap was unlikely to cause

[6] We also coded the first syllables of prosodic phrases as "initial" but, again, given a relatively small number of such cases as well as only negligibly shorter durations in those prosodic positions, we collapsed across the initial and the medial categories, mainly in order to simplify the statistical modelling described in 2.3.

problems for statistical analyses, given that the rest of the coding for each factor diverged. The cases coded as *VE-long* vs. *SVLR-long* differed with respect to following voiced stops (nasal and oral) but not voiced fricatives: the latter were included as *long* in both long contexts; the former was considered *VE-long* but *SVLR-short*.

Table 2 Summary of the data coding (categorical predictors of interest).

Predictors		Levels	Examples	Counts
Global phrasal prosody	Prominence	Metrical stress	*Firhill Stadium should be behind us; just see them go*	202
		Pitch accent	*Catch you the morra; I am keeping away*	699
		Nuclear Accent	*That was two of them; I got a coupon*	619
	Phrasal position	Medial	*two of each; much to do down there*	1193
		Final	*something to do; he broke free*	327
Local timing environments	SVLR	Short (including /a/)	*senior, good, keeping*	1071
		Long (phonemic)	*believe, excuse, used*	160
		Long(morphemic)	*wee, knew, doing*	289
	VE	Short	*last, sweeping, look*	546
		Long	*good, fool, reads*	682
		Unspecified	*see, new, two*	292
Vowel	SVLR-group	/i/	*keep, real, see*	425
		/ʉ/	*coupon, should, knew*	557
	Non-SVLR	/a/	*fancy, catch, lassie*	538

Additionally, every token further received several lexical specifications which are known to affect duration: (1) frequency of use (e.g. Bybee 2001; Gahl 2008; but see Cohn et al. 2005 for conflicting evidence), with target words varying between low-frequency items (*saloon, alopecia*) and high-frequency tokens (*that, you*);

(2) number of syllables within the word, to account for polysyllabic shortening (Lehiste 1977; Port 1981; Nakatani, O'Connor, and Aston 1981, Turk and Shattuck-Hufnagel 2000), with target words containing up to five syllables (*antagonising, opportunity*);

(3) number of segments within the syllable, to account for intra-syllabic compression (Katz 2012, Munhall et al. 1992), with target syllables containing minimally one (*eating*, *Arabs*) and maximally six segments (*streets* only).

Lexical frequency counts were obtained from a large-scale electronic corpus of contemporary Scottish English (Anderson, Beavan and Kay, 2007). We used the spoken part of the corpus comprising 1,317 recordings (4,593,555 words) to calculate the raw counts which were subsequently log-transformed (Hay and Baayen 2002, Mendoza-Denton, Hay and Jannedy 2003). Proper nouns were excluded from frequency analyses since their idiosyncratic usage did not allow for a reliable assignment of lexical frequencies. These three factors (defined as covariates since they were all numeric) helped to account for the potential "extraneous noise" affecting the data patterns in an uncontrolled corpus like ours but were not of a primary research interest for the present study. Their results will be reported in Sect. 3 but not discussed in Sect. 4.

2.3 Data analysis

It is well known that speech timing is strongly affected by individual speech production habits and also by the physiology of a speaker (e.g. Allen, Miller, DeSteno 2003; Bailey and Haggard, 1973; Byrd, 1992; Theodore, Miller and DeSteno 2009; Koenig 2000). To account for such variability, normalisation is usually achieved by calculating durational rankings (Allen, Miller, DeSteno 2003), proportional or ratio durations (Nakai et al. 2012; Watt and Ingham 2000; Scobbie 2005), or by specifying the percentage of produced lengthening (Hewlett, Matthews and Scobbie 1999). All of these measurements need stable points of reference available in controlled laboratory settings but absent in datasets drawn from unscripted speech. More specifically, words can be highly variable in duration due to the number of syllables they incorporate while syllable duration itself is dependent upon the type of segments constituting it (e.g. van Santen and Shih 2000). Consequently, the exact same duration of a vowel may take up a higher or a lower proportion of a word or a syllable making a comparison across different tokens of different structures difficult and this type of normalisation effectively meaningless for non-controlled datasets.

Instead of following a particular normalisation procedure, we report estimates obtained from the statistical analyses which used linear mixed effects models. These models depend both on parameters attributable to the effects of fixed factors and on variance terms attributable to random effects or sources of random variation. Given a dataset, all parameters can be estimated by a variant of the maximum likelihood method. While a raw ('true') mean value at a given level of a fixed factor is an average across various sources of variation present in a dataset, an estimate represents a weighted mean of the values observed only at that level of the factor (i.e. all effects of fixed parameters and random components defined in the dataset are separately estimated by corresponding sample counterparts). Since mixed-effects modelling deals particularly well with uncontrolled, unbalanced datasets typical of spontaneous speech, this appeared to be a useful approach to tackling the normalisation issues while preserving interpretability of the normalised output. Since speaker age is known to often correlate with speech rate (e.g. Ramig 1983; Quené 2008), we additionally ran an ANOVA on speech rate (in syll/sec) as the dependent variable and age group (M vs. Y) as the predictor, but did not find an age-rated speech-rate difference in the sample.

In order to test the hypotheses outlined above, three covariates, seven fixed and two random factors were defined for this dataset, with its dependent variable vowel duration (in ms). Since temporal properties of the SVLR pair /i ʉ/ and of the non-SVLR vowel /a/ are governed by substantially diverging principles, equal variances could not be assumed for the overall dataset. We therefore conducted two separate analyses: one for /i ʉ/ and one for /a/ tokens only.

The *group* factor had four levels (*70M, 70Y, 00M, 00Y*) to represent the real- and apparent-time structure of the speaker sample. Note that this way of coding assumes an interaction of age with the year of recording, and represents the idea that taken together, these two factors represent the flow of time in terms of the speakers' decades of birth spanning 1920s (70M) and 1990s (00Y) in these data (cf. Pope, Meyerhoff and Ladd, 2007). This approach is further underpinned by both theoretical considerations and statistical practicalities: while the comparisons of 00Y and 70M or 00M and 70Y are not meaningful under the 'real-time' (and are obviously impossible under the 'apparent-time') model, 2 x 2 factor definitions lead to an increased number of factor-level comparisons, thus substantially, and unnecessarily, reducing the power of the analyses.

As for the *SVLR,* a three-level factor describing the types of conditioning environment (*phonological, morphological, short*) was tested first, and led to a simplified two-level alternative (*short, long*). The conditioning of VE (*long, short, unspecified*) was tested in every model. Further fixed factors included contact with Anglo-English varieties (*high, low*), levels of prominence (*stressed, accented, nuclear*), and phrasal position (*medial* or *final*). Number of syllables (in the word), number of segments (in the target syllable) and lexical frequency entered all models as covariates. Speaker and word were treated as random effects.

Linear mixed effects models were fitted by restricted maximal likelihood using lme4 and lmerTest packages available in R (version 3.1.0). All relevant two- and three-way interactions of fixed factors were tested for in a backward fitting procedure. The best model fit was established through likelihood ratio tests.

2 Results

3.1 Analysis-1: non-SVLR vowel /a/

Our first analysis concentrated on the open vowel /a/ only, and tested the predictions of the DCH that timing alternations consistent with change might be linked with dialect contact and result in the development of the VE, particularly in this non-SVLR vowel (see 1.4). Following this idea, we tested for an interaction between *VE* and *contact* but failed to find an effect. This separate analysis of /a/-tokens further revealed no group effects suggesting that the durational patterning of this vowel has been stable over time.

The best fit was obtained for a model shown in Table 3, and included all typical prosodic timing effects which have been well documented in the literature (see Fletcher 2010 for a detailed overview). The model contained both prosodic factors (i.e. *prominence*: $\chi^2_{(2)} = 29.3$, $p < 0.0001$; and *phrasal position*: $\chi^2_{(1)} = 37.2$, $p < 0.0001$). Accordingly, phrasal finality caused lengthening of 25 ms ($t_{(500.7)} = 6.2$, $p < 0.0001$) while each increased level of prominence lengthened the duration of the vowel by approximately 15 ms (*accented > stressed*, $t_{(470.6)} = 2.2$, $p < 0.05$; *nuclear > accented*, $t_{(525.7)} = 4.5$, $p < 0.0001$). There was also evidence for two low-level timing processes in these data, the intra-syllabic compression and the polysyllabic shortening. That is, two out of three covariates (here, *number of segments* $\chi^2_{(1)} = 7.1$ and *number of syllables* with $\chi^2_{(1)} = 16.5$) were significant at $p < 0.01$ whereas *lexical frequency* did not reach significance. Accordingly, vowel duration was incrementally shortened by 6 ms with every additional segment in the target syllable ($t_{(274.8)} = 2.7$, $p < 0.01$). Syllables had minimally one and maximally five segments, with CVC/CCV being the most common structures in the dataset (50%). Furthermore, shortening of 10 ms was induced by every additional syllable in the word ($t_{(262.9)} = 4.1$, $p < 0.0001$). Longest words in the dataset had five syllables in total (such cases amounted to merely 0.2% of all tokens whereas the clear majority of 58% was constituted by monosyllabic words).

Table 3: Summary of the best fit model obtained in Analysis-1 (based on /a/-tokens only).[7]

Factor	AIC	χ^2	df	p-value
Prominence	5263.9	29.3	2	.0001
Phrasal position	5273.8	37.2	1	.0001
Number of segments in the target syllable	5243.8	7.1	1	.01
Number of syllables in the target word	5253.2	16.5	1	.01

[7] As suggested by an anonymous reviewer, tables summarising the distribution of observations across factor levels were created and can be found in Appendix A.

3.2 Analysis-2: SVLR-vowels /i ʉ/

The second analysis was conducted with /i ʉ/-tokens only and focused on testing the predictions of the PTH and the DCH. In order to find empirical support for the PTH, we should be able to ascertain an interaction of the prosodic factors (phrasal position and/or prominence) with the SVLR; a three-way interaction involving speaker group would be indicative of change related to prosodic timing (see 1.4). The DCH would hold if a two-way interaction of *contact* and *VE* turned out significant, with high-contact speakers producing longer vowels in *VE-long* contexts.

A preliminary analysis established that the two lengthening environments of the SVLR (morphological vs. phonological) did not significantly differ for either of the SVLR-vowels. Long SVLR-contexts were therefore collapsed across the two conditions. Vowel category (/i/ vs. /ʉ/) showed no effect on its own but entered a three-way interaction with *VE* and *contact* ($\chi^2_{(2)}$ = 8.7, p = 0.013). The best-fit model further contained a two-way interaction of *SVLR* and *prominence* ($\chi^2_{(2)}$ = 13.9, p < 0.001) and a three-way interaction of *phrasal position* with *group* and *SVLR* ($\chi^2_{(3)}$ = 19.3, p < 0.001). Among the covariates, only *number of segments* ($\chi^2_{(1)}$ = 4.9) was significant at p < 0.05 (but not *lexical frequency* or *number of syllables*) meaning that with each segment added to the syllable, the vowel duration decreased by approximately 3 ms ($t_{(94.2)}$ = 2.2, p < 0.05). The overview of the model is given in Table 4.

Table 4: Summary of the best fit model of Analysis-2 (based on /i ʉ/-tokens only).[8]

Factor/interaction	AIC	χ^2	df	p-value
*SVLR*prominence*	9259.5	13.9	2	.001
*Phrasal position*speaker group*SVLR*	9263.0	19.3	3	.001
*VE*vowel*contact with Anglo-English*	9254.4	8.7	2	.013
Number of segments in the target syllable (1-6)	9252.6	7.1	1	.01

[8] Tables summarising the exact numbers of observations for each significant factor and interactions revealed by Analysis-2 can be found in Appendix B.

The interaction of *group*, *SVLR* and *phrasal position* contributed to the ultimate improvement of the model fit, and is shown in Figure 1. The effect was indicative of the 70M-group being different from the other groups in phrase-final positions (real-time 70M/00M-comparison: $t_{(80.2)} = 2.6$, $p = 0.01$; apparent-time 70M/70Y-comparison: $t_{(59.3)} = 2.9$, $p < 0.01$). As illustrated in Figure 1, the 70M-speakers realised 30-50 ms more lengthening of the SVLR-long vowels in phrase-final positions in comparison to other groups. In these speakers, the difference between phrasal-final SVLR-long vs. SVLR-short vowels amounted to approximately 100 ms while all other groups produced a difference of approximately 60-70 ms and did not significantly differ from each other.

--------------------Figure 1 around here -------------------------

The second significant prosodic effect, which shaped the implementation of *SVLR* across both age groups and decades of recording, was attributable to the degree of *prominence*. Without the presence of a pitch accent, stressed vowels received 20-30 ms less lengthening in the SVLR-long contexts (*accented* vs. *stressed* comparison: $t_{(834.8)} = 5.1$, $p < 0.001$; *nuclear* vs. *stressed* comparison: $t_{(901.1)} = 6.0$, $p < 0.001$). The durational difference between *nuclear* and *accented* SVLR-long vowels was comparably small (10 ms, $t_{(944.7)}=2.4$, $p<0.05$). These effects are shown in Figure 2.

In contrast to the considerable impact of the presence of a pitch accent on SVLR-long vowels, SVLR-short vowels remained largely unaffected. There was a small lengthening effect in nuclear positions with only *stressed* vs. *nuclear* comparison reaching significance ($t_{(943.3)}=2.4$, $p<0.05$).

--------------------Figure 2 around here -------------------------

In comparison to the prosodic influences described above, the impact of vowel category combined with *VE* and *contact* was considerably weaker. The results of the three-way interaction are displayed in Figure 3. The significant comparison involves one vowel-specific lengthening effect related to the amount of contact with AE: among speakers with high AE-contact, /i/ was found to be significantly longer in unspecified *VE*-contexts (i.e. at morphemic boundaries, as in *see##, bee#hive, see#ing*). The difference amounted to approximately 15 ms ($t_{(25.3)}$=2.2, $p<0.05$). Unlike a previous results provided by Scobbie, Hewlett and Turk (1999:244, fn4) for Standard Scottish English spoken in Edinburgh, we did not find vowels in *VE-unspecified* contexts to be generally as long as *VE-long* contexts in the vernacular Glaswegian data. Both /i/ and /ʉ/ vowels were numerically but not significantly longer in contexts specified as *long* by *VE*; for neither vowel could we find a significant lengthening distinction between *VE-short* and *VE-long* contexts within the group of high-contact speakers.

--------------------Figure 3 around here -------------------------

3.3 Analysis-3: SVLR and prosodic timing

As shown in the second analysis, SVLR interacts with each type of prosodic timing phenomena independently (i.e. *SVLR*prominence* and *SVLR*phrasal position*, see 3.2). To fully understand the scope of the interaction of the SVLR with prosodic timing phenomena in these data, a further exploration of the three-way interaction (i.e. *SVLR*prominence*phrasal position*) seemed worthwhile. Given that accented vs. nuclear levels of prominence were not strongly distinguished by duration, we collapsed them into one category, *accented*. Accordingly, the resulting factor *prominence* had two levels, *stressed* and *accented*. This enabled us to probe the three-way interaction of SVLR with the two prosodic timing effects simultaneously. Of particular interest was here the question whether or not we could find evidence for durational ceiling effects arising from the combined demarcation of SVLR, accentual and phrase-final lengthening.

Subsequently, the best-fit model reported in 3.2 was taken as a starting point and modified as to include the additional three-way interaction of interest. The new output (see Table 5) contained the same significant effects with comparable durational estimates as the best-fit model reported in 3.2, with the new three-way interaction only trending towards significance ($\chi^2_{(1)}$=3.2, p=0.075). This marginal finding appeared somewhat unsurprising given how rare some cases in the *stressed*-condition were in the database (e.g. the number of SVLR-long post-nuclear phrase-final vowels amounted to less than 2% of all stressed vowels). Nevertheless, we examined the output of the new model. The estimates for the additional three-way interaction *SVLR*prominence*phrasal position* are displayed in Figure 4.

Table 5: Summary of the best fit model of Analysis-3 (based on /i ʉ/-tokens only).[9]

Factor/interaction	AIC	χ^2	df	p-value
*Phrasal position*speaker group*SVLR*	9264.4	16.2	3	.001
*VE*vowel*contact with Anglo-English*	9258.2	8.0	2	.018
Number of segments in the target syllable	9257.4	5.2	1	.023
*SVLR*prominence*phrasal position*	9255.4	3.2	1	.075

--------------------Figure 4 around here -------------------------

Under this view of the data, a clear durational demarcation of the SVLR-contrast was absent in phrase-medial positions without a pitch accent (the difference between SVLR-long and SVLR-short vowels produced $t_{(851.6)}$=1.5). However, SVLR-related lengthening surfaced under accentuation ($t_{(668.7)}$=5.9, p<0.001) and in phrase-final positions regardless of accentuation (*stressed*: $t_{(902.4)}$=4.7, p<0.001 and *accented*: $t_{(851)}$=8.9, p<0.001).

Phrase-final lengthening effect of SVLR-short vowels amounted to merely 15 ms yet was significant (*stressed*: $t_{(909.3)}$=2.2, p < 0.05; *accented*: $t_{(939.6)}$=3.5, p < 0.001). In contrast, these vowels did not show a significant lengthening due to the presence of a pitch accent in either medial or final phrasal position.

[9] A table summarising the distribution of observations for the new interaction (*SVLR*prominence*phrasal position*) tested in Analysis-3 can be found in Appendix C.

The interaction of phrasal position and accentuation defined as having two instead of three levels was also tested for the non-SVLR vowel /a/. However, the interaction failed to produce a significant effect ($\chi^2_{(1)}$=0.1, p=0.7). This indicates that in contrast to the SVLR-set, prosodic timing effects apply to non-SVLR vowels additively, and should be conceived of as two independent effects.

4 Discussion

The present study addressed the evidence for variation and potential change in the implementation of the SVLR in spontaneous speech in a Scottish urban vernacular. In so doing, we combined evidence from real- and apparent-time data and tested two hypotheses which predicted patterns of variability and change to arise from external (DCH) and/or internal (PTH) influences. We will discuss evidence gathered to shed light on each hypothesis, and draw conclusions about the stability vs. change over time in the SVLR in Glasgow.

4.1 Is there an external influence on SVLR-patterns in Glasgow?

The results provide rather weak support for an externally-driven weakening of the SVLR and shift to the VE as a result of an exposure to Anglo-English as outlined by the *Dialect Contact Hypothesis* in 1.4. We failed to find a clear timing distinction between contexts specified as *VE-long* (i.e. in vowels followed by voiced consonants) and *VE-short* (i.e. in vowels followed by voiceless consonants) among the high-contact speakers of our corpus, although there was a non-significant tendency for the duration of /ʉ/- and /i/-allophones to be longer in *VE-long* environments and /ʉ/-allophones to be slightly shorter in *VE-short* environment. This lack of a significant effect may at least partly be due to the small sample size of the group identified as "high-contact" (just five speakers from the 70M, 70Y and 00Y groups).[10] Interestingly though,

[10] An anonymous reviewer noted that our high-contact group was dominated by young speakers (4 Y vs. 1 M), stating that this imbalance in terms of age could have contributed to the lack of the expected effects. However, the fact that the youngsters, otherwise well-known for being leaders of sound changes and linguistic innovations, did not produce patterns consistent with change may rather reinforce the idea that there were none to be observed.

/a/ that was hypothesised to be the first vowel to develop the timing alternations of the VE because it lacks the SVLR-allophony, did not show any effect of an increased contact with Anglo-English (and there was not even a numerical tendency to lengthen slightly in VE-long contexts that we observed in the high vowels).

However, we observed a subtle, albeit unpredicted, influence of dialect contact on one SVLR-vowel category. The only significant effect applied to /i/ (but not /ʉ/) which was lengthened in high-contact speakers, and this lengthening was localised in the *VE-unspecified* contexts, i.e. at morphemic boundaries. We note that this is an environment where Anglo-English speakers would also be expected to show vowel durations longer than those specified by voiced consonants (see 1.1), although we are unaware of any experimental study to date that has shown a potential difference in lengthening due to the VE vs. morpheme boundary in Anglo-English.

In general, our results confirmed the assumption by Scobbie, Hewlett and Turk (1999) that the degrees of morphologically and phonologically conditioned lengthening did not differ for either SVLR-monophthong in our Glaswegian data. Future research designed explicitly to make comparisons between the VE and morphological boundary effects in both Anglo-English and Scottish speakers (with different degrees of dialect contact) is needed to resolve this issue.

Overall then, our results did not support the *Dialect Contact Hypothesis*, if by this one assumes a simple equation of increased exposure to Anglo-English leads to a weakening of the SVLR and appearance of VE patterns – irrespective of the relative degree of contact within the community, the community network structure and its attitudinal outlook. It is clear from the studies of Scottish English reviewed in 1.2 that the SVLR weakening and shift to the VE under dialect contact in these varieties presumes a sustained intimate contact over a long periods of time, at the community level. Scobbie, Hewlett and Turk (1999) themselves assume that the maintenance of the SVLR in the Glaswegian sample recorded in the 1990s, is at least partly due to differences in the Anglo-English contact demographies in Glasgow and Edinburgh. Added to this, the linguistic outcome of dialect contact for working-class Glaswegians may also have been constrained in the kinds of ways envisaged by Andresen (1988), namely that the levelling of this marked dialect feature to the more widespread VE is effectively braked by both community structure and endocentric attitudes, though the latter is still to be established empirically for Glasgow.

Furthermore, it is also clear from the previous studies that less clear-cut patterns under conditions of contact may emerge. Both Hewlett, Matthews and Scobbie (1999) and Scobbie (2005) show that intermediate patterning of durations may be found. Our results present only tendencies towards VE in high vowels but these are neither significant nor consistent. It may well be that these less well determined patterns are actually indications of the very beginnings of a shift to the VE for this sample, which is still nevertheless constrained by a relatively consistent implementation of the SVLR (see 4.2 and 4.3 below). Further research on contemporary and future recordings of Glaswegian, with more data from speakers of different levels of exposure to Anglo-English, will enable us to assess the extent to which the VE may be encroaching in this variety.

4.2 Are there internal constraints at play?

The results of this study are fully in line with the *Prosodic Timing Hypothesis* and provide a strong support for the idea that the variation in SVLR-patterns is constrained internally, interacting with prosodic timing effects such as accentual and phrase-final lengthening. From a typological perspective, Scottish English seems to have developed a mixed system of timing constraints. On the one hand, its non-SVLR vowels like /a/ show simple cumulative lengthening effects of increased prominence and finality similar to those attested for a variety of dialects of English which do not use durational alternations phonemically (e.g. Cummins 1999; Umeda 1975). On the other hand, the subsystem of SVLR-monophthongs (consisting of only /i/ and

/ʉ/) patterns with quantity languages which restrict the amount of lengthening available to the demarcation of the prosodic hierarchy (e.g. Finnish: Nakai et al. 2012; Dinka: Remijsen and Gilley 2008; Hungarian: White and Mády 2008). Interestingly, the limitation of lengthening degrees apply almost exclusively to SVLR-short, but not the SVLR-long vowels. As presented in 3.2 and 3.3, the duration of SVLR-short vowels was utterly unaffected by the presence of a pitch accent in these data, while SVLR-long vowels showed a considerable degree of lengthening under accentuation. Thus phrasal prominence seems to enhance the durational SVLR-contrast as it enhances phonemic quantity distinctions in many quantity languages (e.g. Arabic: de Jong and Zawaydeh 2002; Finnish: Suomi 2007; Swedish: Heldner and Stranger, 2001).

Similar to the prominence, phrasal finality led to a minimal increase in duration of SVLR-short vowels but lengthened SVLR-long vowels quite considerably. Nevertheless, it would be premature to conclude that there is only a limited degree of phrase-final lengthening in some Scottish phrases since the SVLR-short vowels are always followed by at least one consonant (i.e. a nasal, a lateral or a stop) where the effect of finality may manifest itself. Future investigations need to address the impact of proximity to phrasal edges on syllable components of a syllable susceptible to SVLR. Taken together, these results suggest that vocalic timing in Scottish English functions phonemically like in any quantity language (e.g. Nakai et al. 2012; Remijsen and Gilley 2008; White and Mády 2008), even if in a very limited set of Scottish monophthongs.

What is most striking about these findings is, however, the fact that a clear durational distinction in keeping with the SVLR-constraints was practically absent in phrase-medial, unaccented positions but enhanced in phrase-final positions regardless of prominence. This result is at odds with previous research on quantity languages reviewed in the introduction (see Myers and Hansen 2007; Nakai et al. 2013 and references therein), which provided evidence for quantity neutralisations in phrase-final but not phrase-medial positions. This discrepancy potentially derives from two sources. First, the *quasi*-phonemic status and a rather peripheral role of vowel quantity in Scottish English might encourage a lessened articulatory control of timing in less salient prosodic positions. After all, phrase-medial positions are known for increased coarticulation and articulatory weakening (e.g. Fougeron and Keating 1997). A different, somewhat complimentary, explanation is, however, also plausible. In contrast to previous studies that were based on investigations of laboratory speech (e.g. Heldner and Stranger 2001, de Jong and Zawaydeh 2002, Nakai et al. 2012, Suomi 2007), our study drew upon unscripted speech which is known to be typically less careful (e.g. Warner and Tucker 2011). This idea is in line with previous observations on Japanese where timing oppositions fail to apply in casual (and fast) speech (Kubozono 2002). Future investigations would benefit from comparisons of SVLR-patterns produced in spontaneous vs. prepared speech, and in different prosodic environments to shed light on a series of internal factors constraining the variation and possibly inducing a change.

4.3 Is SVLR changing in Glaswegian Vernacular?

Our final question addresses the extent to which the SVLR may be changing in Glasgow. Given that the PTH is largely supported by these data, can we also infer a change hypothesised to be due to influences from prosodic timing? Indeed, the results are broadly suggestive of a system-internal sound change which becomes visible in speakers born between 1950s (00M-goup) and 1960s (70Y-group) and involved a weakening of SVLR in prosodic tails. The speakers with the earliest dates of birth in the corpus (70M-group) were different from all other groups in that they had a stronger demarcation of SVLR-related lengthening in phrase-final position. Although the phrase-final shortening of SVLR-long vowels did not eliminate the strong temporal contrast between SVLR-long and SVLR-short vowels, the finding still presented us with a development that points in the direction reported for a variety of quantity languages (see Myers and Hansen 2007; Nakai 2013 and references therein).

Why might speakers born in the 1950s and after show a reduction in SVLR-long vowels? We further suggest that the *Prosodic Timing Hypothesis* alone does not entirely explain the main data patterns. Given that the change was observed in speakers who had acquired their vernacular during the time of urban regeneration happening in Glasgow between 1950 and 1970 (i.e. speakers from the 1970Y and 2000M groups), we argue that the results align well with a key postulate of social network theory (Milroy and Gordon 2008; Milroy and Milroy 1985). Loosening of network structures reduces the stability of vernacular norms, facilitating language change towards a new, system-internally plausible form. Alongside system-internal factors inducing sound changes (e.g. Lawson et al 2013), social factors are also known to have promoted recent consonant changes in Glaswegian vernacular, especially changes in social network structure and class-based ideologies which developed alongside and after the urban regeneration, amongst other things (Stuart-Smith et al 2007). Glasgow experienced substantial socio-spatial changes across the course of the 20th century. The city landscape was radically reorganised during the period of urban regeneration starting in the 1950s and continuing until the mid-1970s. The process resulted in the fragmentation of communities as inner-city housing was demolished and inhabitants were decanted to new homes, sometimes at opposite ends of the city. According to a contemporary historian, the urban regeneration policy in Glasgow was *the "wholesale destruction, the consequence of which is clear to see – a city of desolation, devoid of the community spirit which used to be so strong, but above all the city devoid of pride"* (Worsdall 1979:12). These changes appear to have left their impact on the consonantal system of Glaswegian (Stuart-Smith et al 2007); the shift from close-knit to more open networks, and then back to strongly close-knit, dense, networks which swiftly reformed as the regeneration ceased, seems to have led first to a weakening of the norm enforcement mechanism which maintained traditional vernacular features and rebuffed innovations. However, once the communities had returned to their earlier state of strong ties , both levelling and diffusion could accelerate again (cf. Andersen 1988), also promoted by other factors such as shared social practices, engagement with the London-based soap, *EastEnders,* and to a certain extent, dialect contact with Anglo-English speakers (Stuart-Smith et al 2013).

With respect to the urban regeneration period in Glasgow, the 70M-speakers were born well before it began, becoming children and even teenagers before the Second World War. Speakers of the 70Y and 00M-groups were born and acquired their vernacular during the early period of regeneration. From the results here, the SVLR is most robustly maintained – in the strongest prosodic position – in those born before the Second World War. The reduction in SVLR-long vowels in phrase-final positions appears in those speakers who acquired their vernacular during the time of urban regeneration, suggesting that for vowels, too, the shifts in the network structure may have led to a loosening of traditional norms, possibly paving the way towards a weakening of the SVLR which was then maintained as the networks reformed (the 00Y-group show the same pattern as 00M and 70Y, but were born some time later).

We have seen above (4.1) that there are glimmers of influence of Anglo-English dialect contact, but they are weak, and much more so than for the diffusion of consonant innovations such as TH-fronting. This is alongside what appears to be a system-internally-driven shift in the SVLR, possibly also facilitated by historical shifts in the city's network structure; this weakening is also subtle.

5 Summary and conclusions

The study presented in this paper seeks evidence for a longitudinal development of the Scottish Vowel Length Rule from durational analyses of a sixteen-speaker sample drawn from a large-scale corpus of spontaneous Glaswegian speech. The results show that the Rule remains operative in Glaswegian Vernacular, although signs of a weakening over time are also evident. Shifts in the implementation of the Rule seem to be promoted by prosodic factors (i.e. to be induced system-internally) and perhaps entrenched by social factors, namely historical changes in the social network structure during the urban regeneration. However, this weakening is not accompanied by a straightforward shift towards the constraints of the consonantal Voicing Effect present in Anglo-English, and is not triggered by high levels of individual exposure to Anglo-English; in this, our findings diverge from previous evidence collected in the context of an extensive dialect contact at the community level (like in Berwick and Edinburgh; see Watt and Ingham (2000) and Hewlett, Matthews and Scobbie 1999). Given the relatively small sample of high-contact speakers investigated in this study, the conclusion needs to be treated with caution until a future replication with a new, larger group of speakers.

In contrast, our results are clearly in line with the predictions of a prosodic timing model which expects an erosion of categories to be found in prosodically weak environment (e.g. phrase-medial, unaccented positions of prosodic phrases, Beckman et al. 1992; Jacewicz, Fox and Salmons 2006) or to be shaped by durational ceiling effects (e.g. in positions combining accentual, phonemic and phrase-final lengthening, Myers and Hansen 2007; Nakai 2013). The present study is the first to provide evidence for this interaction of the SVLR with prosodic timing, and the first to investigate the SVLR as it occurs in conversational speech. In this way, our naturalistic, socially-stratified, data demonstrate how prosodic constraints on vowel duration operate as a mechanism of phonological change in conjunction with social factors (e.g. Scobbie and Stuart-Smith 2012). A combination of laboratory and naturalistic evidence may perhaps pave the best way towards a well-informed theory of language as it helps identifying phonetic features which are under a speaker control and can be modified for stylistic purposes.

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Appendices

Appendix A: Number of observations for each significant factor in Analysis-1

Table A.1 Number of observations for the three-level factor *prominence* (χ^2=29.3; p<.0001).

	Stressed	*Accented*	*Nuclear*
N	23	259	256

Table A.2 Number of observations for the two-level factor *phrasal position* (χ^2=37.2; p<.0001).

	Phrase-medial	*Phrase-final*
N	436	102

Table A.3 Number of observations for the covariate *number of segments in the target syllable* (χ^2=7.1; p<.01).

	1	*2*	*3*	*4*	*5*
N	5	142	268	109	14

Table A.4 Number of observations for the covariate *number of syllables in the target word* (χ^2=16.5; p<.01).

	1	*2*	*3*	*4*	*5*
N	311	150	61	15	1

Appendix B: Number of observations for each significant factor in Analysis-2

Table B.1 Number of observations for the two-way interaction *SVLR*prominence* (χ^2=13.9; p<.001).

	Stressed	*Accented*	*Nuclear*
SVLR-short	106	225	229
SVLR-long	73	215	134

Table A.2 Number of observations for the three-way interaction *phrasal position*speaker group*SVLR* (χ^2=19.3; p<.001).

	70M		*70Y*		*00M*		*00Y*	
	Phrase-final	*Phrase-medial*	*Phrase-final*	*Phrase-medial*	*Phrase-final*	*Phrase-medial*	*Phrase-final*	*Phrase-medial*
SVLR-short	35	118	50	119	24	54	40	120
SVLR-long	19	107	18	67	14	57	25	115

Table B.3 Number of observations for the three-way interaction *VE*vowel*contact with Anglo-English* (χ^2=8.7; p=.013).

	Low-contact		*High-contact*	
	/i/	*/ʉ/*	*/i/*	*/ʉ/*
Unspecified	67	99	51	66
VE-short	80	62	58	55
VE-long	95	165	74	110

Table B.4 Number of observations for the covariate *number of segments in the target word* (χ^2=7.1; p<.01).

	1	*2*	*3*	*4*	*5*	*6*
N	14	366	438	142	20	2

Appendix C: Number of observations for a new three-way interaction in Analysis-3 (*SVLR*prominence*phrasal position*, χ^2=3.2; p=.075).

	Phrase-medial		*Phrase-final*	
	Stressed	*Accented*	*Stressed*	*Accented*
SVLR-short	84	327	22	127
SVLR-long	70	276	3	73

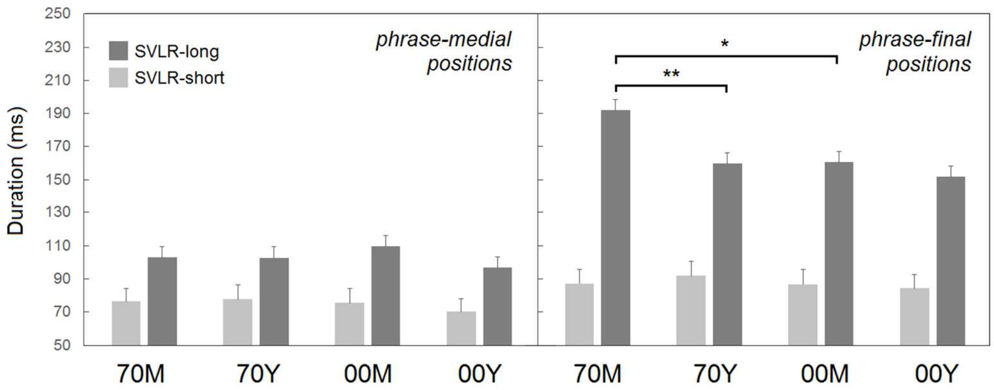
List of figures

Figure 1: Estimated means and standard errors of vowel duration for the vowels /i ʉ/ in the two SVLR-contexts (indicated by the two shades of grey) in phrase-medial vs. phrase-final positions across four speaker groups. The reference level for prominence is accented, and for vowel is /ʉ/.

Figure 2: Estimated means and standard errors of vowel duration for the vowels /i ʉ/ in SVLR-long vs. –short contexts (indicated by the two shades of grey). The three levels of prominence are given on the x-axis. The reference level for phrasal position is medial, and for vowel is /ʉ/.

Figure 3: Estimated means and standard errors of vowel duration for the vowels /i/ vs. /ʉ/ in high- vs. low-contact speakers (indicated by the two shades of grey). The *VE*-contexts (unspecified, long, short) are displayed along the x-axis. The reference levels are accented, phrase-medial.

Figure 4: Estimated means and standard errors of vowel duration for the vowels /i ʉ/ in SVLR-long vs. –short contexts (indicated by the two shades of grey) and two different phrasal positions. The two levels of prominence are given on the x-axis. The reference level for vowel is /ʉ/, and for group is 70Y (i.e. about 30 ms need to be added to the SVLR-long phrase-final duration to arrive at the corresponding estimate for the 70M-group only).



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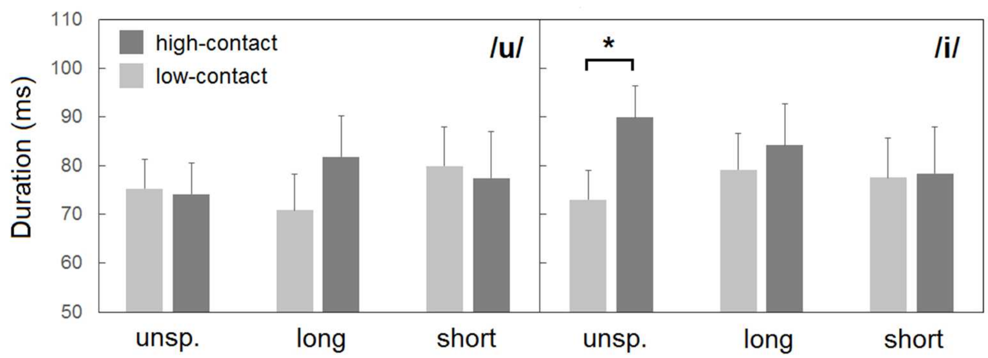

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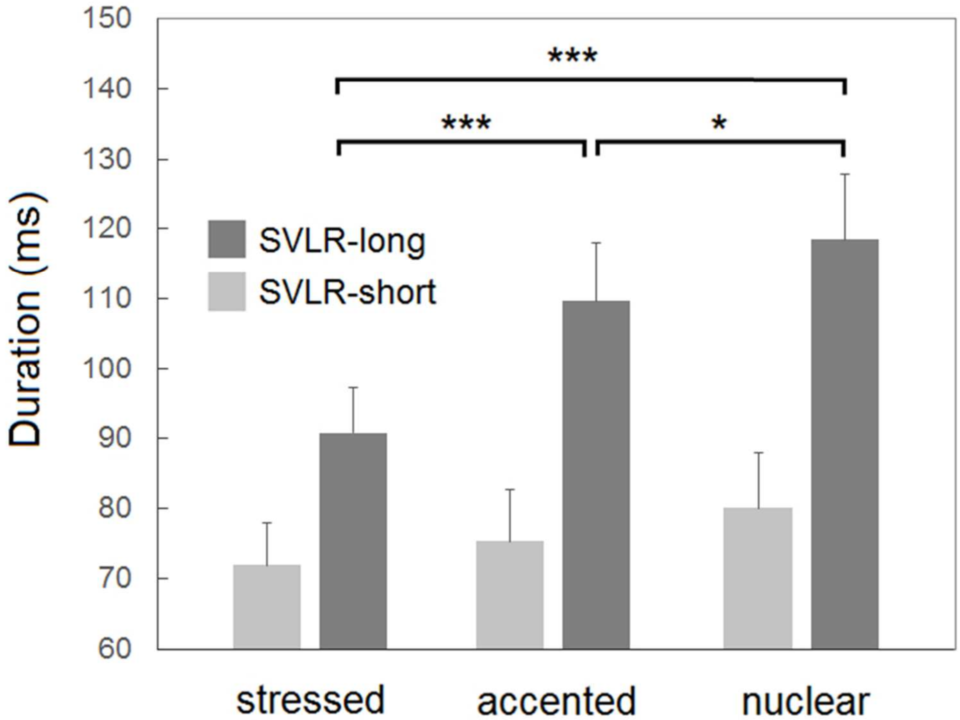

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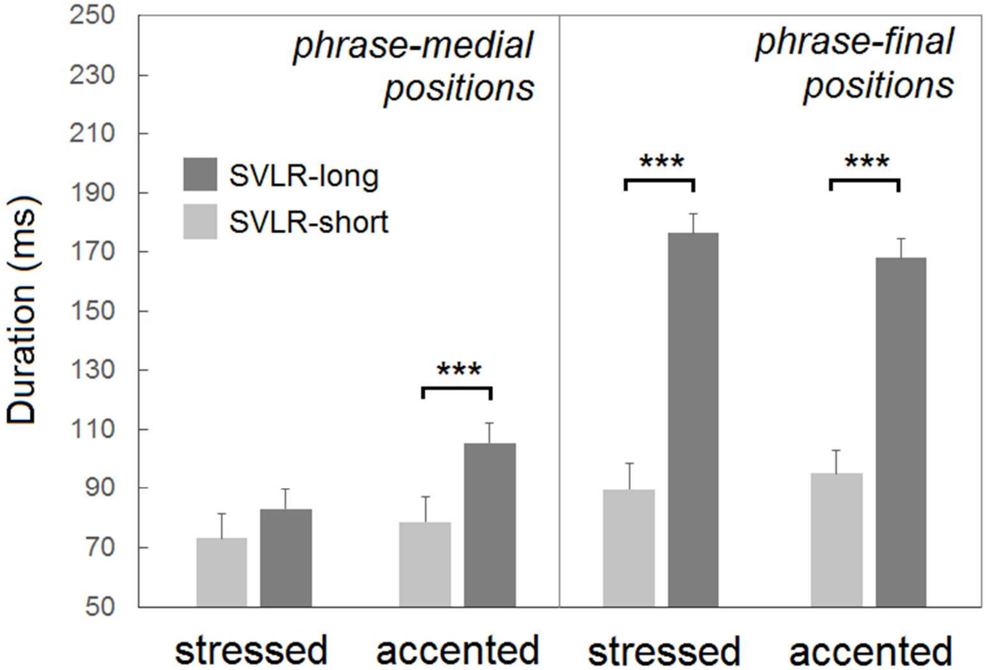

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