

THE STATUS OF THE “SYLLABIC” TRILL IN SLOVENE: A PHONOLOGICAL AND PHONETIC ANALYSIS

Mark J. Jones

Introduction

In the overwhelming majority of languages only vowels can form the nucleus of a syllable and bear tonal and stress distinctions. Some languages, however, allow other sounds to function as the syllable nucleus: languages of the Pacific Northwest of America, like Bella Coola, allow syllabic fricatives and stops. Many Bantu languages of Africa have syllabic nasals. German and accents of English allow both syllabic nasals and laterals, and rhotic accents of English also allow syllabic approximant /r/. Languages of the Slavonic sub-group of Indo-European like Czech and the Serbo-Croatian linguistic complex have a syllabic trill /r/. Cognate forms in Slovene, also a Slavonic language and particularly closely related to Serbian and Croatian, are written with orthographic ‘r’, but phonological descriptions of Slovene differ as to the exact syllabic treatment of this /r/. Some phonologists treat this sound as a single phonological unit capable of acting as a syllabic nucleus, others regard it as a sequence of a vowel + /r/.

The dispute arises because most accounts of Slovene phonetics indicate that the trill component of the nucleus is preceded by the mid central vowel schwa [ə]. For example, De Bray (1969, 371) states that the syllable nucleus /r/ is pronounced “ər in educated conversational language, e.g., between two consonants [...] or initially when accented.”¹ Derbyshire (1983, 15) also mentions this potential pronunciation of “[t]he letter r,” but makes no comment on its phonological status. The phonetic transcription of Slovene in Šuštaršič et al. (1999) transcribes the word *prvemu* with a long schwa [pə:rvemu]. Herritty (2000, 17) also comments that when syllabic, the trill is realised as a phonetic sequence of [ər]. Broch (1911, 96) can also be included here.

Based on the attested pronunciation of the nuclear trill as [ər] and the independent presence of the phonemes /ə/ and /r/ in Slovene,

¹ Although DeBray is not a Slavicist, his comments are pertinent and find wider support, particularly when the issue is phonetic and may have a basis in general human phonetic capabilities.

Lenček (1982, 119) considers “syllabic” /r/ to be a sequence of the phonemes /ə/ and /r/: “CSS [Contemporary Standard Slovene] and most of its dialects do not have syllabic consonants in their vocalic systems. Phonemically, in languages with an indeterminate vowel in their systems, the syllabic consonants are to be interpreted as polyphonematic units.” Srebot-Rejec (1988) appears implicitly to agree with this analysis, and Priestly (1993, 395) appears to concur with this phonological interpretation in using angled brackets for phonemes when he states that “[o]rthographic r represents the sequence /ər/ initially before a consonant and interconsonantly.” However, Herritty (2000) lists the syllabic /r/ amongst the consonants, which suggests that he regards this phonetic sequence as a single unit, a syllabic allophone of /r/.

There is therefore some dispute about the phonological nature of the syllabic trill in Slovene as to whether it can be regarded as a syllabic allophone of /r/, or a sequence of two phonemes. There is general agreement on the presence of a vocalic element [ə] at the phonetic level, but what remains unclear is the phonological status of this element. Note that this dispute says nothing about the more general question of syllabicity itself—either the trill functions as a syllabic nucleus, as trills can in other languages, or it is the coda to a nucleus containing schwa. In both cases the orthographic ‘r’ represents a separate syllable.²

The purpose of this paper is to investigate the status of this [ə] element from a phonological and instrumental phonetic perspective. For the purposes of the discussion here the term “syllabic trill” will be employed to describe the phonetic sequence [ər] when this represents orthographic ‘r’.

Phonological Evaluation of the Syllabic Trill

Lenček’s “polyphonematic” analysis of the syllabic trill as a sequence of /ə/ + /r/ respects a notion of economy as a factor in determining the size of phoneme inventories. As Slovene possesses both a phoneme /ə/ and a phoneme /r/, a phonetic sequence of [ər] must be interpreted as a sequence of the relevant phonemes. The interpretation of

² The question of what counts as syllabic is a thorny issue, and whilst there is no doubt that an analysis of Slovene “syllabic” /r/ can contribute to the debate, it is not a central issue here, where both alternative accounts of “syllabic” /r/ function uncontroversially as a syllable nucleus.

a phonetic sequence as a sequence of phonemes does not simply rely on the separate phonological occurrence of each phone, however. Affricates provide a case in point. In English, the phonetic sequence [tʃ] exists in words like "chip." Both of these phones can be linked to separate phonemes /t/ and /ʃ/, e.g. "tip" and "ship," yet the phonetic sequence [tʃ] is described as a separate unitary phonological contrast, not a sequence, an analysis based primarily on the non-occurrence of comparable sequences involving a voiceless stop + /ʃ/, like /pʃ/ and /kʃ/. Similarly, vowel sequences such as [ai] and [au] in English and many other languages tend to be regarded as single phonological units (diphthongs) despite the fact that most languages have the vowel phonemes /a/, /i/ and /u/, and hence a sequential polyphonemic account could be advanced. However, the lack of a larger repertoire of vowel pairings such as /ɛu/ or /ʌi/ in many accents of English indicates that vowel sequences may not occur in any possible combination, and suggests that the phonetic sequences of [ai] etc. should be regarded as indivisible phonological units. It should be clear from these examples that the ability of the phonologist to reduce a phonetic sequence to a phonological sequence cannot in itself be taken as evidence for the non-existence of a single phonological unit. Possible phonological evidence which might bear on the monophonemic or polyphonemic status of the trill comes from the distribution of vowel-/r/-consonant (henceforth VRC) sequences in the lexicon, and the tonal and length characteristics of the trill.

As regards the VRC sequences, a cursory survey of lexical items from any dictionary rapidly leads one to the conclusion that this syllable type is not one which has been inherited from the ancestor of the present-day Slavonic languages, Common Slavic. All words containing VRC sequences, regardless of the particular vowel involved, appear to be recent borrowings from other languages, e.g. *karta* 'map', *torta* 'cake', *kurva* 'curve' (from German or Italian). This lack of VRC sequences in native Slavonic vocabulary is also reflected in other Slavonic languages and can be attributed to processes like /r/ metathesis or the development of epenthetic vowels in the development of Slavonic (Schenker 1996: 74–75). Inherited words from Proto-Indo-European which contained a VRC sequence were subject to this metathesis process which resulted in RVC sequences. This can be illustrated by a consideration of the cognates /rabota/ in Russian and *Arbeit* 'work' in German. Consequently, sequences of vowel + /rC/ are very rare in the modern Slavonic

languages, and tend overwhelmingly to be present in proper names and loan words. Interpreting “syllabic” /r/ as a /Vr/ sequence multiplies the number of /ərC/ sequences considerably when compared with identical sequences involving other vowels.

This approach might be rejected on the grounds that vowel + /r/ + /C/ sequences do occur in modern Slovene in words which have been fully integrated into the morphology (such as *karta* ‘map’), and a distributional skewing of this sort is often found in languages as an anomaly of the lexicon which need not be subject to any phonological explanation. For example, although vowel + voiced stop sequences are permitted in English as in *big*, *rid*, *cub*, when we consider words containing tense /i/ + voiced stops such as *read*, *league*, we find that these occur overwhelmingly with a final alveolar /d/. A relatively recent coinage in British English such as *Beeb*, a familiar term for the BBC (British Broadcasting Corporation), demonstrates that there is no phonological prohibition on other sequences, but there are no Standard English words *deeb*, *neeb*, *teeb*, or *teeg*, *seeg* etc. The lack of examples of this pattern reflects a historical “accident,” an anomaly in the English lexicon and nothing more. Such an argument could be used to counter a phonotactic motivation for introducing a syllabic /r/ phoneme into the Slovene inventory on the basis of the paucity of other /Vr/ sequences. There are, however, further indications that the “polyphonematic” analysis is problematic.

It is clear that in Slovene other vowels can be followed by /r/ if that /r/ is intervocalic, i.e. sequences such as /ara/ do exist as intervocalic /r/ did not fulfil the conditions for metathesis in Common Slavic. Yet, contrary to what we would reasonably expect if vowels could combine freely with /r/, /ərV/ sequences are non-existent in modern Slovene. If the schwa + /r/ sequence is treated as a unitary syllabic nucleus then the distributional imbalance is motivated in an economical way: [ərV] sequences fail to occur because phonologically they are /rV/, i.e., a sequence of two syllabic nuclei with no intervening onset or coda. Slovene does not have any such sequences.

These observations could be regarded simply as lexical indications of the historical development of the syllabic trill, which tell us nothing about its synchronic phonological status. A further additional piece of evidence for the analysis of syllabic trills as a phonological VR sequence comes from the treatment in Slovene of Slavonic syllabic /l/,

which has developed into a polyphonematic unit /ol/ (= phonetic [ov]) in words like *volk* 'wolf', etc. A later Slovene development of vocalic nuclei to support historically syllabic consonants is therefore well-founded. The occurrences of historical syllabic /l/ are written with an orthographic vowel in modern Slovene, a point which may suggest a more recent development as far as /r/ is concerned.

Rather more pertinent to the synchronic status of syllabic trills as a sequence of schwa + /r/ in Slovene comes from a consideration of stress and length. As Srebot-Rejec (1988) shows, this is a problematic area of Slovene phonology, and the discussion below is necessarily simplistic. Traditionally, where stress and length have been considered separate entities, dictionary entries for words containing the "syllabic trill" show it to be universally long when stressed—short stressed "syllabic trills" do not occur. This contrasts with the pattern for schwa, which is always short when stressed (Derbyshire 1993). If the syllabic trill is analysed phonologically as a sequence of schwa + trill, then some kind of phonological (phonotactic) rule must operate to produce only long schwa + /r/, but short schwa before other consonants. However, it should be noted that a similar prohibition is not entirely without precedent in Slovene: the open vowels [ɛ] and [ə] only occur when long and stressed (Derbyshire 1983, 18).

To summarise the phonological arguments presented thus far: it is insufficient to provide a sequential phonological interpretation on the basis of the independent phonological occurrence of the members of such a sequence. Phonotactic data must also be brought to bear. The data from Slovene indicate that the syllabic trill could be a sequence of /ər/ on the basis of other (borrowed) VR sequences and the development of the Slavonic syllabic /l/. Issues of suprasegmental effects such as stress and length are more complex, but there is no obvious indication that the syllabic trill is necessarily a unit phoneme. Additional evidence is required to indicate which analysis is preferable.

Alternatives to the polyphonematic analysis

One way to furnish this evidence is to approach the problem from the opposite direction: if the phonetic [ə] identified as an inherent phonetic component of the syllabic trills by so many researchers is not an instance of the phoneme /ə/, some other explanation for it must be sought. Two possibilities present themselves as being most obvious. On

the one hand, [ə] could be an epenthised vowel not part of the underlying representation and used to allow a correct syllabification of underlying CRC sequences. On the other hand, [ə] could be a phonetic unit generally associated with the production of trills, in much the same way that a phonetic [h] can be associated with the production of a voiceless aspirated plosive.

Epenthesis of vowels to break up otherwise “illegal” clusters of consonants in a language is a commonly proposed phonological device (Blevins 1995, 222–28; Steriade 1995, 132; Spencer 1996, 63). Blevins (1995, 225) exemplifies this process with data from Lenakel where an underlying form /rnol/ with an illegal /rn/ onset surfaces as [rɪnol] ‘he has done it’, and /tnakol/ is found as [tɪnagol] ‘you (singular) will do it’. As Steriade (1995, 132) points out, these epenthetic segments are not present in the underlying representation but are introduced as “empty place-holders” at a later stage of derivation. Their actual phonetic content is determined at a still later stage. Applied to Slovene syllabic trills, this analysis would posit a syllabic trill at the underlying level, with a later specification of a vocalic element which is attributed the phonetic qualities of [ə] for phonetic implementation. This process is illustrated below:

Fig. 1: Illustration of a putative process of [ə] epenthesis in Slovene *prst* ‘finger’.

underlying form		/prst/	‘finger’
		↓	
epenthesis		/pVrst/	
		↓	
surface form		[pərst]	

The existence of multiple levels within phonology is not universally accepted, but is widespread and will be accepted here without further comment. Two aspects of the process remain to be

determined—the relative location of the epenthesis element, and its phonetic quality. As for the location, in order to produce a legal syllabification of the word *prst*, a vowel can be epenthesised in either of two positions: /pVrst/ or /prVst/. The phonetic accounts of Slovene do not indicate the occurrence of an onset /pr/ cluster preceding the vowel in words of this type, but instead, the epenthetic vowel appears to split the /p/ and /r/. It might be argued, given the independent existence of /pr/ onsets in Slovene (in accordance with a general principle which maximises the membership of syllable onsets, Blevins 1995) and the lack of native VR sequences, that the location of this epenthetic vowel appears to contradict other phonological patterns in the language. Against this line of argumentation can be set the details of the development of Slavonic syllabic /l/ which has surfaced with a similarly preposed vocalic element, e.g. Czech *vlk* ‘wolf’ = Slovene *volk*. There does appear, therefore, to be some independent evidence for an epenthesis process of this type. Although the /l/ example lends support to an epenthesis account in this regard, it complicates the matter of vowel quality, as for syllabic /l/, no [ə] is present. Instead, the vowel is [o]. It remains to be determined why the phonetic quality of a “placeholder” should differ. In most accounts of epenthesis, the quality of the epenthesised vowel is constant or subject to vowel harmony processes. Possibly it is the nature of /r/ or /l/ which determines this. Regardless of these details, the status of the phonetic [ə] as an epenthetic vowel does appear plausible.

The third possibility is that the phonetic [ə] is an inherent and unavoidable aspect of the production of a trill. Phonetically, a trill is a rapid series of closures produced at a particular place of articulation, usually apical alveolar, although uvular trills are not uncommon, and bilabial trills have also been reported. The oscillation of the tongue tip for production of a trill depends upon aerodynamic factors (Perkell 1997, 352; Solé 2002 656–58). In order to produce an alveolar trill, it is essential to balance an appropriate degree of muscular tension in the tongue tip and tongue body with a sufficiently rapid rate of airflow. The build-up of oral pressure drives the articulators apart and allows air to flow out of the oral cavity between them. An increase in velocity of the lung air between the tongue tip and the alveolar ridge during release leads to a drop in pressure (the Bernoulli effect) and this pressure drop allows the elastic forces in the tongue tip to restore it to its position against the alveolar ridge. Air pressure begins to increase behind the occlusion until the articulators are once again forced apart and the cycle repeats itself.

Précise control of the tongue tip muscle force and the airflow to produce a trill is not easy, which may explain why trills are found in such a wide variety of allophones (Lindau 1985; Solé 2002). The control of voicing during trill production may conflict with the requirements for tongue tip vibration. Voicing requires loosely adducted vocal folds; a high airflow for the production of the trill is more likely to require a relatively open glottis, as in the production of (especially voiceless) fricatives. This conflict may explain the tendency for phonetic trills to devoice allophonically or to appear as voiced but without a trill component.

During the closed phase a trill is in effect a stop and during the open phase the vocal tract changes shape constantly as the tongue tip is forced down then moves upwards once more to effect a closure. As in the release of a stop, a close approximation of the articulators follows release, and there may be some frication due to turbulence in the airstream. Less approximation as the tongue tip is forced down will result in a more vowel-like vocal tract setting. In theory then, a vowel like articulation may accompany the production of a trill between the closed phases. It remains to be seen whether such vocalic elements are reported in descriptions of trills in other languages.

Ladefoged and Maddieson (1996, 218) in their survey of trills from various languages note that the open phase in both Russian and Finnish non-syllabic trills “is vowel-like in its acoustic structure.” They also record the presence of a short approximant/vowel before initial /r/ in Italian *rana* ‘frog’ (Ladefoged and Maddieson 1996: 219–20). Jassem (1964, 339) reported two closures for Polish /r/ in “ordinary non-emphatic speech,” each of short duration, around 40 ms. These closures alternated with a vowel like open phase of around 80 ms. In a study of the syllabic trill in Czech and Slovak, Hála (1963, 263) records an onset transition of 35–45 ms, which is followed by 3 contacts separated by two vocalic elements between 12.5 ms and 23 ms in duration. A further vocalic transition of 20–80 ms follows the final contact in each case. According to Jassem, the quality of the open phase in non-intervocalic Polish trills is like that of schwa (Jassem 1964, 339). In a brief description of the syllabic trill of Croatian, Landau et al. (1999, 67) report that “[w]hen occurring between two consonants, [the syllabic trill] is sometimes pronounced together with *nonphonemic* [ə], i.e. as [ər], e.g. [vêrt] v`rt ‘garden’.” [emphasis added – MJ]. These data from various languages indicate that a vocalic element may be an essential aspect of trill production which need not be determined by the phonology and this

element may be schwa-like in quality. Syllabic trills in Czech or Croatian possess a vocalic element which cannot be associated with a phonemic /ə/, and non-syllabic trills in Polish, Italian, Finnish and Russian exhibit a vocalic element in their production.

So far, it has been shown that a polyphonematic account of Slovene syllabic trills is plausible: the phonetic schwa element cannot be dismissed as an instance of /ə/ on the basis of other phonological patterns in Slovene, though these do attest to its different diachronic development. However, these patterns allow no real conclusion to be drawn either way. It is also possible that the phonetic schwa is not an instance of underlying /ə/. Instead it could be an epenthesised 'placeholder' segment to enable legal syllabification. Finally, data on the phonetics of trills in other languages indicate that phonetic [ə] may occur as an inherent element in trill production with no phonological status. A phonetic study of syllabic trills in Slovene may indicate which analysis is correct.

An instrumental phonetic analysis of Slovene "syllabic" trills

An acoustic analysis of controlled Slovene speech data will allow durational properties of the schwa component in "syllabic" trills to be measured and compared with a) the duration of phonemic schwa, and b) the duration of other vowel qualities before /r/. An assessment of durational properties can be used to support a particular phonological analysis. Furthermore, acoustic analysis will allow the identification and measurement of vocalic elements in non-syllabic trills, e.g. in onset position before vowels. The presence of such an element would be damaging to a phonological account, and might be difficult to identify impressionistically.

Data for acoustic analysis were collected from three natively monolingual Slovene speakers. The speakers were all female postgraduate students at the University of Cambridge in the 25–35 age range. All three speakers were from different dialect backgrounds and had moved several times within Slovenia during their childhood. The differing dialectal backgrounds of the speakers should have no discernible effect as Lenček (1982) states that most Slovene dialects do not possess syllabic trills.³ No

³ The comparable behaviour of all three subjects indicates that no dialectal differences were present in their speech. It is unfortunately beyond the scope of this paper to discuss possible dialectal differences.

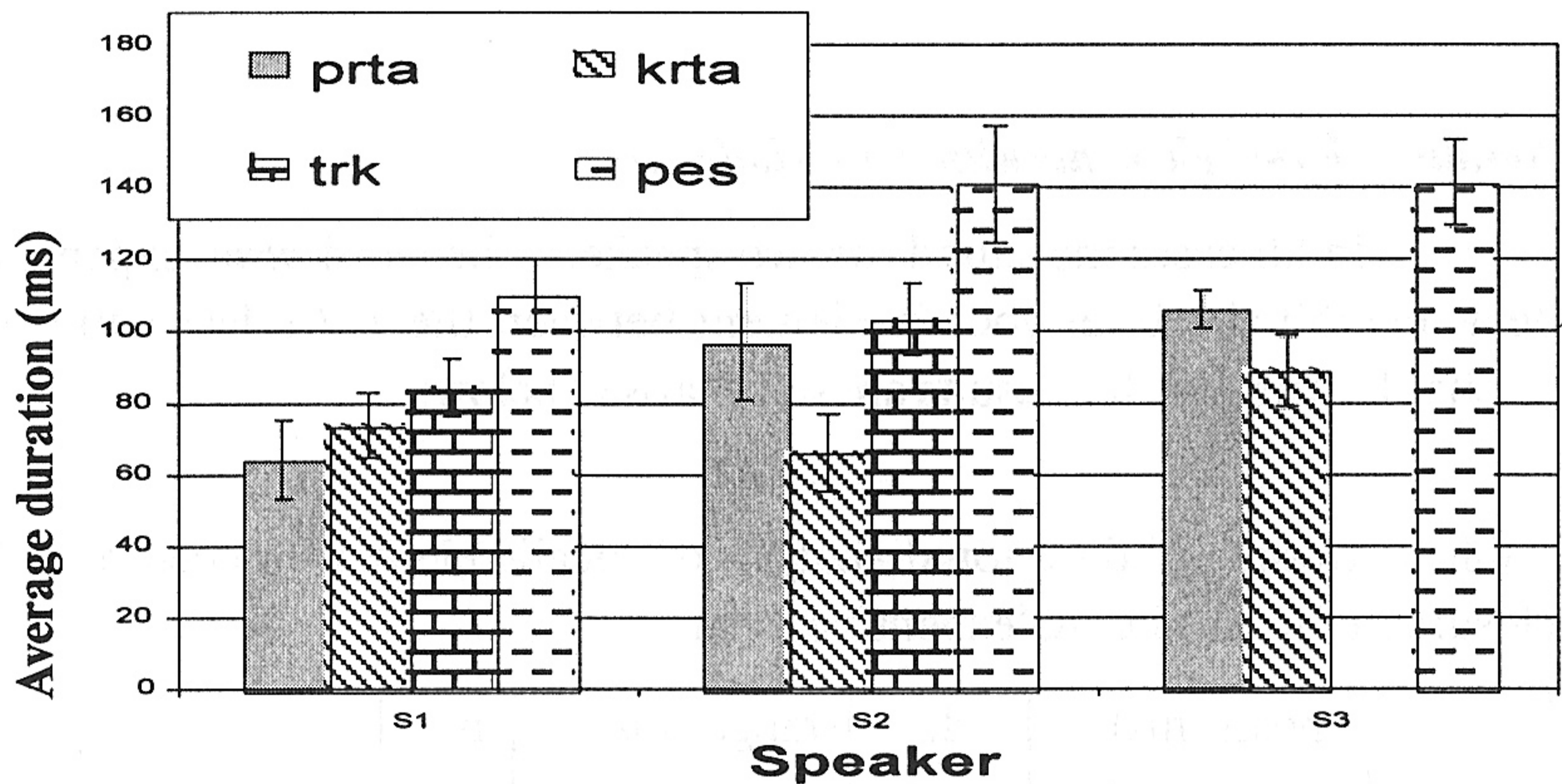
speaker had spent longer than five years abroad, and speaker S2 had been in Cambridge for less than a year. Though fluent in English, all three speakers retained traces of a non-native accent. The speakers were recorded using a Kensiko unidirectional lip-microphone (range 20-14,000 Hz, signal-to-noise ratio 30 dB) in a quiet room as they read a data task aloud. The task was presented in a Microsoft PowerPoint slide show on a Toshiba laptop and progression through the slides was controlled by the subjects. The task involved the elicitation of test words (labelled here as X) directly from the carrier phrase *Reči X enkrat* 'Say X again'. The words for analysis here were *pes* 'dog', *porta* 'gate', *karta* 'map', *torta* 'cake', *krtā* 'mole' (genitive singular), *prta* 'fodder', *trk* 'crack', and *drag* 'expensive, dear'. A number of filler words, not intended for analysis, was included to present a more varied phonological pattern. The test words were elicited six times each. The recordings were digitised at 11,025 Hz and low-pass filtered at 5,000 Hz for acoustic analysis using Sensimetrics' Speech Station 2 speech analysis program.

Several measurements were made: the duration of the entire VR sequence in all test words except *drag*, duration of pre-trill vocalic element (including occurrences in *drag* if identified), duration of trill, duration and number of closures, and duration of post-trill vocalic element. Sequence duration was measured from the onset of the vowel, as judged from the waveform and spectrogram window using standard visual techniques, i.e. onset of broadband periodic energy showing vowel formants, backed up by auditory analysis of selected portions of the signal. Offset of the sequence depended on the quality of the next segment. In the case of stops, the onset of stop closure was usually very clear and illustrated by the sudden loss of amplitude across a wide frequency range in the spectrogram window. General qualitative observations on the trills were also recorded. Misreadings were not analysed. For further information on acoustic analysis, see Johnson (1997), Hayward (2000), and Ladefoged (2003).

Results – Vowel Duration

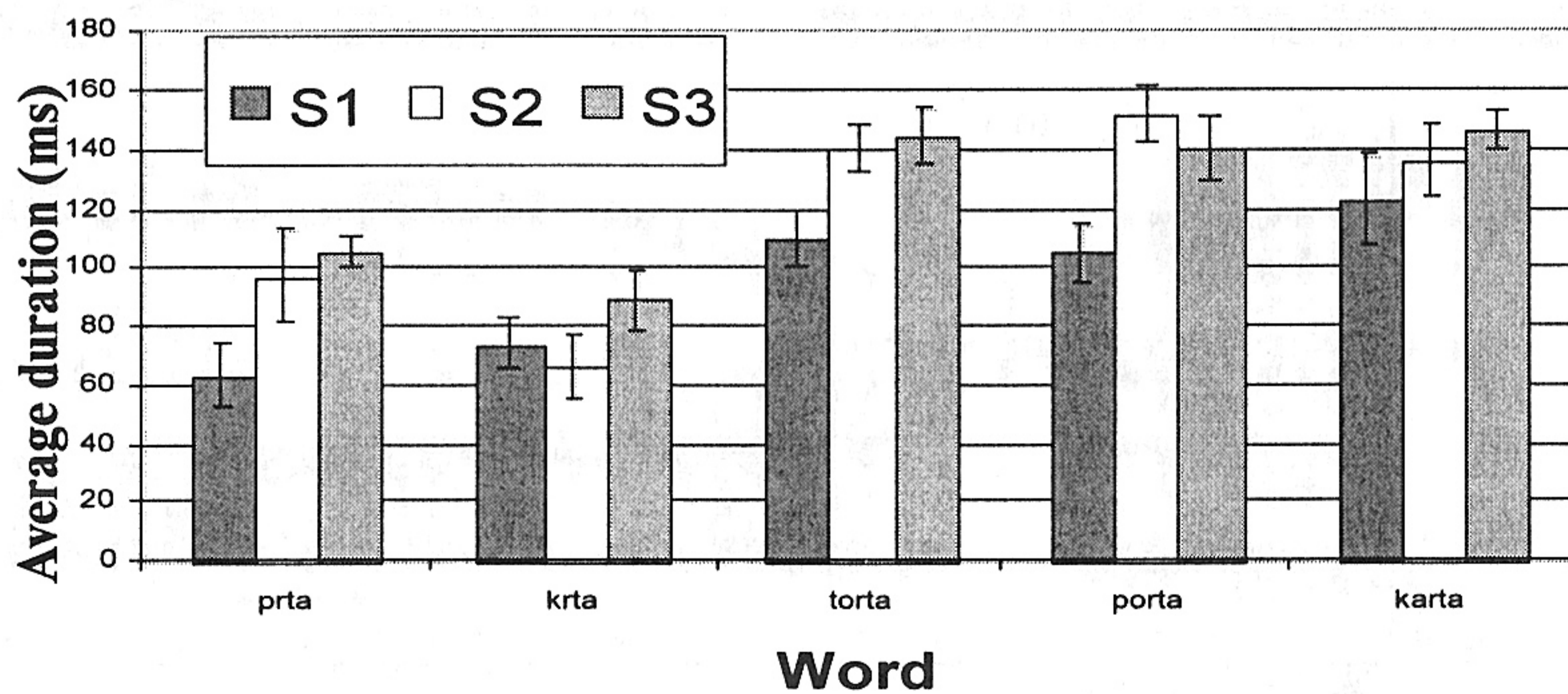
The results for the measures of vowel duration are presented in figures 2 and 3; details appear in the appendix.

Fig. 2: Average duration (ms) of vowel elements in the words *prta*, *krta*, *trk* and *pes* for all three Slovene speakers. Error bars indicate \pm standard deviation



The results show that the phonemic schwa vowel in *pes* is longer than the schwa-like vocalic element in the “syllabic” trills by at least 26 ms. The average difference between the duration of schwa-like vowels in the “syllabic” trills and the vowel in *pes* is 43 ms (s.d. 11).

Fig. 3: Average duration (ms) of schwa-like vowels in the “syllabic” trills and vowels + /r/ for all 3 speakers. Error bars indicate \pm standard deviation.



The graph in figure 3 compares the duration of the vocalic element in the “syllabic” trills with the phonemic vowels in VR clusters in *porta*, *torta*, and *karta*. It can be seen that the durations of the vocalic elements in the “syllabic” trills are always shorter than those in the VR sequences for individual speakers.

Results – Vowel elements with non-syllabic trills

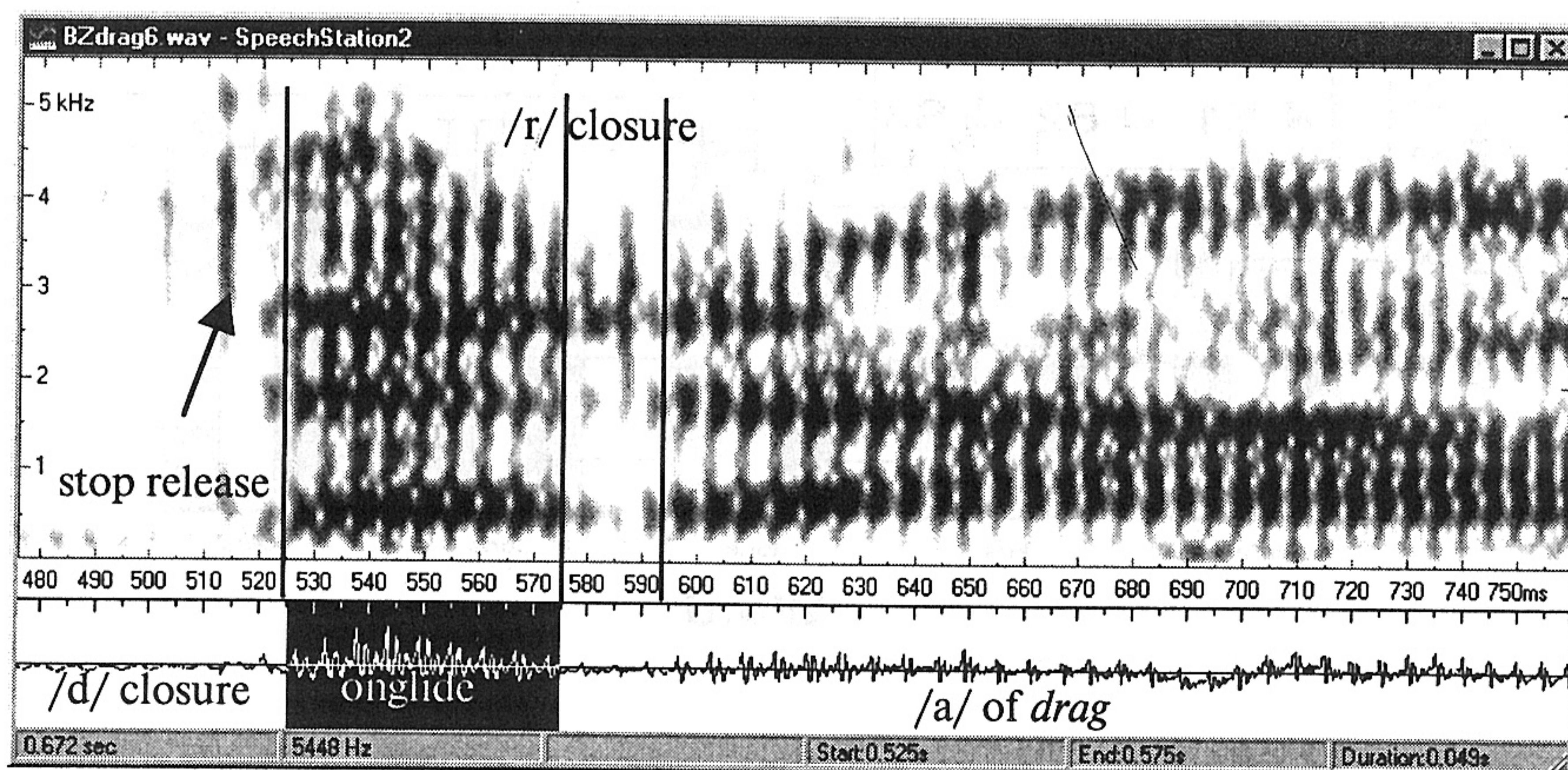
In all cases measured for two speakers, the word *drag* ‘expensive, dear’ exhibited a brief vocalic element between the /d/ release and the closure for the trill. the results are summarised below:

Table 1: Results of durational analysis of vocalic element preceding trills closure in the word *drag* ‘expensive, dear’.

	mean (ms)	s.d.	range (ms)	n
S1	24	3	21–29	6
S2	39	9	29–50	4

It can be seen that the vocalic element is brief but consistently present. The following spectrogram shows one instance of a vocalic element in the /dr/ onset cluster.

Fig. 4: Spectrogram showing the vocalic element in the onset cluster /dr/ as produced by speaker S2.



The spectrogram above shows a production of *drag* by S2. The stop release is followed by a vowel like onglide to the /r/ closure of 49 ms duration (indicated in black on the waveform window).

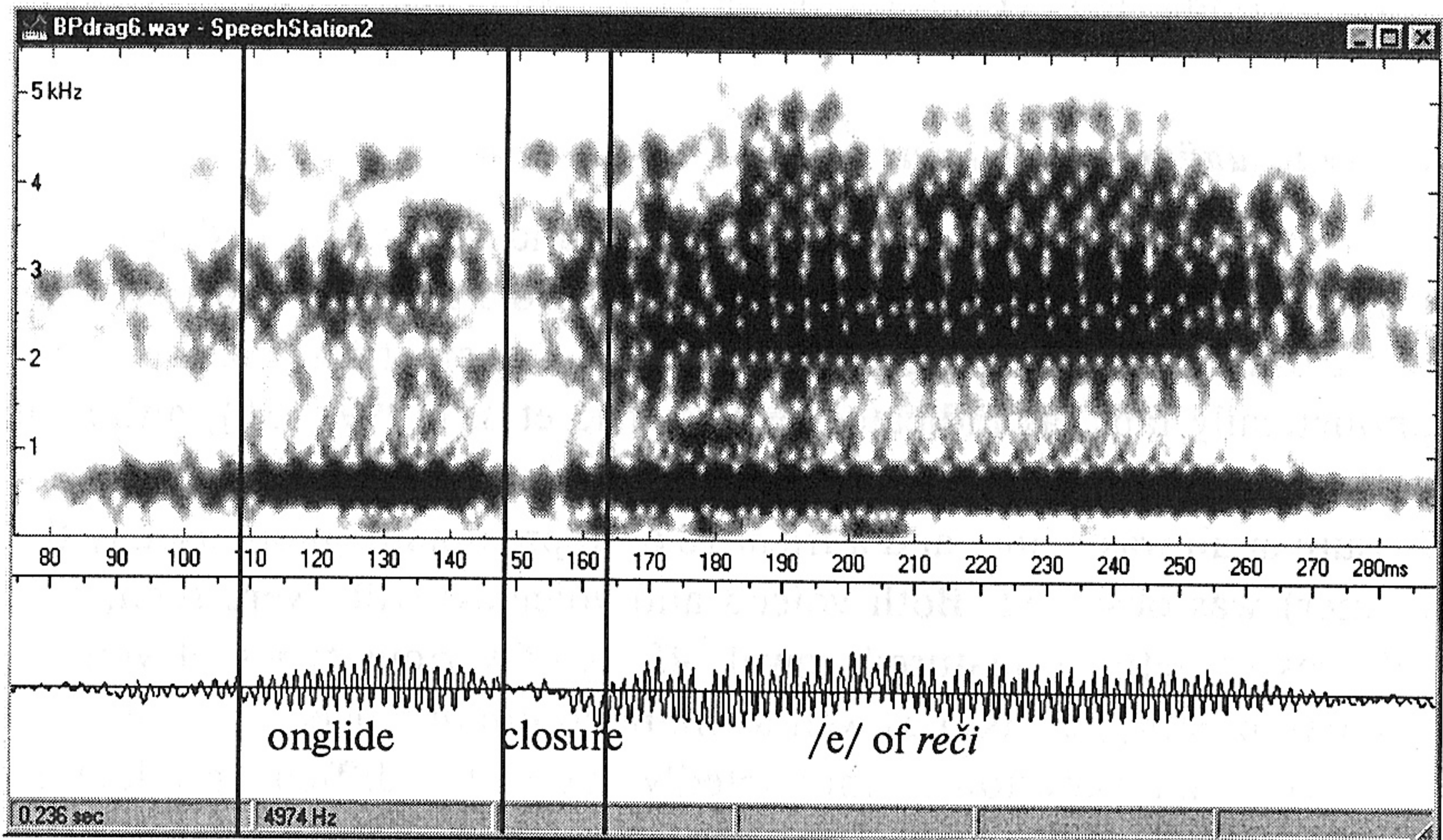
General qualitative comments

A huge amount of variation was found in the production of the trill elements themselves (cf. Lindau 1985; Solé 2002). In general only one closure and release was observed in the Slovene trills, i.e. they were phonetically taps, as indicated in Šuštaršič et al (1999, 136), although some speakers did have occasional multiple releases. Frequently no closure at all was made, and a fricative or approximant (more usually the former) was observed. Both voiced and voiceless trills were seen, and releases sometimes featured vowel offsets of various types of voicing (modal, breathy, creaky) as well as more common voiced and voiceless frication. This variation is undoubtedly due to the difficult production requirements for voiced trills outlined above.

In addition to the expected vocalic onglides, speaker S2 had a vowel-like offglide after the trill in *krta* and *trk* in all tokens measured. Similar offglides were seen for S2 in 44% (7/16) of the tokens for *karta*, *porta* and *torta*. There would seem to be a tendency for S2 to produce these vowel-like offglides with the “syllabic” trills, but she is by no means consistent. S1 had a different /r/ realisation, which included a closure period or period of weak frication, followed by a vowel-like offglide of between 20 and 31 ms duration.

A vocalic element was also observed before onset /r/ in *reči*. No durational measurements were made across the data as a whole. An example is presented below: The spectrogram in figure 5 shows the production of the word *reči* by S1. The vowel-onglide preceding the closure for the initial trill is marked and has a duration of around 39 ms.

Fig. 5: Spectrogram showing the vocalic element before onset /r/ in the word *reči* (speaker S1).



Discussion

This paper has applied laboratory phonology techniques to investigate the status of the schwa-like vowel element reported to occur with a possible syllabic trill. It was argued that notions of economy are insufficient to determine whether or not a unit or sequence analysis is preferred, but additional considerations of lexical and suprasegmental patterns in Slovene phonology were inconclusive. Three possible sources of the vocalic element could be identified: 1) a phonemic /ə/, 2) an epenthetic [ə] required to syllabify otherwise illegal consonant sequences, and 3) a phonetic element reported to occur with syllabic and, most importantly, non-syllabic trills. Three native speakers of Slovene resident as students in Cambridge, UK, served as subjects for an acoustic production study.

In accordance with cross-linguistic descriptions of trills, a range of realisations was found which included voiced and voiceless taps, approximants and fricatives. As expected from previous impressionistic phonetic accounts, a vocalic element was found to precede the “syllabic” trills of Slovene. The duration of this vocalic element was brief when compared to that of /ə/ in the word *pes* ‘dog’ and when compared to

other vowels preceding /r/. All instances of the syllabic trill are classified as "long and stressed," according to traditional accounts in Slovene grammars and dictionaries, whereas the vowel of *pes* is referred to as "short and stressed" in such works. As such we might expect to find that the vowel component of *pes* is shorter than that of the syllabic trills, yet the results presented here contradict this assessment, even when the number of syllables in the test word is controlled for. Consequently, the phonemic nature of the vocalic element present with the "syllabic" trills may be doubted, even if it is not conclusively ruled out.

Data from non-syllabic trills must also cast a shadow of doubt over an interpretation in terms of a phonological epenthesis process. Vocalic elements were seen to precede non-syllabic trills in the onset cluster /dr/ and were also observed before onset /r/. Furthermore, vocalic elements occurred *after* both syllabic and non-syllabic trills. The presence of these elements ties in with cross-linguistic reports of the production of trills in other languages. The vowel-like offglides observed in these data have not been reported in previous accounts of "syllabic" and non-syllabic trills in Slovene, a point which emphasises the limits of auditory impressionistic analysis and the usefulness of instrumental techniques in investigating fine-grained phonetic patterns and devising phonological accounts for such patterns. The presence of a vowel-like element *after* both "syllabic" and non-syllabic trills complicates the phonological analysis presented in the literature. Though these elements are shorter than those seen with Slovene syllabic trills in stressed nuclear position, the additional duration of the latter may simply be a function of stress. The vocalic element in a few unstressed syllabic trills, as in *grmeti*, has been measured for one speaker (S3) and has been found to equate in durational terms with the vocalic element in the cluster /dr/ in *drag*. More work is needed to ascertain how unstressed syllabic trills might be distinguished phonetically from non-syllabic trills.

Conclusion

It appears that the phonetic [ə] which precedes (and occasionally also follows) the syllabic trill in Slovene is neither an instance of phonemic schwa, nor an epenthesised vowel to aid syllabification. It is a phonetic element present in nuclear and non-nuclear trills which can also be observed cross-linguistically, and forms an essential part of trill production. In this sense, it can be likened to the

[h]-like aspiration noise which accompanies post-aspirated voiceless stops in English. This study has demonstrated the utility of instrumental phonetic research in investigating phonological phenomena. Much remains to be discovered about the phonetics of trills, both syllabic and non-syllabic, in Slovene. The syllable itself remains a debated concept in terms of its definition and delimitation. Work on syllabic consonants may provide valuable insights into the notion of syllabicity itself.

University of Cambridge

Appendix

Table of results

speaker	<i>prta</i>	<i>krta</i>	<i>trk</i>	<i>pes</i>	<i>karta</i>	<i>torta</i>	<i>porta</i>
S1							
mean	64	74	84	110	123	110	105
s.d.	11	9	8	10	15	9	10
n	6	6	6	6	6	6	6
S2							
mean	97	66	103	141	136	141	152
s.d.	16	11	10	16	12	8	10
n	6	5	6	6	6	5	5
S3							
mean	106	89	-	141	146	145	140
s.d.	5	10		12	7	9	11
n	6	6		6	6	4	6

Works Cited

- Blevins, Juliette (1995). "The syllable in phonological theory." John Goldsmith (ed.). *Handbook of Phonological Theory*. Oxford: Blackwells, 206–44.
- Broch, Olaf (1911). *Slavische Phonetik*. Heidelberg: C. Winter.
- de Bray, R. G. A. (1969). *Guide to the Slavonic Languages*. London: J.M. Dent & Sons.
- Derbyshire, William (1993). *A Basic Reference Grammar of Slovene*. Columbus: Slavica.
- Hála, Bohuslav (1962). *Uvedení do fonetiky Čestiny na obečne fonetickém základe*. Prague: Československé akademie ved.
- Hayward, Katrina (2000). *Experimental phonetics*. London: Longman.
- Herritty, Peter (2000). *Slovene: an essential grammar*. London: Routledge.
- Jassem, Wiktor (1964). "A spectrographic study of Polish speech sounds." Abercrombie, David (ed.) *In Honor of Daniel Jones*. New York: Humanities Press, 334–49.
- Johnson, Keith (1997). *Acoustic and auditory phonetics*. Oxford: Blackwells.
- Ladefoged, Peter (2003). *Phonetic data analysis*. Oxford: Blackwells.
- Ladefoged, Peter, & Maddieson, Ian (1996). *Sounds of the World's Languages*. Oxford: Blackwells.
- Landau, Ernestina, Lončarić, Mijo, Horga, Damir & Škarić, Ivo (1999). "Croatian." *Handbook of the International Phonetic Association*. Cambridge: Cambridge UP, 66–69.
- Lenček, Rado L. (1982). *The Structure and History of the Slovene Language*. Columbus: Slavica.
- Lindau, Mona (1985). "The story of /r/." Fromkin, V.A. (ed.). *Phonetic Linguistics*. Orlando: Academic Press, 157–68.
- Perkell, Joseph S. (1997). "Articulatory processes." In Hardcastle, William and John Laver (eds.). *The Handbook of the Phonetic Sciences*. Oxford: Blackwells, 333–70.
- Priestly, T.M.S. (1993). "Slovene," in Comrie, Bernard, and Greville G. Corbett (eds.) *The Slavonic Languages*. London: Routledge, 388–451.
- Schenker, Alexander M. (1996). *The Dawn of Slavic*. New Haven: Yale UP.

Solé, Maria-Josep (2002). Aerodynamic characteristics of trills and phonological patterning. *Journal of Phonetics* 30 (4), 655–88.

Spencer, Andrew (1996). *Phonology*. Oxford: Blackwells.

Srebot-Rejec, Tatjana (1988). *Word Accent and Vowel Duration in Standard Slovene - An acoustic and linguistic investigation*. Slavistische Beiträge, Band 226. München: Otto Sagner.

Steriade, Donca (1995). Underspecification and markedness. Goldsmith, John (Ed.). *Handbook of Phonological Theory*. Oxford: Blackwells, 114–74.

Šuštaršič, Rastislav, Komar, Smiljana & Petek, Bojan (1999). Slovene. *Handbook of the International Phonetic Association*. Cambridge: Cambridge UP, 135–39.

POVZETEK

STATUS ZLOGOTVORNEGA ZVENEČEGA GLASU V SLOVENŠČINI: FONOLOŠKA IN FONETIČNA ANALIZA

Mnenja o slovenski fonologiji so neenotna glede fonemskega statusa glasu, ki tradicionalno velja kot »zlogotvorni zveneči glas«, to je soglasnik /r/ kot jedro zloga. Nekateri analize so prišle do zaključka, da ima zlogotvorni zveneči glas fonemski status, druge pa trdijo, da gre za zaporedje fonemov, in sicer /ə/ in /r/. Zadnja analiza temelji na pogostih opažanjih, da je zlogotvorni zveneči glas v slovenščini izražen s fonetičnim zaporedjem [ər], in stališčem, da načelo varčnosti deluje na foneme tako, da fonetična struktura (zaporedje obstoječih fonemov) ne potrebuje dodatne definicije. Študija podrobno preiskuje fonološke razloge za takšno sklepanje in predstavlja prvo instrumentalno fonetično analizo zlogotvornega zvenečega glasu v slovenščini, ki temelji na podatkih, pridobljenih s pomočjo treh maternih govorcev, in na drugih fonetičnih opažanjih, da bi se prepričali, ali je analiza zaporedja upravičena. Študija trdi, da fonološkim argumentom v prid načelu varčnosti lahko nasprotujemo in, kar je še bolj pomembno, da instrumentalni podatki kažejo na nefonemski status polglasniku podobnega glasu /ə/, ki naj bi bil povezan z zlogotvornim zvenečim glasom. Zato je slovenščino najbolje analizirati kot jezik z zlogotvornim zvenečim glasom, vendar pa je njegova fonološka definicija predmet nenehnih razprav.