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A COMPARATIVE STUDY OF ESTONIAN SWEDISH VOICELESS LATERALS: ARE VOICELESS APPROXIMANTS FRICATIVES?

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ABSTRACT

Are voiceless approximants categorically distinct from voiceless fricatives? We address this question by means of acoustic analysis of voiceless laterals in Icelandic, Welsh, and the endangered variety Estonian Swedish. All three have a voiceless lateral functioning in contrast to a voiced lateral approximant. The analysis focused on duration – including any period of voicing ('pre-voicing') just before the release of the lateral – and the intensity of the voiceless lateral relative to the following vowel.

Welsh showed no pre-voicing in the lateral, whilst Icelandic and Estonian Swedish did, though the latter less consistently. The Welsh voiceless lateral was also greater in relative intensity. This could be taken as a difference of phonetic category between a fricative [ɬ] in Welsh as against a voiceless approximant [l̥] in the other two languages, but we argue that the complexity of the data from Estonian Swedish excludes a categorical interpretation.

Keywords: voiceless lateral, lateral fricative, phonetic categories, pre-voicing, Estonian Swedish.

1. INTRODUCTION

Devoicing an approximant almost inevitably produces some degree of audible friction [3], and so an obvious question is whether there is a distinction between such sounds and homorganic voiceless fricatives. When voiceless laterals are contextually conditioned allophones, as in English [pl̥eɪ] *play*, it is reasonable to assume that glottal opening is contextually determined rather than the result of an inherent gesture, and declines through the sound giving the possibility of partial voicing – unlike, for instance, the glottal abduction gesture for the affricate of [tʃeɪn] *chain*. However, *a priori* expectations are less clear when voiceless laterals are contrastive in a phonemic system. There are suggestions in [6] that criteria exist which can discriminate [l̥] and [ɬ], in particular the tendency to voicing in the latter stages of [l̥], and friction of lower intensity and frequency. Our study explores this question, comparing voiceless laterals in Estonian Swedish with those of Welsh and Icelandic.

Estonian Swedish perhaps requires some introduction. Until the Soviet Russian occupation at the end of WWII there was a substantial Swedish speaking population in Estonia, the result of settlement there from the 13th century onwards. Swedish speakers were concentrated mainly on the islands off the west coast of Estonia and on the north-west corner of the Estonian mainland. Nowadays, Estonian Swedish survives only in a small community of elderly emigrants to Sweden and a tiny handful of equally elderly speakers in Estonia. As with all threatened languages, this precarious status limits the scope of the research which can be carried out.

Phonetic aspects of Estonian Swedish have been described recently by [1] and [9], with laterals being the focus in [10]. The language has a rather rich set of laterals, comprising a voiceless alveolar lateral /ɬ/, which has historically replaced /sl/ clusters, and a voiced alveolar lateral /l/ which has contextual variants [l ɭ ɽ]. The retroflex lateral occurs after /r/, and the retroflex non-lateral flap is found in some medial contexts and in initial consonant clusters. However, the sound of interest here is /ɬ/. At this stage we symbolise it, without prejudice, as a lateral fricative, as we will the other voiceless laterals.

Welsh is the Brythonic Celtic language of Wales, and has two lateral phonemes, voiced and voiceless, the latter normally being described as a fricative. Icelandic is regarded as the most conservative extant North Germanic descendant of Old Norse. It has voiced and voiceless alveolar laterals in contrast.

2. EXPERIMENT

2.1. Speakers

Six speakers from each language were recorded. The Estonian Swedish speakers were all in their 80s and live in Stockholm. The Icelandic speakers ranged in age from 40 to 68; five were from greater Reykjavik and one originally from Vestmannaeyjabær Island. The Welsh subjects were native speakers of North Welsh living in north-west Wales who were Welsh-dominant by self-report, and aged 15-60.

2.2. Materials

The analysis used read materials designed specifically for the elicitation of voiceless laterals, among other sounds. The materials for Estonian Swedish and Icelandic were created for this study, while the Welsh materials were from a pre-existing recording made for [4]. The test words were elicited in invariant carrier sentences, as shown in Table 1.

Table 1: Carrier sentences used in each language.

	Carrier	Translation
Icelandic	*Segðu X takk*	'Say X thanks'
Est. Swe.	*Jag sa X igen*	'I said X again'
Welsh	*Dyweda X hefyd*	'Say X also'

Since different languages were involved it was not possible to find exactly equivalent contexts across the three languages. However, all voiceless laterals in this study were word initial in either monosyllables or trochaic disyllables; and the vowel environments covered a broadly similar range of the vowel space. The test words used are shown in Table 2.

Table 2: Words used in the analysis, arranged to show broad equivalence of vowel contexts.

Estonian Swedish		Welsh		Icelandic	
slit(a) *to rip*	[ɬiːt]	llif *saw* (n)	[ɬiːv]	hlíf *screen*	[ɬiːf]
slipp *cloth*	[ɬɪpː]			hlið *gate*	[ɬɪːð]
slak *limp*	[ɬɑːk]	llath *yard*	[ɬaːθ]	hlakka *exult*	[ɬahka]
		llaw *hand*	[ɬaʊ]	hló *laughed*	[ɬɒʊ]
slag *stroke*	[ɬoː]	llwch *dust*	[ɬuːχ]	hlotið *received*	[ɬoɐtɪð]
slå *to hit*	[ɬoː]			hlúði *fostered*	[ɬuːðɪ]

2.3. Recordings

All recordings were made in the field, using quiet rooms and a variety of recording equipment (see [4, 10] for details). Recordings were sampled at 44.1 kHz with 16 bit resolution, and saved as .wav files.

2.4. Analysis

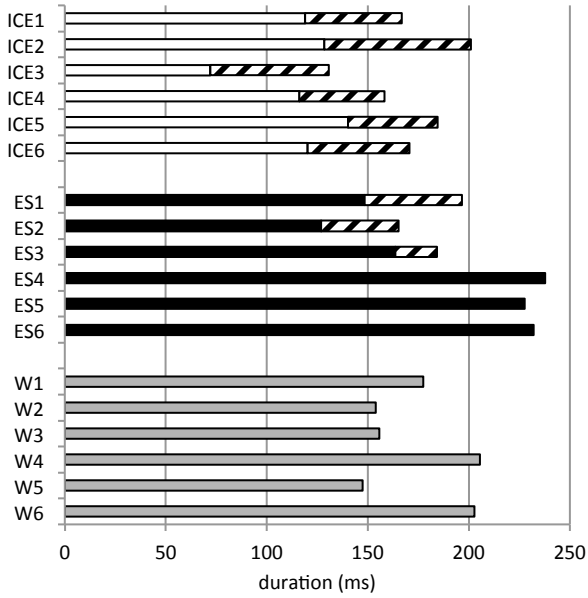
In all cases analysis was carried out using Praat [2]. Durations of the lateral and any voiced portion in it were measured. Mean intensity of the voiceless portion of the lateral and of the following vowel were also estimated.

3. RESULTS

3.1. Duration

The durational measurements for the lateral segment are shown in Fig. 1.

Figure 1: Duration of initial laterals, showing voiceless (solid) and any voiced (hatched) portions. Six speakers each of Icelandic, Estonian Swedish, and Welsh.

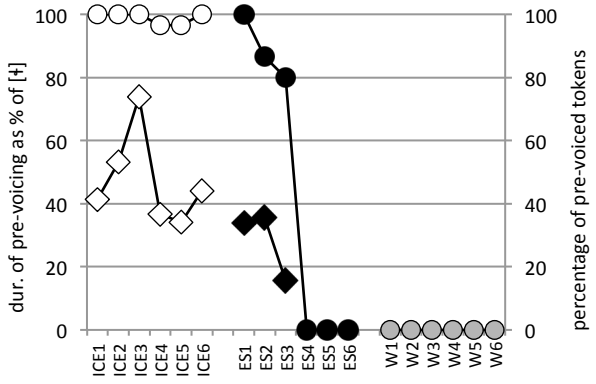


It can be seen that while the overall mean duration of each speaker's voiceless lateral phoneme realisations is broadly similar, there is a clear difference in stance towards initiating voicing (hatched bar) in advance of release of the central coronal occlusion of the lateral. Welsh speakers (W1–W6) don't evidence voicing; Icelandic speakers (ICE1–ICE6) do, and Estonian Swedish speakers (ES1–ES6) seem to be divided half and half. In fact, the data from Icelandic suggest that pre-voicing may be a requirement in Icelandic since all six speakers exhibit it, whereas the Estonian Swedish speakers are more variable, with three having no detectable pre-voicing.

Another view of the same phenomenon can be obtained by considering the proportion of tokens of the voiceless lateral which exhibit pre-voicing. This is shown in Fig. 2 by the circles (related to the right-hand axis). The Icelandic speakers almost exceptionlessly pre-voice, with just one token out of 30 for each of ICE4 and ICE5 failing to manifest at least some pre-voicing. As already seen in Fig. 1

Welsh speakers resolutely avoid pre-voicing, while Estonian Swedish speakers are divided. The other data points (diamonds – left-hand axis) on Fig. 2 are the duration of pre-voicing, this expressed not in ms (as in Fig. 1) but as a proportion of the voiceless lateral event. More specifically, for each token the pre-voiced section (if present) was expressed as a percentage of the voiceless lateral portion, and the values averaged for each speaker.

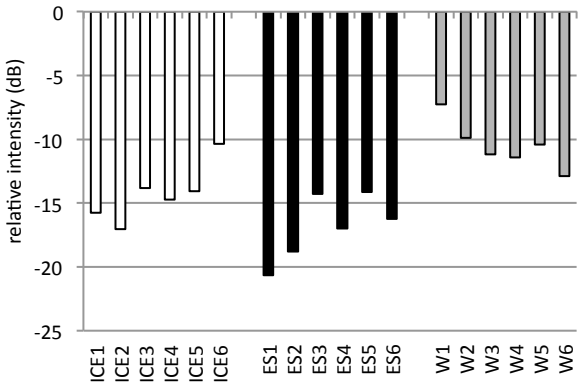
Figure 2: Lateral pre-voicing: right axis (circles), percentage of pre-voiced tokens; left axis (diamonds), mean duration of pre-voicing where present. Six speakers each of Icelandic, Estonian Swedish, and Welsh.



3.2. Relative intensity

Praat was used to estimate the (mean) intensity of the voiceless lateral portion (excluding any voiced part) and that of the following vowel. For each token, the vowel intensity in dB was then subtracted from the voiceless lateral's dB value, to find how much lower the intensity level of the lateral was relative to the vowel. These values were then averaged for each speaker. It can be seen in Fig. 3 that the Welsh voiceless lateral is relatively more intense than the voiceless portions of the similar sound in the other two languages, with a mean difference of 6.35 dB between Welsh and Estonian Swedish language groups. A one-way ANOVA revealed a significant effect of language on intensity [$F(2,15) = 12.06$, $p<0.001$]. A post-hoc Tukey test showed significant differences between Welsh and Estonian Swedish ($p<0.001$), and Welsh and Icelandic ($p<0.05$). However, the intensity values for Icelandic should be treated with caution as for three speakers not all tokens of the voiceless lateral event were straightforwardly measurable due to DC flow causing a disruption of the intensity contour. Some tokens were therefore excluded, and in others the value is based on only part of the voiceless event.

Figure 3: Intensity level of voiceless portion of lateral relative to the following vowel. Six speakers each of Icelandic, Estonian Swedish, and Welsh.



4. DISCUSSION

4.1. Language-specific facts

On the basis of the findings for Welsh and Icelandic it would be tempting to find confirmation for the notion that there are two categories of voiceless lateral, the fricative (as in Welsh), and the voiceless approximant (as in Icelandic). Indeed, four Icelandic tokens had to be rejected for measurement of distinct voiceless and voiced elements, three from speaker ICE3 and one from ICE2, because they exhibited a lateral with breathy voicing throughout its duration. This might prompt the conclusion that there is one type of sound (as in Welsh) with enthusiastic glottal abduction, ensuring enough airflow for a voiceless fricative – a voiceless lateral fricative [ɬ] in a very real sense – and another type – crying out for the symbol [l̥] – with arguably just a lack of sufficient glottal *ad*duction to keep the voicing going. In the latter type, premature voicing reliably results as the vocal folds approximate for the vowel, or indeed, on occasion, voicing never fully ceases. The voiced portion is on average around half the duration of the supposedly definitional voiceless portion (47.2% averaged over the six Icelandic speakers). Here then, it seems, are two diametrically opposed strategies.

Estonian Swedish, however, rather confounds any categorical interpretation. Here we have some speakers who pre-voice in most instances, but when they do so the pre-voicing is on average (six speakers, 28%) only just over a quarter of the duration of the voiceless portion. Others are apparently as resolute as the Welsh speakers in resisting voicing. Notice, however, that while they avoid pre-voicing, the intensity of their voiceless lateral is on average a substantial 5.3 dB less than that of the Welsh laterals relative to the following vowel. This suggests the two dimensions can be

controlled independently, and cannot be attributed to a single glottal control parameter.

At this point, it is time to reveal that in fact the six Estonian Swedish speakers came originally from two sub-dialects. The three who pre-voice their voiceless laterals between 80 and 100 per cent of the time grew up in Rickul (Riguldi), on the west coast of the Estonian mainland. The ones who do not pre-voice grew up on the small island of Ormsö (Vormsi). We have to be cautious, of course, and not place too much trust in a difference based on three speakers of each sub-dialect, all of whom have spent most of their adult lives surrounded by a dialect of Swedish which is not their native one. Nonetheless, this finding at least raises the possibility that gradient control of the timing and magnitude of a devoicing gesture of an approximant can be a stable, and characteristic, feature of a variety.

4.2. Implications for phonetic theory

If our discrete IPA categories [ɬ] and [l̥] dissolve into separately controllable dimensions of fricative intensity and voice timing, we again have to ask what the status of IPA categories is. They are not, apparently, a store from which a language can select prefabricated elements with which to build its phonological system. Instead, it reinforces the message that speech is where language meets the physical world, and in particular meets the vocal mechanism with its multiple degrees of freedom [7, 8]; a place where we can expect languages to vary gradiently and multi-dimensionally. Phonetic categories, then, are arguably just tools to help the analyst impose finite structure on infinite variation.

But maybe this is too extreme a view. Instead, we should consider [5], who argues on the basis of VOT that languages 'do not differ without limit.' This claim is made possible by advancing an analysis which posits a limited number of phonetic categories ({voiced}, {voiceless unaspirated}, and {voiceless aspirated}) onto which phonological voicing contrasts are mapped; and by allowing detailed differences in quantitative realisation (such as how long the VOT of {voiceless unaspirated} is in a given language) to be determined by a principle of 'polarisation'. Polarisation – phonetic dispersion, roughly – specifies that within the parameter range of a phonetic category, the modal value occurring is the one that best distinguishes sounds from those in another phonetic category onto which an opposing phonological value is mapped. However, whilst such a rationalisation of variation may be attractive, we can't see a way in which the voiceless lateral behaviour of the three languages studied here can be explained by such principles.

Alternatively, it might be suspected that the susceptibility to voicing in Icelandic and Estonian Swedish is the result of morphophonological alternation involving the voiceless lateral. If there are morphosyntactically determined forms of the same lexeme containing, instead, a voiced lateral, this might be creating a pull towards voicing. As it happens, the evidence is exactly to the contrary. It is in Welsh that /ɬ/ and /l/ alternate, e.g.: *llyfr* /ɬɨvr/ 'book', *(ei) lyfr* /lɨvr/ '(his) book'. Even if the evidence from Icelandic and Welsh were the other way round, we would still be at a loss to explain the presence and simultaneous absence of voicing in Estonian Swedish, a language where the lateral contrast is purely lexical. We incline to the view that speakers of these languages have either exploited the degrees of freedom in voiceless laterals for sociolinguistic differentiation, or have simply converged on a given implementation randomly.

5. CONCLUSIONS

We have shown the existence of a range of variants within voiceless laterals, rather than a categorical split between lateral fricatives and voiceless approximant laterals. This bears on the ontological status of universal phonetic categories, and whether language really constrain the boundless articulatory variation available to them to converge on common outcomes.

The fact that Estonian Swedish proved crucial in providing data intermediate between those from Icelandic and Welsh underlines the need to capture endangered varieties before it is too late.

6. ACKNOWLEDGEMENTS

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