

PHONETIC PRECONDITIONS FOR THE DEVELOPMENT OF NORMATIVE PREASPIRATION

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ABSTRACT

In several languages and dialects of north-western Europe, preaspiration – the early timing of glottal abduction relative to oral closure in vowels preceding a voiceless stop consonant – has become normative in the sense of being an obligatory feature of sequences of vowel and fortis stop. Impressionistic observations suggest that non-normative preaspiration may occur across the whole Scandinavian language area. In the present paper, speech samples from 4 speakers of Central Standard Swedish were analysed with regard to the temporal aspect of preaspiration. It was found that three of the speakers tended to preaspirate, and that impressionistic predictions regarding preaspiration tendencies in their speech were borne out by instrumental analysis. It is suggested that the presence of this kind of non-normative preaspiration in the Scandinavian language area in general provides a favourable ‘phonetic soil’ for the development of normative preaspiration.

1. INTRODUCTION

As a normative feature of sequences vowel and fortis stop, preaspiration seems to be extremely rare. Its geographical distribution exhibits strong areal tendencies, with a high concentration in Scandinavia and surrounding areas, mainly to the west. This areal tendency of preaspiration is pointed out by Wagner [1] and dealt with in more detail by Hansson [2].

Preaspiration in Central Standard Swedish (henceforth CSSw) is not regarded as a normative feature of the dialect. However, as early as 1940, Rositzke [3] investigated phenomena occurring on the boundaries of vowels and stops that are reminiscent of preaspiration. More recently, Gobl & Ni Chasaide [4] studied glottal abduction in sequences of vowel and fortis stop. They found that most of their 11 Swedish informants and 2 out of 4 English informants tended towards early glottal abduction before an unvoiced stop. However, the 2 remaining English informants and 4 French informants seemed to synchronise glottal abduction and oral closure more tightly. In a study on voice source characteristics, Fant et al. [5] also observed the tendency in CSSw towards ‘pre-occlusive aspiration,’ and comment that this seems to be a feature more common in women’s speech than in men’s.

My own impressionistic observations of Swedish speakers suggest that a tendency to preaspirate is quite common in Swedish, especially among women. In the present paper, four speakers of CSSw were investigated. For three of these speakers, who were all women, a tendency to preaspirate had been observed impressionistically, while for the remaining one, a male, no such tendency had been observed.

Examples of normative preaspiration are drawn from two sources, Icelandic and the Gräsö dialect of Swedish. Preaspira-

tion in Icelandic has been widely discussed in the literature, both with regard to production and perception. However, the normative status of preaspiration in the Gräsö dialect is more debatable since data are very scarce (cf. [2]). Findings for one Gräsö informant are presented here, and this is the only data available at present on Gräsö preaspiration. Still, judging from the sheer duration of the preaspirations produced by this informant, as well as their phonological distribution, it seems most likely that they are normative in the informant’s dialect.

Numerous parallels between on-line phonetic variation and sound change have been pointed out in the literature (e.g. [6] and [7]). In all cases, sound change is thought to have its roots in articulatory phenomena that occur more or less fortuitously in on-line speech. It will be argued here that this is also the case for normative preaspiration. Thus the data on the non-normative preaspiration of Central Standard Swedish may shed some light on the historical development of normative preaspiration.

2. METHOD

This study involves three different sets of data, spontaneous CSSw, read CSSw and spontaneous Gräsö speech.

The first set of data (spontaneous CSSw) comes from three informants, one male (MP) and two female (FS and FK). For both female informants a tendency to preaspirate had been observed, but not for the male informant. Spontaneous speech interaction between informant pairs was elicited using map tasks (cf. Anderson et al. [8]). Total recording time was approximately 20-30 minutes per subject. To reduce overlap between channels, directional microphones were used. The microphones were mounted on a headset so that they were placed 2-3 cm out and to the side of the corner of the informants mouth, much as a telephone operator’s headset. The CSSw material analysed amounts to 15 minutes of continuous dialogue, with a total of about 3600 words uttered. A component of the SNACK program module [9] was used for segmentation and labelling. The points labelled were: voice onset in the vowel, beginning of preaspiration, beginning of the stop’s silent phase, and release of oral closure. The criterion for marking the onset of preaspiration was that noise should be present in formant frequencies above 750 Hz.

The second set of data (read CSSw) comes from one female speaker, FE, who had been observed to have a tendency to preaspirate. FE read the same list of 56 sentences twice. Before the first reading, she was asked to keep a slow but comfortable speaking rate. In the second reading, she was instructed to read at a faster rate. Each sentence had a target word containing a sequence of /at:/ or /et:/. Thus, the read speech data only consider VC: syllables (i.e., syllables where the vowel is phonologically short). The target word appears in one of three positions: non-focal, focal or both focal and sentence-final. The following three

Table 1. Durations in the spontaneous Central Standard Swedish data (see explanations in text). Note that VC: and V:C only indicate the syllabic quantity structure. Thus the VC: data do not differentiate between, for example, /att/ and /atr/ sequences.

	MP						FK						FS					
	V	P	O	VPO	n	n _p	V	P	O	VPO	n	n _p	V	P	O	VPO	n	n _p
'VC:	65	5	72	142	51	16	76	26	100	201	59	48	59	30	96	184	59	48
'V:C	78	1	62	141	45	5	106	13	87	205	59	29	107	14	77	197	63	46
,VC:	76	0	89	165	7	0	88	32	118	238	2	2	74	20	80	173	13	12
,V:C	80	0	55	135	7	0	145	24	92	262	5	3	104	5	88	197	4	1
VC	54	0	56	110	54	1	74	7	93	175	67	25	63	7	63	133	28	12
V:C	78	1	67	146	7	0	107	32	90	229	16	13	95	17	74	186	24	20

sentences exemplify each type of sentence. The number in brackets indicates how often each type appeared in the text.

När KOM Petter egentligen? (26)
 Det är just på NATTEN dom fiskar. (26)
 Du har RÄTT! (15)

In the text presented to the informant, focus was indicated with capitals. Here, the target word of each sentence is underlined, but they were not marked in the text presented to the informant.

The third set of data (spontaneous Gräsö speech) comes from one informant, MM, a male inhabitant of Gräsö born in 1904. The material is obtained from the *Uppsala Landsmålsarkiv* (ULMA) archives. It consist of a 12 minute interview conducted by two dialect field researchers with the informant in his own home. The recording is of good quality and poses no problems for instrumental analysis.

3. RESULTS

3.1. Spontaneous Central Standard Swedish

From the spontaneous CSSw material, 570 sequences of vowel and fortis stop were analysed with respect to duration. For MP, 171 sequences were analysed, 208 for FK and 191 for FS. Instances where a morpheme or word boundary comes between the vowel and the stop were not included.

Table 1 divides the data into 6 categories based on phonological length (V:C or VC: quantity types) and lexical stress (primary stress ('), secondary stress (,) or unstressed). For each of these categories, the following information is given: the mean duration (in ms) of vowel (V), preaspiration (P), occlusion (O), and the entire sequence (VPO), the number of sequences observed (n) and the number of preaspirated sequences observed (n_p). Note that VC: indicates a syllabic quantity structure, not specifically that there should be a long consonant. Thus the C: may indicate either a long stop or a stop followed by some other consonant (see also caption for table 1).

The impressionistic observations regarding the tendency of the different informants to preaspirate are borne out by the instrumental analysis. In only 22 out of 171 cases does MP have some degree of preaspiration, while the corresponding figures for FK and FS are 120 out of 208 and 139 out of 191. Further, the mean duration of MP's VPO sequences is generally shorter than for the other two informants. Thus it may be suggested that because of his faster speaking rate, MP is less prone to preaspi-

rate than the other two informants.

For both FK and FS, the mean duration of preaspiration is approximately twice as long in VC: syllables with primary stress as in V:C syllables with primary stress (t-test significant at $p < 0.0001$ for both informants). In other words, preaspiration duration is much longer after phonologically short vowels than after phonologically long ones. A comparable analysis of syllables with secondary stress is not possible because there are not enough observations.

The data for V:C syllables without lexical stress need comment. Most of the tokens for this category come from the words *ut* and *åt*, usually in compound words such as *söderut* 'southwards' and *uppåt* 'upwards'. In the present data, there is a strong tendency for these words to occur pre-pausally. As a result, 11 of FK's 16 tokens and 8 of FS's 24 tokens are pre-pausal instances of *-ut* and *-åt*. For FK, preaspiration in the pre-pausal instances has a mean duration of 41 ms, while for non-prepausal cases it is 13 ms. For FS these figures are 26 ms and 12 ms respectively. This suggests that pre-pausal position has the effect of increasing preaspiration duration, which causes skewness in the data for V:C syllables without lexical stress.

From table 1 it is also evident that for VC: syllable types, preaspiration tends to occur more often and be longer if the syllable has lexical stress (primary or secondary) than if it is lexically unstressed. For FK, preaspirations in VC: syllables with primary stress are on average 3.6 times longer than in lexically unstressed VC: syllables. For FS, the primary stress preaspirations are on average 4.6 times longer.

The central findings so far can be summarised in the following points:

- Non-normative preaspiration is found in CSSw
- Preaspiration is longer in VC: than in V:C syllables
- Lexically stressed VC: syllables have longer preaspiration than unstressed ones
- Pre-pausal position yields longer preaspiration

Syllables with primary lexical stress seem to be those syllables that are most often preaspirated in the data. 77 of FK's 118 primary stress syllables have some degree of preaspiration and 94 of FS's 122. Figures 1-3 plot preaspiration duration against the combined duration of vowel and preaspiration. Filled diamonds indicate preaspirations in VC: syllables (i.e., following a phonologically short vowel) and unfilled circles indicate preaspirations in V:C syllables (i.e., following a phonologically long vowel).

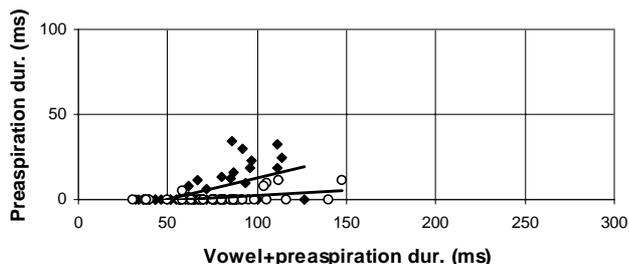


Figure 1. Analysis of preaspiration for informant MP (see text).

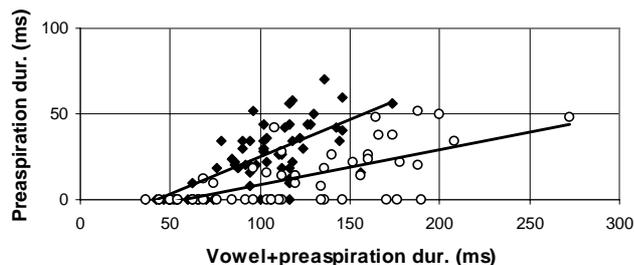


Figure 2. Analysis of preaspiration for informant FK (see text).

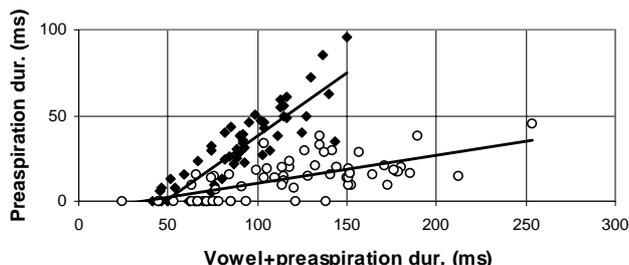


Figure 3. Analysis of preaspiration for informant FS (see text).

As indicated earlier, it is evident in all cases that preaspirations following short vowels are longer than those following long vowels. The figures also indicate that the ratio of preaspiration in the vowel + preaspiration sequence (P/VP) is much higher for VC: syllables than V:C syllables. For FK and especially for FS, the P/VP ratio in VC: syllables is seen to increase as vowel duration increases, while it remains more or less constant for V:C syllables. For FS, for example, vowel duration in VC: syllables does not go much below 50 ms, at which point there is practically no preaspiration. With increased vowel duration, preaspiration duration increases sharply such that its proportion within the VP sequence increases steadily.

3.2. Read Central Standard Swedish: preliminary findings

The impressionistic observations that FE tends to preaspirate are borne out by instrumental analysis. Table 3 shows the mean duration (in ms) of vowel (V), preaspiration (P), occlusion (O) and the entire sequence (VPO), and the number of observations (n). These are given for each of the 6 conditions observed: focal-final, focal and non-focal at two different reading speeds, fast and slow. In fast speech, FE tended to produce the phrase-final sequences of vowel and stop with creaky voice. These instances

were omitted in the analysis and therefore only 4 observations were made for the focal-final condition in fast speech.

Table 2. Durations in the read speech data (see text).

		V	P	O	VPO	n
Slow	focal-final	104	63	264	431	15
	focal	85	41	278	404	26
	non-focal	79	31	134	243	26
Fast	focal-final	100	49	229	378	4
	focal	65	31	180	276	26
	non-focal	67	26	108	200	26

The mean duration of preaspiration for the different conditions ranges from 26 ms to 63 ms. Preaspiration duration neither seems to depend directly on vowel duration nor stop occlusion duration. Rather, it seems to be a function of speech rate, sentence position and focus. However, before more data are available these findings have to be regarded as preliminary.

3.3. The Gräsö dialect

An analysis of preaspiration in the speech of the Gräsö informant (MM) is given in table 3. As before, instances where a word or morpheme boundary comes between the vowel and the stops are not included.

Table 3. Durations in the Gräsö data (see text).

	V	P	O	VPO	n	n _P
VC:	107	50	83	240	104	88
V:C	138	37	82	257	93	66
VCs	114	0	55	170	23	0

As was observed in the spontaneous CSSw data, preaspiration duration is greater in VC: syllables than in V:C syllables. Thus, preaspiration duration is, on average 50 ms after short vowels and 37 ms after long vowels. My own impression is that preaspiration in MM's speech more resembles that of Icelandic than that of CSSw. This does not receive direct support from measurements of Icelandic preaspirations. For example, Indriðason et al. [10] find that preaspiration in read Icelandic (elicited with frame sentences) is typically slightly less than 100 ms in duration. Preaspirations after short vowels in MM's speech are generally much shorter than this. However, it should be kept in mind the Gräsö data are from spontaneous speech and it is not unlikely that mean preaspiration durations would be much longer if the data were from read speech and only contained words embedded in focal position in frame sentences.

Perhaps the most interesting finding regarding preaspiration in MM's speech is that it does not seem to occur at all if an /s/ follows the fortis stop. Such sequences are shown in table 3 under the heading VCs. Thus in words such as *strax* (phonematically /straks/) 'soon', and *plats* '(place)' there is no preaspiration. Note also that in VCs syllables, VPO duration is considerably shorter than in both VC: and V:C syllables. The reason for this difference may be that, in the cases of VC: and V:C syllables, preaspiration is a segment-like element that simply is not present in VCs syllables.

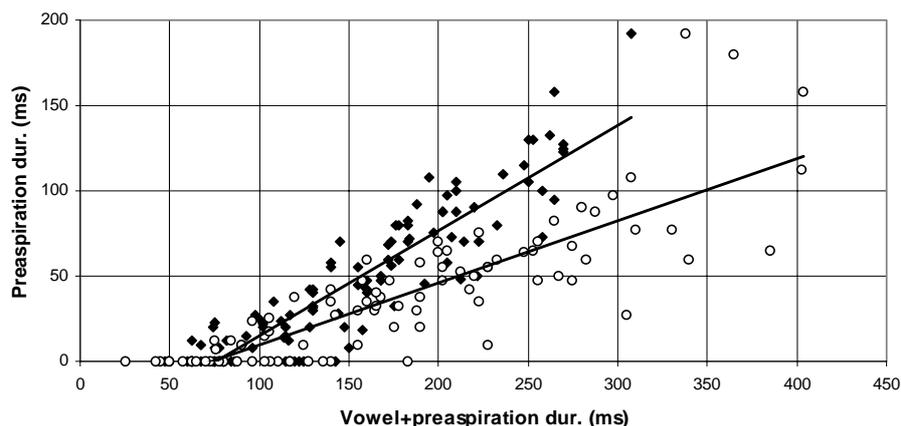


Figure 4. Analysis of preaspiration in the Gräsö dialect, informant MM (see text).

Figure 4 plots preaspiration duration against the combined duration of vowel and preaspiration for all of MM's VC: and V:C syllables (VC: syllables are not included). Filled diamonds indicate VC: syllables and unfilled circles indicate V:C syllables. A similar picture emerges as with informants FK and FS in figures 2 and 3 (where only lexically stressed syllables were plotted), although MM's preaspirations are longer. Interestingly – setting aside MM's lack of preaspiration in VC: syllables – the difference between MM on the one hand, and FK and FS on the other, seems to be that of scale rather than that of nature.

It should be kept in mind that the Gräsö dialect and CSSw are different dialects and thus data from the two are not always directly comparable. In particular, lexically unstressed sequences of vowel and fortis stops are much more uncommon in the Gräsö dialect than in CSSw. For example, only two of the VC: tokens in table 3 are lexically unstressed and none of the V:C and VC: tokens.

4. DISCUSSION

It has been shown that non-normative preaspiration does occur in CSSw. Its duration and frequency of occurrence seem dependent on syllable type (VC: or V:C), speech rate, sentence position and focus. The following characteristics can also be discerned:

- It is idiolectal rather than sporadic. Thus, preaspiration seems to be a quite regular feature for some speakers, but not for others.
- It is 'planned'. This means that, for the speakers who have it, preaspiration seems to be part and parcel of the production of all unvoiced stops. (In this respect its phonological status seems to resemble that of postaspiration.) However, it seems that it will not surface unless the duration of the syllable reaches a certain minimum.

Normative preaspiration, however, has quite different characteristics. For Icelandic and, as has been argued, in the Gräsö dialect of Swedish it can be stated that:

- It is a feature of stops in specific contexts. Thus normative preaspiration is not a part of the production of all voiceless stops, but has a more complex, phonologically conditioned distribution.
- It is obligatory. Leaving out the preaspiration in the specified contexts results in a deviant pronunciation.

It is quite possible that, as my own impressionistic observations suggest, preaspiration of the type found in CSSw exists throughout the Swedish speaking language area, and possibly throughout Scandinavia. It is claimed here, that this kind of phonetic variation in the production of fortis stops is a phonetic precondition for the development of normative preaspiration.

Given that the tendency towards preaspiration is areal, this would account for the areal skewness in the distribution of normative preaspiration. However, other factors also need to be considered. For example, one general reason why normative preaspiration is uncommon may be that, in phrase initial position, preaspiration seems to lack perceptual salience. Indeed, no language seems to have developed word-initial preaspirated stops, only medial and final ones. Also, it seems probable that for normative preaspiration to develop, the language should have at least two contrastive series of stops (such as fortis and lenis).

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