

# PRE-ASPIRATION IN SOUTHERN SWEDISH AND ITS RELATIONSHIP TO PROSODY

Mechtild Tronnier

Lund University, Lund, Sweden  
 Mechtild.Tronnier@ling.lu.se

## ABSTRACT

Pre-aspiration has been observed in various languages as a transition between a vowel and a voiceless obstruent. It occurs in northern Swedish dialects, but also as a non-normative feature in Southern Swedish (Scanian). The distribution and magnitude of pre-aspiration in the Scanian variant of Swedish has been investigated in this study, primarily highlighting its relationship to either of the two Swedish word accents. This study is motivated by the fact that laryngeal properties – i.e. *stød* – also occur in Danish, a language, geographically and historically close to Southern Swedish. Furthermore, the role of vowel length was considered.

The results show that the magnitude, of pre-aspiration is more substantial in Accent 1-words in both: the measured duration of pre-aspiration and in its proportion in the VHC-sequence. Furthermore, largest magnitude of pre-aspiration was found in Accent 1-words containing short vowels.

**Keywords:** Pre-aspiration, Swedish word accents, non-normative pre-aspiration, Southern Swedish.

## 1. INTRODUCTION

Pre-aspiration was observed, when carrying out database-work – i.e. segmentation – for Southern Swedish dialects [1], which in contrast to more Northern Swedish varieties [2] are not recognized for that trait. The same observation was made in a comparative study on quantity: a section of pre-aspiration was revealed between long/short vowels and long/short voiceless obstruents in one of the languages under investigation – Swedish – but not in the other one. This made a comparison of durational aspects in the coda between the two languages difficult [3].

Previous work on pre-aspiration showed that neither gender nor age was a factor for preferred production of pre-aspiration in Southern Swedish dialects [1]. In addition, neither vocalic type nor vowel quantity was a reason for increased occurrence of pre-aspiration in monosyllabic words [4].

Some studies on the interaction of pre-aspiration and quantity features for various dialects in Sweden have been carried out ([1, 4, 5]). A possible

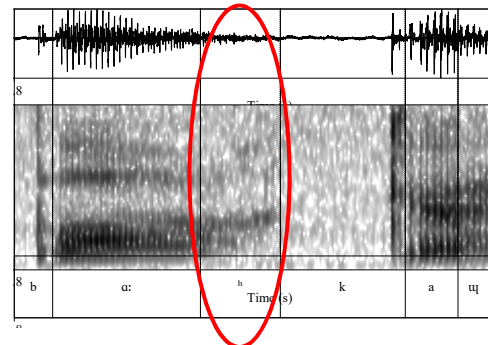
connection between tonal features in Swedish and the occurrence and magnitude of pre-aspiration, however, has not been investigated so far. This contribution, thus, aims to shed some light on the relationship between prosodic features – i.e. contrasting tonal word accents and quantity characteristics occurring in stressed syllables – and pre-aspiration in Southern Swedish, primarily the dialectal variant spoken in Scania.

### 1.1 Pre-aspiration

A very appropriate definition of pre-aspiration is given by Page [6]:

*“Pre-aspiration results from the anticipation of the glottal opening gesture associated with a voiceless obstruent. The glottal opening precedes the oral closing gesture and devoices the latter part of the vowel.”*

Pre-aspiration is shown in a spectrogram of a relevant speech sample in Figure 1.



**Figure 1:** Example of pre-aspiration (highlighted) in the Swedish word *bakar* (“bake”, /'ba:kar/, pronounced as [ˈba:hkaʊ]).

### 1.2. Pre-aspiration in Languages in Northern Europe

Hejná has published a very comprehensive bibliography of studies on pre-aspiration [7]. This shows that pre-aspiration occurs in languages all over the world, but has predominantly been studied for the Northern European languages.

In Icelandic, pre-aspiration occurs between a short vowel and a voiceless long stop and contrasts with the lack of pre-aspiration in exactly the same context [2]. Pre-aspiration is therefore obligatory and normative for specific lexical items.

In Swedish [2] and Norwegian [8], however, pre-aspiration can be either normative or non-normative, depending on the dialect.

Pre-aspiration also occurs in different variants of Sami, spoken in the north of both, Norway and Sweden [9].

In Western Europe, Irish and Scottish Gaelic ([10, 11]) presents us with this phenomenon. In some English dialects, spoken in or close to the areas in the UK where Gaelic is rooted, pre-aspiration can also be found, e.g. in Scottish English [12] and Welsh English [13], among others.

### 1.3. Relationship between pre-aspiration and prosodic features

In Icelandic, pre-aspiration occurs after short vowels and is inherited from Old Norse geminates. This does not mean that pre-aspiration is obligatory in all cases in a sequence of short vowels and a voiceless obstruent. Pre-aspiration is a contrastive feature here, and does not occur in words, not inherited from Old Norse [6].

Studies on quantity in various dialects of Swedish have taken the phenomenon of pre-aspiration into consideration [5]. When comparing two dialects from the North of Sweden, both with non-normative pre-aspiration, pre-aspiration showed its relationship to quantity contrast differently [5]. The phenomenon was considerably longer between a long vowel and a voiceless stop (V:HC) than after a short vowel in one of the dialects (Arjeplog), whereas the reverse was the case in the other dialect (Vemdalen): pre-aspiration was considerably longer between a short vowel and a voiceless stop (VhC:), and almost lacking after a long vowel (V:C).

According to studies on present-day Italian [14, 15], pre-aspiration mainly occurs before geminate stops. In addition, if optional pre-aspiration occurs, closure duration is shorter.

So far, the possible interaction between pre-aspiration and tonal features is not widely studied. As there are connections between Swedish tonal word accents and Danish stød, this matter is presented in more detail in the following section.

### 1.4. Swedish word accents and Danish stød

Stød in Danish is produced with laryngeal constrictions and occurs mainly in stressed syllables containing a long vowel or a short vowel followed by a sonorant in the coda. Historically, stød occurred in monosyllabic words and is therefore related to the word Accent 1 in Swedish and Norwegian [6].

The distribution of both, Danish stød and the two Swedish word accents is very complex and related to the morphological structure of a word. A word carrying stød/Accent 1 – when inflected with a particular morpheme – may change to non-stød/Accent 2 – when inflected with another morpheme.

Pre-aspiration may have emerged as an assimilatory process in Danish – and in other languages – when a sonorant became devoiced due to its placement before a voiceless stop [6]. In the case of Danish, this process may have given room for pre-aspiration in a sequence, which in the non-assimilated form had been the place for stød.

In a recent study [16] stronger signs of laryngeal constriction in Accent 1-vowels in Southern Swedish was discovered, which is coherent with voice measures for Danish stød.

It is for the reasons above, that the current study is interesting: non-normative pre-aspiration was investigated, taking the prosodic characteristics of quantity and tonal word accents in Southern Swedish into consideration.

## 2. THE STUDY

### 2.1. Material

The gathered material consisted of read speech, with target words imbedded in a carrier phrase. The target words were in focus. They were disyllabic, with the stress on the first syllable and a 'CV(:)CV(C)'-structure. The stressed vowel was either short or long and varied between three different phonemes: /i a o/. The medial consonant consisted of a voiceless stop at one of three different places of articulation: /p t k/. The consonants also varied slightly in length and in their role in the sequence of syllables: in the case of a long stressed vowel, the following consonant introduced the unstressed syllable, whereas in the case of a short stressed vowel, the following consonant was slightly longer and ambisyllabic, serving as a coda and an onset. All these combinations were present in both: words with Accent 1 and Accent 2. The balance was maintained by the choice of underlyingly monosyllabic words, where the disyllabic definite form carries Accent 1 and the plural form Accent 2.

V	Accent 1 definite	Accent 2 plural	Engl.
/o/	kocken	kockar	'chef'
/o:/	kåken	kåkar	'building'
/i/	tippen	tippär	'dump'
/i:/	pipen	pipär	'pipe'

Table 1: Examples of some target words

There was one repetition for each target word, so that the sum of recorded target words was 72 per speaker.

### 2.2. Participants

Ten students identifying themselves as speakers of the Scanian dialect were recorded. They varied in age between 18 - 32 years, seven of them were female and three were male speakers. The speakers were not aware of the aim of this study and did not have specific knowledge in phonetics, i.e. beyond pronunciation training in a foreign language.

### 2.3. Recordings

The recordings were made in a quiet room, equipped with wall panels for acoustic dampening, on a portable digital recorder of the type “Roland R-05” in .wav-format (16bit/44.1 sampling rate). A lavalier microphone was used, attached to the upper body of the speaker. The sentences were presented to each speaker one-by-one on the screen of a laptop computer.

### 2.4. Data analysis

The recorded material was further analysed in PRAAT: at first, an automatic segmentation with the help of the PRAAT VOCAL TOOLKIT was carried out, and then manual correction followed. Hereby, the vowel in the stressed syllable (V) in each recorded item of all target words, the section of pre-aspiration (H) and the following voiceless stop (C) was singled out.

To begin with, the frequency of occurrences was extracted from the data, as pre-aspiration is not normative in the Southern Swedish dialect. This gives a good overview over how much the phenomenon is generally present. In addition, the distribution of its occurrence in relationship to word accents and vowel quantity was considered.

Moreover, the magnitude of occurring sections of pre-aspiration was calculated from the segmentations in the PRAAT-TextGrids. Hereby, the absolute duration of pre-aspiration was calculated for each obtained target item and its proportion in relationship to the VHC-sequence it occurred in in percentage (%). The two calculations were chosen for the following reasons: absolute duration measures are interesting for the inspection of the general perceptual relevance of the phenomenon and the measure of proportion in the VHC-sequence accounts for normalization over speech tempo.

Magnitude measures were then compared with independent T-tests for the variables word accent, vowel quantity and across word accent and vowel quantity.

## 3. RESULTS

All ten speakers did produce pre-aspiration, and everyone produced items without it. Due to pronunciation errors, only 718 items could be included in the analysis.

### 3.1. Frequency of occurrence

Under all conditions, pre-aspiration occurred in 70-85% of the utterances – as can be seen in Table 2. There is however a slight advantage for items with Accent 2 over items with Accent 1. The same is the case for quantity, where items with short vowels present us with slightly higher occurrences than items with long vowels.

	With pre-aspiration	Without pre-aspiration
All $\Sigma$ 718	569 (79%)	149 (21%)
Accent 1	275 (77%)	84 (23%)
Accent 2	294 (82%)	65 (18%)
Long V:	271 (75%)	88 (25%)
Short V	298 (83%)	61 (17%)

**Table 2:** Frequency of occurrence of pre-aspiration under different conditions.

### 3.2. Magnitude of pre-aspiration

Table 3 shows the results for the differences of the magnitude of pre-aspiration for both, duration and proportion under the various conditions. Generally, Accent 1-words present us with longer durations and proportions of pre-aspiration than Accent 2-words.

Conditions	Probabilities for durations	Probabilities for proportions
<b>Acc1/Acc2</b>	0.00205** <i>Acc1 &gt; Acc2</i>	0.00034*** <i>Acc1 &gt; Acc2</i>
<b>Long/Short V</b>	0.0258* <i>L &lt; S</i>	8.5E-07*** <i>L &lt; S</i>
<b>Acc1 Long/Short V</b>	0.02739* <i>L &lt; S</i>	1.4E-05*** <i>L &lt; S</i>
<b>Acc2 Long/Short V</b>	0.44568 <i>L = S</i>	0.01341* <i>L &lt; S</i>
<b>Long V: Acc1/Acc2</b>	0.2116 <i>Acc1 = Acc2</i>	0.19986 <i>Acc1 = Acc2</i>
<b>Short V Acc1/Acc2</b>	0.00547** <i>Acc1 &gt; Acc2</i>	0.00161** <i>Acc1 &gt; Acc2</i>

**Table 3:** Probabilities and significance levels for durational and proportional differences of pre-aspiration for various conditions.

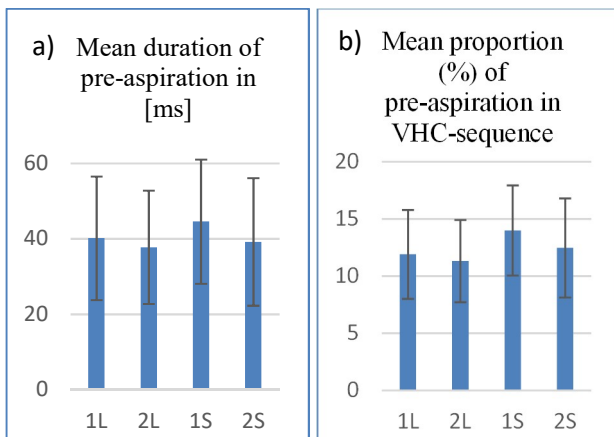
Furthermore, words with short vowels occur with a larger magnitude of pre-aspiration than those with long vowels. A more detailed analysis shows that in

Accent 1-words, pre-aspiration is larger in the case of short vowels. In addition, for words with short vowels, pre-aspiration is larger for Accent 1-words. In words with Accent 2 or a long vowel pre-aspiration does not appear to be equally substantial.

### 3.2.1. Duration of pre-aspiration

The length of pre-aspiration in this data is on average around 40ms (Figure 2a)), which makes the phenomenon perceptually noticeable.

Figure 2a) also shows, that pre-aspiration is longest in Accent 1-words with short vowels (“1S”) and it is shortest in Accent 2-words with long vowels (“2L”). Accent 1-words with long vowels (“1L”) have slightly longer pre-aspiration than Accent 2-words with short vowels (“2S”). The last two composites are thus found between the previous two extremes.



**Figure 2:** The mean magnitude with standard variation of pre-aspiration ( a) duration and b) proportion) under accent-conditions (“1” and “2”) and vowel quantity-conditions (“Long V” and “Short V”).

### 3.2.2. Proportion of pre-aspiration in VHC-sequences

The range of the proportions of pre-aspiration spreads around 12% on average in the VHC-sequence under all conditions (Figure 2b)).

The distribution of the mean proportion of pre-aspiration is similar for the utmost conditions as for the duration measurements: pre-aspiration has the largest proportion in Accent 1-words with short vowels (“1S”) and the smallest proportions in Accent 2-words with long vowels (“2L”). In the middle, Accent 1-words with long vowels (1L”) have more or less the same proportion of pre-aspiration as Accent 2-words with short vowels (“2S”).

## 4. DISCUSSION AND CONCLUSIONS

Pre-aspiration does occur in about 80% of the collected data of the Scanian variant of Swedish and

it was produced irrespectively of which accent a word carries and whether the stressed syllables contains a long or a short vowel. There was, however, a slight preference for words with Accent 2 and those with short vowels. The results from quantity measures are not coherent with the results in [4], where monosyllabic words were analysed and vowel quantity did not have an influence on number of occurrence.

In what concerns the magnitude of the produced pre-aspiration on the other hand, a clear trend was observed. Hereby, a larger magnitude of pre-aspiration occurs for Accent 1-words and those with short vowels in comparison to Accent 2-words and words with long vowels. With regard to quantity features, the current results are similar to what had been found in [5] for the dialect of Vemdalen, in that pre-aspiration was longer in the case of a preceding short vowel. The measures of the magnitude however varied: in [5], pre-aspiration after a short vowel took about 28% of the VHC-sequence, whereas in the current data it was only around 12%.

When it comes to the word accents, larger magnitude was favoured for Accent 1-words. Furthermore, Accent 1-words with short vowels show the largest magnitude of the phenomenon.

At this point, the relationship between the current findings and stød and pre-aspiration in Danish comes into the picture. Stød occurs in stressed syllables with either long vowels or short vowels followed by a sonorant. Historically, words with stød are related to words with Accent 1 in Swedish. If a sonorant in a historical stage lost its voicing due to tonal assimilation to the following voiceless stop, that sequence could have ended up as a pre-aspiration and without stød, i.e. stød got lost [6].

Without considerations about the historical connection of the target words with Danish words, which underwent such a process, it is still striking, that words in Southern Swedish with similar structures expose the largest degree of pre-aspiration.

Strong signs of laryngeal constriction were also found in the vowel of Accent 1-words in Southern Swedish in [16], similarly to Danish stød. The investigated material in [16] did not only contain words where a voiceless obstruent followed the vowel. Therefore, the occurrence of pre-aspiration was not accounted for. From that study [16] and from the current one, it can, however, be acknowledged, that some laryngeal action is taking place for words with Accent 1 – in addition to the production of a tonal pattern, which usually characterises the difference between the two word accents – in Southern Swedish. Similar laryngeal actions, however, could not be confirmed for words with Accent 2.



## 5. ACKNOWLEDGEMENT

The author gratefully acknowledges Lund University Humanities Lab for making available their recording facilities.

In addition, the author wants to thank Svenja Willenborg, who assisted with data collection and analysis during her internship at Lund University.

## 6. REFERENCES

- [1] Tronnier, M. 2002. Preaspiration in Southern Swedish Dialects. *Proceedings of Fonetik 2002, Speech, Music and Hearing Quarterly Progress and Status Report, Vol.44*, KTH, Stockholm, 33-36.
- [2] Helgason, P. 2002. *Preaspiration in the Nordic Languages. Synchronic and Diachronic Aspects*. PhD thesis, Stockholm University.
- [3] Tronnier, M. 2018. Observations on the transitions from vowels to voiceless obstruents: a comparative study. *Proceedings of Fonetik 2018*. Department of Philosophy, Linguistics and Theory of Science, Göteborg University, 73-74.
- [4] Tronnier, M. 2002. Preaspirated Stops in Southern Swedish. *Proceedings of ICSLP 2002*, Denver, Col., 1117-11
- [5] Wretling, P., Strangert, E., Schaeffler, F. 2003. Preaspiration as a Quantity Feature. *Proceedings of the 15th International Congress of Phonetic Sciences (ICPhS 03-Barcelona)*, 2701-2704.
- [6] Page, B. R. 1997. On the origin of preaspiration in Scandinavian. *American Journal of Germanic Linguistics & Literatures* 9(2), 167-190.
- [7] Hejna, M. Pre-aspiration biblio.  
<https://misprdlina.wordpress.com/pre-aspiration-biblio/>
- [8] van Dommelen, W. A. 1999. Preaspiration in intervocalic /k/ vs. /g/ in Norwegian. *14th ICPhS, San Francisco*, 2037-2040.
- [9] Engstrand, O. 1987. Preaspiration and voicing contrast in Lule Sámi. *Phonetica* 44, 103-116.
- [10] Ní Chasaide, A. 1985. *Preaspiration in Phonological Stop Contrasts*. PhD thesis, University College of North Wales.
- [11] Ó Murchú, M. 1985. Devoicing and pre-aspiration in varieties of Scots Gaelic. *Ériu* 36, 195-198.
- [12] Gordeeva, O., Scobbie, J. 2007. Non-normative preaspirated voiceless fricatives in Scottish English: phonetic and phonological characteristics. *QMU Speech Science Research Centre Working Papers*.
- [13] Hejná, M. 2015. *Pre-aspiration in Welsh English: A case study of Aberystwyth*. Ph.D. dissertation, University of Manchester.
- [14] Stevens, M. 2011. Consonant length in Italian: gemination, degemination and preaspiration. *Selected Proceedings of the 5th Conference on Laboratory Approaches to Romance Phonology*, 21-32.
- [15] Stevens, M., Reubold, U. 2014. Pre-aspiration, quantity, and sound change. *Laboratory Phonology* 5(4): Ed. J. Cole, 455-488.
- [16] Hjortdal, A. 2022. Creaky voice in South Swedish accent 1. *Phonetic Experimental Research at the Institute of Linguistics (PERILUS), Proceedings of Fonetik 2022: XXXIIIrd Swedish Phonetics Conference*. Royal Institute of Technology, Stockholm.