

CLOSURE DURATIONS IN STOPS AND GRAMMATICAL ENCODING: ON DEFINITE ARTICLES IN LUXEMBOURGISH

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ABSTRACT

This paper examines the phonetic substance of the cliticised definite article in Luxembourgish, which generally renders as an alveolar lenis stop consonant, and how it relates to similar lexical alveolar stops and homorganic consonant clusters. It turns out that closure duration is the decisive acoustic feature: Compared with lexical stops, the clitic alveolar stop is realised with longer closure duration, which leads to a three-way distinction of alveolar stops.

Keywords: Luxembourgish, stops, cliticisation, closure duration, VOT

1. INTRODUCTION

This study deals with the realisation of plosive consonants in Luxembourgish, especially with regard to the cliticisation of the definite article and how this grammatical structure is encoded phonetically. As a typical feature of a Germanic language Luxembourgish, too, shows a fortis-lenis contrast in the stop series /p-b, t-d, k-g/ [6]. This contrast is realised with a different voice onset time (VOT) [2, 8, 5] with a shorter VOT for the lenis stops compared to the fortis stops. However, closure duration (CD) of the stops does not differ between fortis and lenis stops [7]. Also, the lenis stops are frequently completely or partially devoiced [9], in addition to the phonological feature of word-final devoicing ("Auslautverhärtung") that is also valid for Luxembourgish [6].

It can be assumed that stop production in Luxembourgish behaves similar to standard German and neighboured varieties of German spoken in Saarland [3], Lorraine [4] and Alsace [10].

The Luxembourgish definite article (see Table 1) for the cases nominative and accusative (singular and plural) consists of two paradigms: The monosyllabic full forms *den*, *déi*, *dat* (sg) and *déi* (pl), which are used for specific forms of determination and in front of adjectives in complex nominal phrases (NP). In all other contexts the much more frequent clitic form *d'* is used, which consists of the realisation of a lenis alveolar stop consonant solely. This clitic developed from the gradual reduction of the full form.

Since definite articles play a crucial role for the grammatical setup of NPs, the article *d'* belongs to the high frequency words in Luxembourgish.

Phonologically the *d'* in an NP like *d'Achsen* ('the axes') is incorporated into the word and then becomes the onset of the syllable as it is the case for *Dachsen* ('badgers'), which exhibits a lexical initial alveolar stop. Although in both cases the same phoneme /d/ occurs in the same syllabic position, realisations of /d/ in *d'Achsen* and *Dachsen* can be distinguished by native speakers.

Table 1: The paradigm of definite articles in Luxembourgish constitutes of (infrequently used) full forms and of (highly frequently used) short forms. Forms under investigation are in bold.

Number	Singular		Plural	
	full	clitic	full	clitic
masculine	den	den	déi	d'
feminine	déi	d'	déi	d'
neuter	dat	d'	déi	d'

Moreover, the *d'* in an NP like *d'Dachsen* ('the badgers') or *d'Taxen* ('the taxes') would lead to syllable-initial geminates, which generally do not exist in Luxembourgish. Although native speakers can perceptually distinguish between NPs like the one in the mentioned minimal triple *d'Achsen* – *d'Dachsen* – *d'Taxen* the phonetic substance of these geminates is unclear so far. Particularly the phonetic difference between /dd/ as in *d'Dachsen* and /dt/ as in *d'Taxen* remains obscure.

Of course, the clitic *d'* can be attached to nouns with all possible syllable onsets, partially forming otherwise disallowed initial consonant clusters, e.g. /dfra:/ *d'Fra* 'the woman', /dkant/ *d'Kand* ('the child'), /dlait/ *d'Leit* ('the people'), /dʃtrɛɪ/ *d'Stréi* ('the straw'). Auditorily, most forms of clitic *d'* could be described as unreleased lenis stops (except before vowel where the burst can be heard), which gives them a somewhat phonetically weak status.

For this first paper on the phonetic substance of the clitic *d'* we will concentrate only on single lexical alveolar plosives and homorganic clusters. Two research questions arise:

1. What are the phonetic exponents of the cliticised article *d'*?

2. How does this article *d'* interact with other following plosives when forming complex and unusual initial clusters?

In order to answer the first question, the clitic *d'* has to be systematically compared with plain initial fortis /t/ and lenis /d/ using minimal pairs. To answer the second question the clitic *d'* was combined with words beginning with homorganic /t/ and /d/, respectively.

2. DATA AND METHOD

Previous tests with highly controlled carrier sentences of the type ‘I said x again’ proved to be unsuited because the speakers were forced to produce sentences with definite articles on grammatically wrong positions and they then often tended to make a pause just before the test word. To overcome this problem, carefully designed meaningful sentences were developed. Five contextual environments for the plosive(s) were selected (the ‘#’ indicates a morpheme boundary):

1. #d: word-initial /d/ followed by a vowel
2. #t: word-initial /t/ followed by a vowel
3. d#: initial definite article *d'* followed by a vowel
4. d#d: combination of definite article and following word-initial lenis stop
5. d#t: combination of definite article and following word-initial fortis stop

To focus as much as possible on the structure of the plosive/s itself/themselves and the effect the clitic article adds to the phonetics of the word, words were selected which were similar except for the initial plosive/s, i.e. near minimal pairs. Three of these ‘quintuples’ have been set up and form the core of the reading task (see Table 2).

Table 2: The ‘quintuples’ of test words illustrating the five contexts for the plosive(s).

#d	#t	d#	d#d	d#t
<i>Dachsen</i> /daksən/ 'badgers'	<i>Taxen</i> /taksən/ 'taxes'	<i>d'Achsen</i> /d#aksən/ 'the axes'	<i>d'Dachsen</i> /d#daksən/ 'the badgers'	<i>d'Taxen</i> /d#taksən/ 'the taxes'
<i>Dieren</i> /di:rən/ 'doors'	<i>Tirett</i> /tiræt/ 'zipper'	<i>d'Iren</i> /d#i:rən/ 'the Irish'	<i>d'Dieren</i> /d#di:rən/ 'the doors'	<i>d'Tiretten</i> /d#tirætən/ 'the zippers'
<i>Dafen</i> /da:fən/ 'baptisms'	<i>Taarten</i> /ta:rtən/ 'cakes'	<i>d'Afen</i> /d#a:fən/ 'the apes'	<i>d'Dafen</i> /d#da:fən/ 'the baptisms'	<i>d'Taarten</i> /d#ta:rtən/ 'the cakes'

In addition, to control for the context on the left-hand side, each test item was placed before a word with a final vowel and a final voiceless fricative,

respectively. It was taken care that all test items carried sentence stress. Every test item was realised twice. The entire list of sentences was presented in a randomized order interspersed with a few other sentences.

For the reading task, subjects were presented then sentences like *En hat sech schonn op héich Taxen agestallt* (‘He was already used to higher taxes’) which they had to read at their average speaking rate. Recordings were made for a set of 5 speakers, mainly university students with an age ranging from 25 to 35. The recordings were made in a quiet office environment. From the total of 300 expected plosives a subset of 230 plosives could be used for the analysis. The acoustic analysis was performed with the standard speech editor Praat. As for the acoustic cues, closure duration (CD) and voice onset time (VOT) were measured. In the few cases of continuously voiced plosives, only the stretch starting with the burst until the voicing onset (indicated by the voice bar in the spectrogram) was taken into account.

3. RESULTS

3.1. Singletons

The main results for average closure duration and voice onset time are shown in Fig. 1 (after vowels) and Fig. 2 (after voiceless fricatives). With regard to VOT we can confirm the classical pattern for fortis stops tending to have long and lenis stops having short VOT values. It also is evident that the clitic article *d#* with its short VOT also behaves like a lenis plosive. What is more crucial, though, is how the single, lexical stops *#d* and *#t* are separated from the clitic article *d#* in word pairs like *Dachsen* ~ *d'Achsen*. It can be observed for the latter that CD is the crucial factor. Everything else equal, CD is longer for the clitic article *d#* than for single stops *d#* or *t#*. All these differences are statistically significant (Welch Two Sample t-test), except for the pair *#d* ~ *d#* after the voiceless fricative (see Table 3 for the levels of significance). Note that Figures 1 and 2 display only the average values; individual values for the speaker differ to some extent. Thus, the CD in *d#* can be longer than *#d* between 18% and 71%, depending on the speaker. Taken together, the longer CD for *d#* indicates that Luxembourgish makes use of a special phonetic make-up for the grammatical category of the clitic definite article: In order to distinguish it from the homorganic lexical plosive, it has developed into a lengthened or geminate structure [d:], although otherwise Luxembourgish does not exhibit geminates. Accordingly, the phonetic transcription for the above minimal pair then would

be [d̥aksən] *Dachsen* ('badgers') and [d̥:aksən] *d'Achsen* ('the axes').

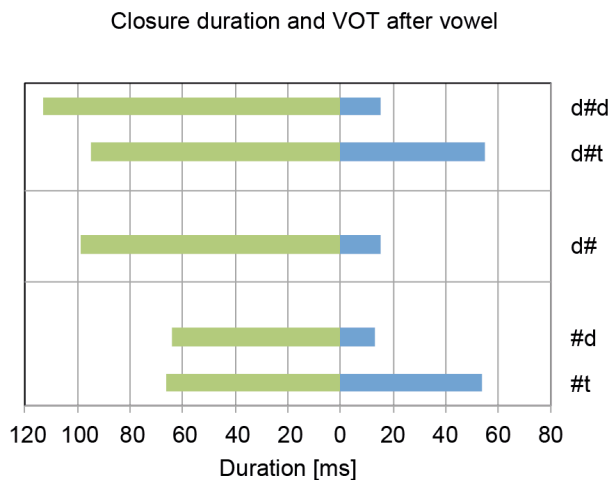


Figure 1: Mean values for the closure duration and voice onset time for the five plosive environments with a vowel as the left context.

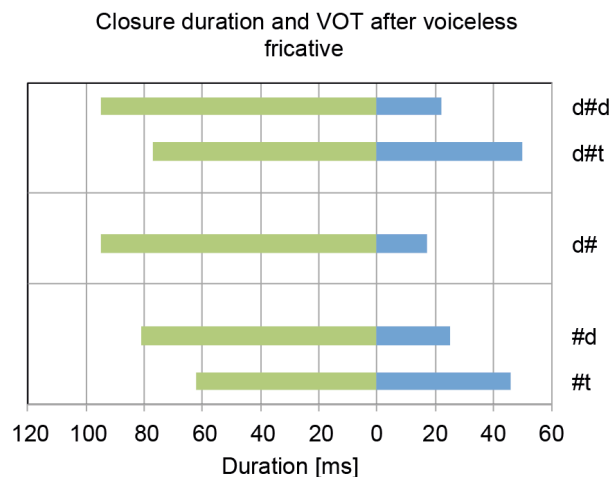


Figure 2: Mean values for the closure duration and voice onset time for the five plosive environments with a voiceless fricative as the left context.

3.2. Geminates

The next aspect concerns the question what happens when the clitic article is attached to a word which already begins with a homorganic alveolar plosive. It is expected that in such plosive combinations like *d#d* and *d#t* the closure of the clitic article [d̥:] remains unreleased and that this duration is then added to the following CD of the lexical plosive (e.g. /d̥#daksən/ > [d̥::aksən] *d'Dachsen* 'the badgers'). They thus should be considerably longer than the clitic *d#* (and, of course, the lexical plosives *#d* and *#t*). However, as the average durations in Fig. 1 and 2 indicate, CD for these clusters shows a somewhat incoherent picture. Only the cluster *d#d* after vowel

is longer than *d#* and this difference is statistically slightly significant ($t = -2.4325$, $df = 38.661$, $p\text{-value} = 0.01973$). For the other clusters CD is about the same or even a little shorter and most of the differences are not statistically significant. It thus seems that an assimilation process is taking place, which reduces the complexity of onset clusters like *d#d* and *d#t* by reducing CD. For Luxembourgish, then, extra long CD like [d̥:] seems to be avoided. Furthermore, when preceded by a voiceless fricative, the clusters *d#d* and *d#t* are considerably shorter than when preceded by a vowel (approximately by 20 ms). In general, CD seems to be no crucial factor in distinguishing the clitic *d#* from homorganic clusters like *d#d* or *d#t*. Interestingly, the acoustic difference between *d#d* and *d#t* is maintained through VOT, which is considerably longer for the latter and turning this whole cluster *d#t* into one fortis consonant. This indicates that the voicing feature of the lexical plosive is conveyed also to the clitic article, which in this case turns into a fortis plosive.

Table 3: Levels of significance (Welch Two Sample t-test) for closure duration. The left column in each plosive environment contains the levels for the context after vowel, the right column for the context after voiceless fricative.

	#d		d#		d#t		d#d	
#t	n.s.	*	***	***	***	*	***	***
#d			***	n.s.	***	n.s.	***	n.s.
d#					n.s.	*	*	n.s.
d#t							***	***

4. DISCUSSION

Like in other Germanic languages, the singleton lexical plosives *#t* and *#d* are distinguished by VOT forming a fort-lenis system. For a systematic account of the cliticised definite article *d#* of Luxembourgish, it is furthermore necessary to take also closure duration into consideration. In its most clear form, i.e. when the clitic *d#* is in intervocalic position, the clitic is characterised by comparatively longer CD than lexical *#d*. Thus, a phonetic transcription as [d̥:] seems appropriate. This Luxembourgish case study shows how a grammatical category, i.e. 'cliticised definite article', is encoded on the phonetic level in an unambiguous way. However, when word onsets become more complex the additional CD can be assimilated. From an acoustic perspective it then becomes difficult to distinguish *d#* on the one hand from *d#d* and *d#t* on the other. Furthermore, when the clitic is preceded by voiceless left context, CD of the homorganic onset cluster *d#d* and *d#t* have in general shorter durations and the

more clear-cut picture of the intervocalic context is blurred.

5. CONCLUSIONS

In this study it was shown that Luxembourgish operates with a three-way distinction of syllable-initial plosives. This phenomenon can be considered as unusual among Germanic languages (or at least not described). It should be noted that other languages with a three-way distinction of plosives such as Korean [8] differentiates its unvoiced plosives primarily by VOT (and secondarily by fundamental frequency). In Luxembourgish the three-way distinction works with VOT on the one hand $\#t \sim \#d$, and CD on the other hand $d\# \sim \#d$.

One of the future steps to confirm the production data presented here is to apply perception tests in order to check whether this three-way distinction holds for perception. In addition, the remaining plosive contrasts /p~b/ and /k~g/ should be tested as well as further consonant clusters such as /br, bl, pr, pl, dr, tr, gr, gl, kr, kl/ that also can occur within the same morpheme or across morphemes. Moreover, a special phenomenon in this respect would be gemination across two morpheme boundaries like in *Ech hunn net d'Taxen bezuelt* ('I have not paid the taxes') with a consonant cluster $t\#d\#$ where the closure duration is possibly lengthened again.

Although the use of carrier sentences is an approach that is often applied to elicit highly controlled speech it became clear that this type of speech was completely unsuitable. The use of invented sentences was by far more successful. Although the encoding of the article by means of closure duration seems to be quite stable in read sentences, it might be different in spontaneous speech. Probably a mix of speaking styles as recently suggested by [11] would yield a more stable ground for findings on the phenomena investigated here. This mix could include other *kind* of data but particularly other *amount* of data for this less well documented language [1].

A further direction of research should take into account the language contact situation of Luxembourgish. Nearly all native speakers of Luxembourgish are also speakers of French (which is one of the three official national languages) where the fortislenis contrast in stops is expressed different to Germanic languages [2, 8, 5]. From a dialectological point of view it would be interesting to see how Luxembourgish fits in the transitional area of using closure duration and VOT for the stops series, which has been documented for the main dialectal areas in the neighbored regions of Saarland [3], Lorraine [4] and Alsace [10].

Taken together, though acoustically not very strong substantiated, the grammatical encoding of the definite article *d'* in Luxembourgish is reflected in writing. However, we can consider the closure duration as an inherent fragile phonetic exponent of the grammatical category. Thus, it is susceptible to language change.

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