



Duration as a Contrast Enhancer in a northern German Dialect

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Abstract

This study investigates durational differences of the fricatives /ç/ and /ʃ/ in three minimal pairs, elicited in isolation and in carrier phrases, in German. Data was collected from five groups of speakers in Berlin and – as a contrast - from a group of high school students in a northern German small town. Both, Berlin and the small town near Hamburg belong to the lower German dialect area, however, speakers from these two areas differ with regard to the acoustic realization of these two fricatives. Berlin speakers in general have a stronger tendency to merge [ç] and [ʃ] to various degrees while speakers from the north keep these two sounds quite separate on various acoustic dimensions. In this study, we are investigating the duration of these two contrasting fricatives in these two German varieties. Berlin speakers across five different speaker groups show similar durational patterns in the carrier phrase condition while the northern speakers have a greater durational difference, showing that the contrast is also preserved in [ʃ] being longer than [ç] when normalized for word duration. We attribute the durational differences between the Berlin speakers and the northern German speakers as a prosodic guise of contrast enhancement between these two fricatives.

Index Terms: duration, dialect, German, fricatives, speech communities

1. Introduction

German is one of the very few languages of the world that contrasts /ç/ and /ʃ/. However, in many dialect regions of Germany, ranging from Trier in the south-west up to Cologne in the western middle of Germany all the way across the country towards the east in Dresden, the two fricative sounds /ç/ and /ʃ/ have merged so that the palatal fricative is often realized as [ç] [1,2]. This merger is not yet observed in the northern dialects around Hamburg, however, anecdotal evidence suggests that within some urban areas of Hamburg, younger multiethnic speaker groups have a tendency to conflate these two sounds [1,2] – just as is the case in Berlin. The desire to maintain contrast in the face of a potential merger observed in urban areas will be discussed in this paper.

Our previous work on this contrast in Berlin [3,4] has revealed a tendency to merge the two contrasting speech sounds [ç] and [ʃ] to a variant like [ç] in Hood German. This merger is highly associated with Kreuzberg, a multiethnic neighborhood in Berlin. This multiethnolect though is also spoken by many monoethnic monolingual adolescents in and around Berlin and even extends to university students from the surrounding Brandenburg area. We have also detected an intermediate variant ([ç̥]) in the speech of some older East

Berlin speakers. Thus, there appear to be two forces that facilitate the merger: the multiethnic youth style spoken by many adolescents and some younger adults because it is perceived to be hip, stylish and urban and second, the spread of the dialectal feature from the middle German dialect belt into Berlin.

While many speakers produce intermediate sounds between [ç] and [ʃ], in previous work we set out to investigate the exact nature and extent of the acoustic contrast in the fricatives /ç/ and /ʃ/ in Berlin. Therefore, we recorded word lists of minimal pairs and members of a minimal pair embedded in a carrier phrase. According to Labov, reading lists of minimal pairs constitutes a task that triggers maximal contrast to be produced [5]. All fricatives were labeled based on the energy distribution of the spectrogram and acoustic measurements were logged at the midpoint of the sibilant. Then, multiple acoustic measurements were chosen to parameterize the spectra of the two fricatives. *Discrete Cosine Transformation* (DCT), a method proposed by [8] was used to quantify the shape of the spectra and in particular the fricative contrast in more detail. Using DCTs has previously been found to provide an effective separation between the four fricative types in Polish [3], but also to be a reliable parameter to differentiate the very similar acoustic spectra of /ç/ and /ʃ/ in Berlin German [6].

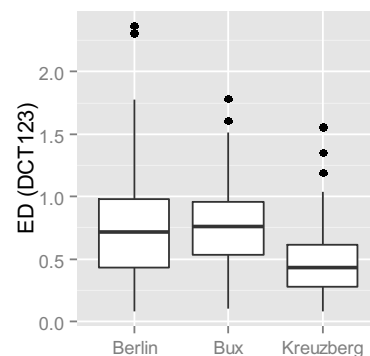


Figure 1: Euclidean Distances (in DCT1x2x3 space) separated by the three speaker groups.

The data in Fig.1 shows the contrast realization between [ç] and [ʃ] by three speaker groups in the acoustic DCT123 space. It is apparent from the data that the speakers from the multiethnic neighborhood Kreuzberg in Berlin (rightmost bar) show the least amount of contrast between these fricatives. Comparing their realization with that of monolingual monoethnic Berliners (leftmost bar) shows a difference.

Moreover, data in the Kreuzberg group also includes renditions from monolingual monoethnic German speakers who live and associate with the district. In a separate study [6], we found that identification with local spaces (e.g. Neighborhood Kreuzberg as opposed to broader Berlin) was a good predictor for the /ç/ and /ʃ/ to merge in the speech of adolescent monolingual and multilingual speakers of German.

Given this effect of identifying with local spaces, we have now gathered data in a small German town located about 350km to the north west of Berlin (Buxtehude) to investigate the realizations of the contrast in the DCT123 space. Both, the Berlin dialect and the Buxtehude dialect are part of the same low German dialect region. We have collected data from high school students in the small northern German town, roughly the same age as the monolingual and multilingual Berlin students in the Kreuzberg group to investigate if the acoustic contrast between these two fricative sounds is maintained more in their speech and if so, if they use the same acoustic features to signal the contrast. The middle bar in Fig. 1 shows the Euclidian Distances in the DCT123 space for the second adolescent group – their speech does not differ from the adult Berlin data with regard to this particular measure.

We have therefore now investigated the word prosodic properties, that is, the relative duration of the fricative in the word of the elicited items for five speaker groups varying in age, city and contact to the multiethnic, suspecting that the relative duration of the fricative in relation to the entire word may give cues as to the quality of the fricative in a dialect spoken further north in the lower German dialect area.

2. Methods

2.1. Recordings

Recordings were made in a sound proofed or quiet room with a professional microphone and recording device (Taskam DR-05 linear PCM recorder and a Sennheiser directional microphone ME64) at a sampling rate of 22kHz.

2.2. Material

All data for this study was elicited in a task whereby speakers had to read a short list of minimal pairs contrasting /ç/ and /ʃ/ in isolation (A) and in a sentential context (B). In order to elicit the maximal contrast between these minimal pairs, we asked speakers to read the test words as contrast pairs and also embedded in a carrier phrase.

(A) words in isolation:

Fich.te – spruce fisch.te – 3rd p. sing. of ‘to fish’
Wicht – gnome wischt – 3rd p. sing of ‘to wipe’

(B) words in sentential condition:

Ich habe *Fichte* gesagt. I’ve said ‘spruce’.
Ich habe *fischte* gesagt. I’ve said ‘fished’.
Ich habe *Wicht* gesagt. I’ve said ‘gnome’.
Ich habe *wischt* gesagt. I’ve said ‘wiped’.

One word of the pair was a noun, the other a conjugated verb. Moreover, one noun and one verb consisted of two syllables so

that the fricative sound was in coda position before the onset of the second syllable (*Fich.te*; *fisch.te*) while in the other word pair, the fricative was part of a more complex coda or preceding the 3rd p. sg. Marker <ɾ> (*Wicht*; *wischt*).

[[Fichte]_{ip}]_{IP}
[[Ich habe Fichte gesagt.]_{ip}]_{IP}

Each speaker repeated the task at least two, in some instances up to four times. It is noteworthy that the syllable containing the fricative was accented in both reading conditions. However, in the isolated word condition, the word should also undergo final lengthening as it is phrase- and utterance final. This effect should be less observable in the carrier phrase condition.

In both elicitation conditions, we may observe an effect of focus on the word as it is not only highlighted but also contrasted with the second word of the minimal pair in the previous or next utterance. Only those utterances were analyzed where speakers uttered it in one single intonational phrase, thus, where there were no pauses.

2.3. Speakers

Data from five groups of speakers were analyzed: 1. monolingual monoethnic adolescents from Berlin, 2. monolingual monoethnic university students from Berlin, 3. monolingual monoethnic professionals from Berlin, 4. Multiethnic multilingual adolescents from Berlin and 5. Monolingual monoethnic adolescents from a small town near Hamburg. In total, acoustic recordings were obtained from 22 adults and 32 adolescents attending a middle school in the multi-ethnic district of Kreuzberg, Berlin and from 10 monolingual monoethnic adolescents from a small town in northern Germany (see Table 1). Data from groups 2 and 3 was collapsed in Fig.1 leftmost bar and data for groups 1 and 4 are represented in Fig.1 rightmost bar.

Table 1. Number of speakers and items for each group in sentence and word condition.

	Nr. of Speakers	Items	Sentence	Word
monoBERwork	12	111	58	53
monoBERstud	10	89	44	45
monoKB	10	72	31	41
multi	22	154	75	79
monoBux	10	136	68	68
Total	64	562	276	286

Meta-data on all speakers was collected, including their age, sex, ethnic background, national and local identity, their own language background, their father’s and mother’s ethnic and language backgrounds, language(s) spoken at home, language spoken with friends, number and age of siblings, their favorite subject in school, or what music they favored.

2.4. Analyses

The target words were segmented and the word as well as the fricative duration was extracted with a script in Praat. To normalize for speech rate effects, first, the duration of the

fricative was calculated as a fraction of the entire word (duration of phon divided by the duration of word). The fricatives were matched for each speaker and minimal pair with respect to the elicitation condition. That is, we calculated the difference between these measures (normalized duration of

[ʃ] minus the normalized duration of [ç] for each speaker, word pair and recording condition). By doing so, we were in a position to compare the mean duration differences between [ʃ] and [ç] for each speaker, word pair and recording condition.

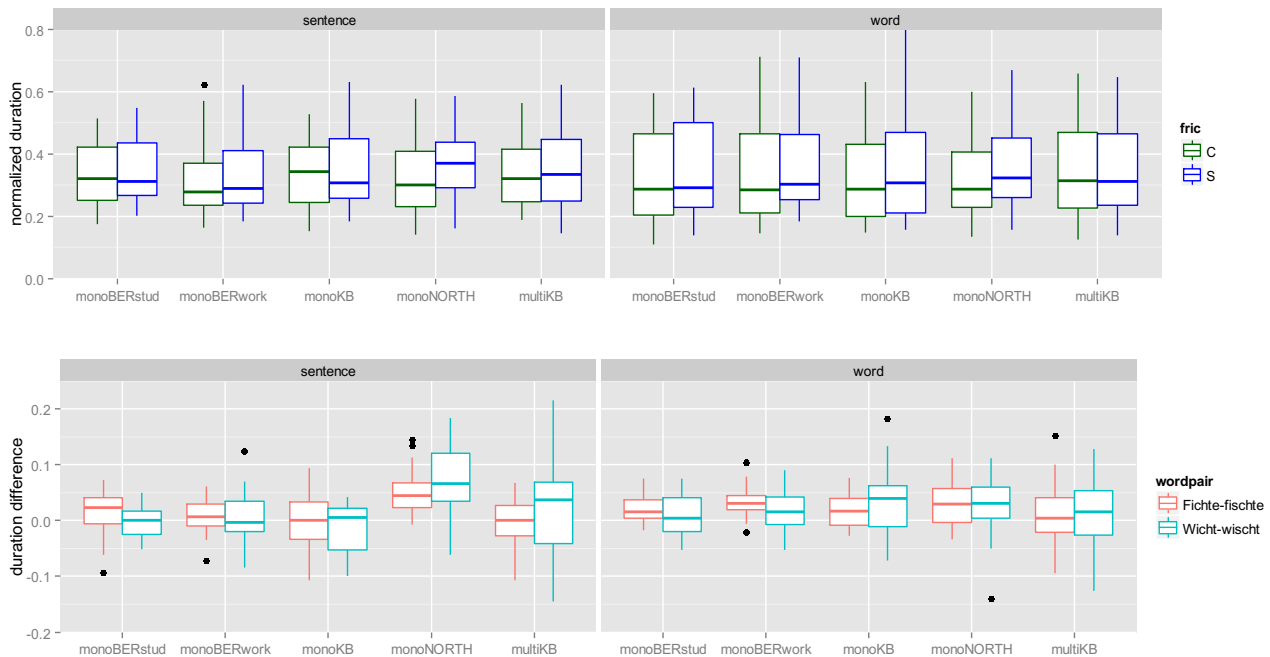


Figure 2: Top: Normalized duration of [ç] and [ʃ] separated by speaker group and elicitation condition. Bottom: Normalized duration differences between the fricatives separated by speaker group and elicitation condition.

2.5. Statistics

Statistical analyses were carried out using the R environment. Linear mixed models were run with the lme4 package and likelihood ratio tests were used to determine significant main effects and/or interactions. The difference measure in duration was used as the dependent variable. Fixed factors included were the elicitation condition (a word in isolation or in a carrier phrase), the speaker group and the minimal pair. As random effects we entered an intercept for speaker as well as a by speaker random slope for the effect of minimal pair and of elicitation condition.

3. Results

The top panel in Fig. 2 shows the normalized duration for the two fricatives [ç] (green) and [ʃ] (blue) for the five speaker groups separated by the elicitation condition. It is very clear that the northern German speakers (monoNORTH) show the greatest difference in duration between [ç] and [ʃ] in the sentence condition which is mainly due to the higher mean duration of [ʃ]. We believe that this difference serves to enhance the contrast between these two fricatives – but only in phrase medial position. However, there is a slight tendency to be noticed towards contrast enhancement also in the word condition.

For the statistical analysis the difference in duration between the fricatives is taken as the dependent variable and the bottom panel of Fig. 2 shows this difference for the two

minimal pairs (red: *Fichte-fischte*; blue: *Wicht/wischt*) for the five speaker groups separated by elicitation condition. As is already apparent from the top panel in Fig. 2, the northern speakers reveal the highest values in the duration difference for both minimal pairs in the sentence condition.

TABLE 2. Summary statistics of the linear mixed model with normalized duration difference between the fricatives as dependent variable, speaker group and elicitation condition as fixed factors and speaker as random factor (number of observation: 562). Interactions between factors marked by *. A significant effect is mirrored by a t-value greater than 2.

Fixed Effects:	Estimate	Std. Error	t value
(Intercept)	0.058722	0.006959	8.438
monoNORTH vs. monoBERstud	0.050476	0.010764	4.689
monoNORTH vs. monoBERwork	0.049610	0.010044	4.939
monoNORTH vs. monoKB	0.064605	0.011747	5.500
monoNORTH vs. multiKB	0.053543	0.009283	5.768
Elicitation condition (sentence vs. word)	0.031628	0.008774	3.605
monoNORTH vs. monoBERstud * condition	0.041094	0.013685	3.003
monoNORTH vs. monoBERwork * condition	0.051038	0.012900	3.956
monoNORTH vs. monoKB * condition	0.061533	0.014624	4.208
monoNORTH vs. multiKB * condition	0.032342	0.011820	2.736

The statistical differences between the northern small town speakers and the other groups is reflected in the t-value stated in Table 2 (t-values above 2 are generally interpreted to be significant).

Likelihood ratio tests revealed that the model with the best fit to the data includes the interaction of speaker group and elicitation condition ($\chi^2(5)=21.02$, $p=0.0008$). The minimal pair did not show an effect, thus, morpho-phonological structure does not seem to be a relevant factor. Table 2 shows the summary statistics. As can be seen in the figures above, the monolingual speakers from the north (monoNORTH) differ significantly in the duration contrast from all other Berlin groups for the sentence condition. The estimates do not differ much between the Berlin groups and vary from 0.045 to 0.063. This is interpreted in the way that the Berlin groups (the monolingual monoethnic speakers as well as the multilingual multiethnic Hood German speakers) do not differ with respect to the temporal realization of the fricative contrast. The significant interaction mirrors that the effect of speaker group on duration difference is not significant for the word condition as already indicated by the figures. We attribute this to a contrast enhancement between these two fricatives in the reading condition which should allow for more coarticulation effects than simple word readings (in the isolation condition).

In summary, in Fig. 2, the difference in duration was plotted separately for each city (Buxtehude and Berlin) and by the recording condition (sentence or word condition) for each word pair (*Fichte/fischte* = red and *Wicht/wischt* = blue). Each bar represents the calculated normalized duration difference between the [f] and the [ç].

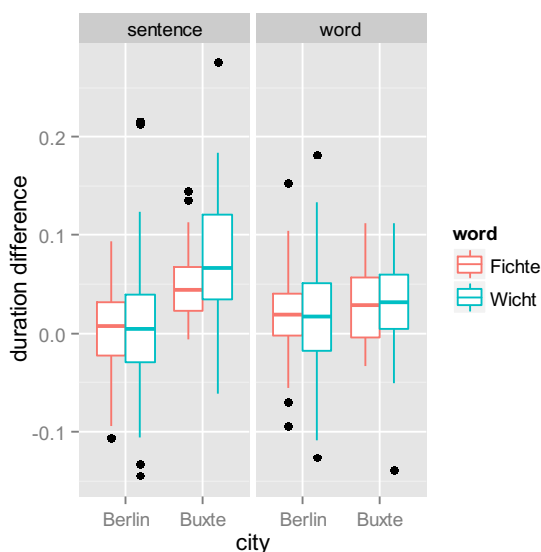


Figure 2: Mean duration differences separated by elicitation condition and geographical area (Berlin= east, Buxte = north).

As shown above, we find larger duration differences between the small northern town *Buxte* and the aggregate bar for all the *Berlin* speakers in the sentence condition compared to the word condition. This is somehow counter intuitive as word and utterance final lengthening should apply and compound more dramatically in the word condition as the word

constitutes a separate utterance and is therefore a phonological phrase by itself. If this effect is due to local emphasis such as focus, we should see a similar pattern for each word pair, this however is not the case. Moreover, the internal structure of the word (monosyllabic and morphologically simple versus disyllabic and morphologically complex) should also not have such a great bearing because both minimal pair types behave similarly in the sentence context. We therefore suspect that in the northern German dialect, in the carrier phrase context, the duration of the fricative [ç] is elongated to enhance the contrast between the /ç/ and the /f/.

4. Conclusions

Contrast maintenance in speech production to facilitate correct parsing by the hearer is one of the desirable features of an ideal speaker. Thus, the better the contrast is maintained, the more efficient is the communication between interlocutors [14]. In this study, we have compared data from two different dialect areas (Berlin and northern Germany) to investigate if contrast maintenance and contrast enhancement is acoustically implemented the same way. While we did not find contrast differences in the Euclidian Distances of the DCT123 acoustic space between the northern and the Berlin speakers, we did find durational differences not apparent in the data of the different Berlin groups. We therefore argue that the difference in dialect (between Berlin and the area near Hamburg) and the subconscious desire of the northern speakers to preserve the contrast in a contextually complex environment (sentence compared than isolated word) explains the patterning of the data. Moreover, from a northern perspective, palatalizing the /ç/ is considered a ‘southern’ feature, so there may be attitudinal reason pertaining to not wanting to sound like someone from the south that preserves structural difference between these two fricatives.

At the same time, realizing [ç] as [ç̥] is also a pervasive marker of the youth-style multiethnolect Hood German ([4, 9] which may be appealing to adolescent speakers far away from speech communities in which Hood German is normally used and where speakers own as opposed to borrow it. Urban centers with multiethnic neighborhoods are supposedly the creative hotspots of this speech variety. Other examples are Multi Ethnic London English (MLE), Straattaal [11,12,13] or Copenhagen Danish. While the adolescent small town speakers of Buxtehude know of this salient and pervasive Hood German marker through movies, music or *youTube* [10], they occasionally cite this speech style for special effects like humor without being able to consistently use all of the morpho-syntactic and phonetic-phonological features.

Generally, we suspect that contrast maintainance is a desirable ability for northern speakers. To test this further, we are currently gathering data in Kiel, one of the urban centers in the very north of Germany.

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