The allophonic fricative [ɛ] in the Frankfurt dialect
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The allophony between the German velar and palatal fricatives, as in Buch [bu:x] ‘book’ and Bücher [by:çer] ‘books’ is well-known and is widely used as an example of complementary distribution in phonology textbooks. However, this allophony is not the only one that is found in the medial fricatives in German, thus [ʃ], [ɛ] and [ç], excluding the peripheral [s] and [x]. In his seminal dissertation, Herrgen (1986) has attracted phonologists’ attention to the existence of the ‘medial’ fricative [ɛ]. In the Frankfurt dialect that we have investigated, [ç] only exists as a variant from the Standard German and not as a dialectal variant. It is thus only used as a ‘hypercorrection’. The Standard German allophony between [ç] and [x] is replaced by another allophony that we will illustrate and formalize in our talk. We will show the results of a production experiment, and illustrate the phonetic properties of the allophones.

We used a reading task in which participants produced words containing [ʃ], [ɛ] and [x] in Standard German.

Results are summarized as follows: 1) The back dorsal fricative [x] has the same distribution as in Standard German, and is regularly realized after a back vowel if it is an underlying dorsal fricative. 2) Word initially, in Chemie and China, the allophone [ʃ] is always used. 3) The dialectal allophony of interest takes place between [ʃ] and [ɛ]:

- [ʃ] and [ɛ] are neutralized to [ɛ] when the preceding vowel is a front unrounded one [i, i, e, æ], see the data in (1).
- [ʃ] and [ɛ] are neutralized to [ʃ] when the preceding vowel is rounded or low [y, y, o, æ, u, u, o, o, a, a], see (2).

In short, the Frankfurt dialect has a complementary distribution of [ʃ] and [ɛ]. We assume an active phonological process, playing a major role in the distribution and emergence of this allophone. [ʃ] and [ɛ] are both postalveolar, but they differ in rounding: [ʃ] is [+round] and [ɛ] is [-round]. A round vowel triggers assimilation in rounding of the following medial fricative. The fact that [ɛ] is the unrounded variant of the allophony, and not [ç], is accounted for, in the following way. First in an OT approach, we use Flemmings’s (2001) Minimal Distance constraint to explain that only one of [ç] and [ɛ] can survive. Second [ɛ] is chosen, because it is the corresponding unrounded version of [ʃ], rendering it a more natural allophone for [ʃ] than [ç], which is articulated further back. Contrary to Robinson (2001) und Hall (2014) thus, we do not think that [ɛ] is just the result of an articulatory simplification ([s] is the most unmarked coronal segment).

As for the phonetic properties, the rule of articulatory depth (see Machelett 1996) predicts that the further back a fricative is articulated, the lower its resonant frequencies are. The uvular [χ] has thus the lowest resonant frequencies, followed by the velar [x]. Postalveolar [ʃ] has the next lowest resonant frequencies (2500 Hz – 7000 Hz). While the palatal dorsal fricative [ɛ] is realized further back than the postalveolar [ʃ], its resonant frequencies start higher (3000 Hz). This does not contradict the rule of articulatory depth, because the rounding of the fricative [ʃ] lengthens the front cavity and therefore contributes to its lower resonant frequencies. Among the medial fricatives, the postalveolar [ɛ] should have the highest resonant frequencies as it is realized at the same place of articulation as [ʃ] and it is [unrounded] resulting in a shorter length of the oral cavity. We find supporting evidence in the Frankfurt dialect, see Figures 1 and 2. In Figure 2, it can be seen that word initial [ʃ] has lower resonant frequencies than final [ɛ]. As for measures, we chose duration, intensity, centre of gravity and standard deviation. Centre of gravity gives the average of frequencies in a spectrum. Standard deviation is a measure for how much the frequencies can deviate from the centre of gravity. Table (1) displays the results for one participant, for a total of 54 items (32 [ɛ]/ 22 [ʃ]): [ʃ] averages higher duration and intensity (mean/max), but has lower centre of gravity and standard deviation compared to [ɛ].
Neutralisation of [ʃ] and [ç] to [ɕ] in Frankfurt dialect
   a. Standard dialect [ʃ]: Fisch, panisch, stoisch, englisch, französisch, Fleisch, Kirsche
   b. Standard dialect [ç]: ich, Blech, echt, nicht, sich, wirklich, eigentlich, Kirche

Neutralisation of [ʃ] and [ç] to [ɕ] in Frankfurt dialect
   a. Standard dialect [ʃ]: duschen, rasch, Löscher, keusche, Bosch, hübsch
   b. Standard dialect [ç]: Bücher, Mulch, Mönch, Löcher

<table>
<thead>
<tr>
<th></th>
<th>Duration (ms)</th>
<th>Intensity-mean (dB)</th>
<th>Intensity-max (dB)</th>
<th>Centre of Gravity (Hz)</th>
<th>Standard deviation (Hz)</th>
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</thead>
<tbody>
<tr>
<td>[ç]</td>
<td>69,7</td>
<td>47,6</td>
<td>49,2</td>
<td>3210,5</td>
<td>1037,1</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>74,5</td>
<td>53,15</td>
<td>55,77</td>
<td>2922,6</td>
<td>590,85</td>
</tr>
</tbody>
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Table 1. Average measures of [ʃ] and [ç] (for one participant)

**Figure 1.** [ç] in Standard dialect: *dich ‘you.ACC’* (0 – 9000Hz)

**Figure 2.** [ʃ] and [ç] in Frankfurt dialect: *Strich ‘line/hyphen’* (0 – 15000Hz)

Hall, Tracy Alan (2014): Alveolopalatalization in Central German as markedness reduction. Transactions of the Philological Society 112: S. 143-166.