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## THE ACOUSTIC FEATURES OF THE POSITIONAL VARIANTS OF NASALS IN CZECH

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In this contribution I want to concentrate on some positional variants of nasal consonants in Czech, from the point of view of their delimitation on the three dimensional spectrum.

When assessing the acoustic character of Czech nasals I base my observations on standard spoken Czech. The acoustic spectrum was made on two types of apparatus: 1. The sonagraph, i.e. a Visible Speech instrument adapted and produced by Kay-Electric Co., and 2. The Czechoslovak TESLA spectrometre which is a variant of the sonagraph.

Like all other sounds, Czech nasal consonants are modified in different environments and their basic acoustic features differ—more or less—from the basic type which occurs most often in the intervocalic position.

Czech nasals *m*, *n*, *ň* belong to occlusives, but differ from other occlusives by a weaker explosion and also by the visibility of  $F_3$ . The strongest explosion among the occlusives is to be found with *ň* which is—acoustically—a variant of the palatal  $\alpha$  and its explosion is in some position marked by noise characteristics. The nasals also differ from other consonants by the fact that their explosive character is manifested only in some positions, for instance in the intervocalic and initial positions. On the other hand there are many positional variants of the nasals which are often characterised on the spectrum by the absence of explosion. This concerns in particular the final position of the nasal *m* and *n* (while the palatal *ň* keeps the explosion in the final position with a number of speakers) or the positional variants of the nasal *n* before sibilants, affricates, labials, alveodentals and velars.

Let us observe more closely some of the individual variants. First of all I will discuss the nasal *n* before velars when the basic variant of the nasal changes in quality into  $\eta$ . This is a typical case of the assimilation of the place of articulation which has been described in almost all the phonetic works on the Czech language.

On the acoustic spectrum the difference between the two variants is usually manifested by the presence of explosion with the alveodental *n* and the absence of explo-

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sion with the velar  $\eta$ . With the velar  $\eta$  there is often a barely noticeable  $F_2$  and always a visible  $F_3$ . This acoustic difference between the alveodental  $n$  and the velar  $\eta$  is obviously the consequence of different articulation conditions. The alveodental  $n$  is shaped by one mouth closure: contact of the tongue on the palate arch mainly in the teeth ridge area. The explosion occurs after the occlusion is freed. With the velar  $\eta$  the articulation shifts from the alveodental area to the velum; in the usual pronunciation of the  $n + k$  combination the off-glide is simplified or the off-glide of the velar  $\eta$  coincides with the on-glide of the velar  $k$ . The position of the organs of articulation with the occlusion of the two sounds is identical, with the only difference being in the position of the soft palate. After the closing of the passage into the nasal cavity, the occlusion is freed in the area of the soft palate.

The nasal  $n$  often has a similar picture in the combination  $n + s + k$  which in the Czech language has a fairly high frequency of occurrence, mainly in the suffixes *-ský*, *-ská*, *-ské*.

The changed acoustical character of the nasal can be observed in these cases while listening to the progressing segments in the work with the segmentator when it is signalled by a strong nasalisation of the preceding vowel, an easy transition from the vowel to the consonant and a lack of explosion. The nasalisation of the preceding vowel is naturally caused by the fact that the soft palate descends and frees the entry into the nasal cavity already during the transition from the vowel to the nasal; the mouth occlusion either does not take place at all or is very weak. The pronunciation is of course potential, but the many examples found in my material testify to the high frequency of this variant of the nasal in a position preceding the combination  $s + k$ . We seem to be confronted here (as in the case of the combination  $n + k$ ), with the influence of a velar, articulated in an entirely different articulation place from the basic type of the nasal. The acoustic picture of this variant of the nasal is close to the velar  $\eta$  and the pronunciation of none of my speakers showed a visible explosion. The nasalisation of the preceding vowel is often manifested by a clear  $F_3$  vowel.

The qualitative change of non-palatal  $n$  into palatal  $\tilde{n}$  or at least of a palatalised variant was observed in the combination  $n + \tilde{s} + \tilde{t}$ . This seems to be the result of the softening influence of the palatal  $\tilde{t}$ . In this case too a weak nasalisation of the preceding vowel was observed, as well as the pronunciation of the nasal without explosion. The softening influence of the palatal  $\tilde{t}$  on the preceding nasal is of course strongest in the combination of  $n + \tilde{t}$ : this is the case of two consonants articulated in the same place of articulation. These groups are characterised by a strong softening of the nasal, manifested in the spectrum by the prolonged duration of the sound and a weakening of  $F_3$ .

A weakened explosion of the nasal  $n$  can also be found in the position before the labials  $p$ ,  $b$ . In sonagrams of this combination the explosion usually is not visible at all. Acoustically the variant of  $n$  in this position is manifested by weakened clarity of  $F_2$ . On the other hand  $F_3$  is clear almost in all cases. This picture of the nasal and

a short pause before the explosion of the labial as well as the weakened explosion all characterise this combination.

It should be added that the lack of explosion in the nasal in consonant clusters is manifested in a different way than with other occlusives. The acoustic spectrum of consonant combinations where one of the components is an occlusive shows very often that the basic acoustic feature of an occlusive, namely explosion, does not necessarily have to keep its priority and can be replaced by a secondary feature which then serves for the identification of the phoneme: for instance in the combination of two occlusives the explosion of the first component can be replaced on the spectrum by a pause before the explosion. With some variants of nasals, for instance before sibilants, even this secondary feature disappears.