A TYPOLOGY OF PALATAL ASSIMILATIONS IN ENGLISH AND SLOVAK

Radoslav Pavlík
Comenius University in Bratislava

Abstract: The paper constitutes another contribution to the discussion of place assimilation typologies in English and Slovak. It is concerned with the selected aspects of palatalization in the two languages. It shows how various phonetic approaches can be used in the description and analysis of this particular assimilation process. The main differences and similarities between English and Slovak palatal assimilations are highlighted, and it is concluded that, in both languages, palatal assimilations are usually less prominent auditorily than other types of place assimilations. At the same time, regressive palatalizations are perceptually more salient than the progressive ones.

Key words: assimilation, coarticulation, palatalization, palatal assimilation, typology

INTRODUCTION

The paper is focused on the description and partial analysis of the involvement of the palatal place of articulation in assimilatory processes occurring in connected speech. The aim of this work is to show various possibilities of the analysis of palatalization and, at the same time, to point out some differences and similarities existing between palatal assimilations in English and Slovak. Palatalization will be studied here with selected samples of natural spoken texts of the two languages: English and Slovak. The data for the qualitative analysis have been
recorded from national TV-stations and radio-stations directly onto the hard-disk of a computer, and they consist of the speech recordings of 13 English and 13 Slovak speakers. The signal has been converted into digital wave files (.wav) with the sampling frequency of 22,050 Hz and the depth of 16 bits. The recordings are spoken texts of top-of-the-hour news, read in the studio by male and female newsreaders. The newsreaders are native speakers of the respective languages. The analysed samples have been selected from a larger corpus and form only a fraction of the available corpus material. Three approaches have been applied in the analysis of the selected data – segmental, parametric, and gestural (Pavlík, 2009c). The IPA phonetic symbols used in this paper to transcribe English and Slovak sounds are described in detail in Pavlík (2003, 2004).

**THE DEFINITION OF PALATALIZATION**

The assimilatory process of palatalization occurs when the palatal characteristics of the assimilator (the segment that causes assimilation) are transferred, categorically or non-categorically, to the assimilee (the segment that undergoes assimilation). This process is referred to as *palatalization* and it is expressed in the IPA by the diacritical mark [\^] (cf. Abercrombie, 1967, p. 63; Brosnahan – Malmberg, 1970, p. 67; Kráľ – Sabol, 1989, p. 149; Laver, 1994, p. 323–325), or by some other means available in the IPA, e.g. som ja [\^[\`m\^]j\^], ak ide [\^[\`\`\`\`\`\`\^]\^], etc.

According to this definition, many of the cases usually characterized as palatalizations in the phonetic literature are actually examples of palatoalveolarization. It would seem that most phoneticians tend to lump palatoalveolarization and palatalization together into one category which is usually referred to as palatalization. In this paper, we will classify as palatal (or palatalized) all those sounds, whose main area of contact or approximation is situated in the palatal region, this being determined palatographically and from sagittal views. The only sounds which are truly palatal (according to this definition) are the /i/-like vowels, and the consonant /j/, both in English and Slovak. Alveolar consonants undergoing palatalization result in the production of palatoalveolar sounds and have been described and classified elsewhere (Pavlík, 2012).

**ARTICULATORIAL ASPECTS OF PALATALIZATION**

Certain aspects of palatalization in English, as defined above, have been studied and/or described by a number of researchers, e.g. Ladefoged (1967),
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Jones (1972), Sereno – Lieberman (1987), Keating – Lahiri (1993), Gimson – Cruttenden (1994), *inter alia*. In Slovak, contextual palatalization has not been studied empirically, although we do find some cases of this phenomenon mentioned in Kráľ (1965, 1988, 2005) and Kráľ – Sabol (1989). However, these authors state that such cases cannot be classified as palatalizations (Kráľ, 1965, p. 8). Here, again, the importance of the definition of palatalization becomes obvious, because such cases as the bunching and raising of the tongue in the pronunciation of the Slovak non-palatal consonants when followed by /i/-like vowels or /j/ will be considered to be palatalizations in this paper. Whether or not such palatalized segments are auditorily perceptible is another question. Naturally, this is also related to the issue of the degree of palatalization and the overlapping of the offset and onset phases of two succeeding segments.

As far as the degree of palatalization is concerned, there are several problems that make its precise determination difficult:

1. The hard palate is a relatively wide area, and it is usually divided vertically into two or three regions: pre-palatal, (medio-palatal), post-palatal (cf. Hála, 1962, p. 65; 1975, p. 62; Recasens, 1984, p. 63; 1991, p. 181; Hardcastle – Gibbon – Nicolaidis, 1991, p. 256). It should be stated specifically, whether a sound with a lingual contact anywhere in the palatal region is to be considered fully palatal (denoted here by the superscript number 3, e.g. \[\varepsilon\]), or whether the central region (medio-palatum) only will be marked as \[\varepsilon\], and the rest of the areas will be marked with lower numbers.

2. As far as the horizontal division of the hard palate is concerned, it must be specified how many parts it will be divided into, and how to assign a particular palatalization degree according to the width of the contact area (see Figure 1).

![Figure 1](image)

*Figure 1.* Possible vertical and horizontal division of the hard palate.
3. It must also be decided whether and to what extent the tongue bunching and upward movement seen in sagittal views will be taken into account.

As of now, there are no precise (and officially accepted) rules that would deal with these problems. Incidentally, similar situation obtains for many other types of assimilations.

In this paper, IPA sounds such as [j], [c], [ʃ], [i], etc. will be defined as fully (truly) palatal, because they have the following characteristics:

(a) Their sagittal views show the main contact or approximation in the area of the hard palate
(b) Their palatograms show a palatal contact area covering more than 50 percent of the hard palate.

Due to the non-existence of any rigorous criteria and the lack of articulatory studies of contextual palatalization, the degree of palatalization of most sounds will be determined more or less impressionistically, on the basis of the available sagittal sections, palatograms of the assimilators, and the author’s own palatographic material of palatalization.

From the point of view of Articulatory Phonology (Browman – Goldstein, 1989, 1990, 1992, 2000; Byrd, 1992, 1996, 2003; Fowler – Saltzman, 1993; Farnetani, 1999; Byrd – Saltzman, 2002; Goldstein – Fowler, 2003, *inter alia*) palatalization can be modeled by means of a gestural score showing the mechanics of intergestural phasing and coordination. One case of palatalization is shown in the following figure.

![figure](image)

**Figure 2.**
A gestural score of the phrase *seek you* with a palatalized consonant /k/. 
As Figure 2 shows, the tongue body constriction location of [j] has been spread backwards to replace the original TB gesture of /k/. At the same time, the tongue body constriction location of [j] has been spread forwards, and therefore this is a case of double assimilation (see Pavlík, 2009b).

**ACOUSTIC CORRELATES OF PALATAL ASSIMILATIONS**

From an acoustic point of view, this phenomenon can be studied by means of spectrographic and spectral analysis. As in the case of other place assimilations (Pavlik 2009a, 2009d, 2010, 2012), the formants of voiced sounds show marked transitions when bordering on palatal sounds.

![Spectrograms of the vowel formant bends into the palatal consonant [j] in nonsense syllables pronounced by the author.](image)

The formant bends of the vowels [v], [ɛ], [ɔ], and [u] all seem to be directed to two main energy foci for the consonant /j/ (Figure 3). The first focus is placed at the frequency of about 2,300 Hz, whereas the second focus appears to be situated at approximately 3,400 Hz. These formant bends indicating palatalization can also be found in voiced consonants. For example, when consonant [g] is followed by palatal [j], the F2 of the voiced stage of [g] is rapidly rising and transiting into the F2 of the following [j], as demonstrated in the following figure.
Sections of the spectrograms of the phrases *ak á(no)* and *ak je (to)* with a palatalized /g/ in the second phrase (in the pronunciation of the author). Formants F2 and F3 of /g/ are marked by black curves.

Similar F2 upward shift during palatalization can be detected for consonant [ʋ], in both English and Slovak. The following figures show the palatalization of the approximant [ʋ], and it should be noted that the palatalization of bilabials and labiodentals is, in general, much less prominent auditorily than the palatalization of other types of consonants, which are formed further back in the oral cavity. This is because the oral cavity is blocked by bilabial or labiodental closure, and the resonances are thus decreased. Articulatorily, however, most palatalizations are very prominent.

Spectrogram of the phrase *state of emergency* with a palatalized [ʋ] (speaker N. G. – male, BBC World, newsreading).
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In both figures above, we can see that the F2 of the frictionless labiodental approximant [ʋ] starts at about 1,500 Hz and moves upwards. Normally, the F2 of a non-palatalized [ʋ] is situated at about 1,000 Hz.

Other voiced sounds, e.g. the nasal consonant /m/, may show specific formant changes during palatalization. For example, whereas the non-palatalized /m/ in Figure 7 has its formants at the frequencies 300 Hz, 950 Hz + 1,050 Hz (a cluster of two formants), 2,100 Hz and 2,900 Hz, plus an antiformant at about 600 Hz, the palatalized /m/ has the formants placed at 300 Hz, 1,500 Hz, 2,100 Hz, and 2,500 Hz, and an antiformant at about 1,200 Hz (cf. Šu – Daniloff – Hammarberg, 1975, p. 255; Fujimura – Erickson, 1999, p. 81–83). Antiformants are marked with arrows.

Figure 6.
Spectrogram of the phrase v januári with a palatalized [ʋ] (speaker L. B. – male, STV, newsreading).

Figure 7.
Spectrogram of the uninterrupted sequence [ʋ:mmːiː] with a palatalized /m/ (in the pronunciation of the author).
Figure 8.
Spectrogram of the phrase novým indickým with a palatalized [m] in the first word
(speaker J. B. – female, Rádio Slovensko, newsreading).

In Figure 8 we see that the final /m/ of the first word has been palatalized, because the placement of the three formants (1,600 Hz, 2,300 Hz and 2,700 Hz) corresponds roughly to the formants in the palatalized /m/ in Figure 7. The absolute formant values of the /m/ in the phrase novým indickým are higher because the speaker is a female.

As far as voiceless consonants are concerned, the general characteristic features of palatalization are either the frequency increase of the fricative energy focus, or the longer duration of the noise component.

Figure 9.
Spectrograms of the syllables [xɨ], [x̂i], and [x̂i] with a palatalized /x/ in the second and third sequence (in the pronunciation of the author).
For example, in the above figure we can see that with increasing palatality of the following vowel, the frequency of the noise focus of the consonant /x/ is split into two, and these two noise foci are moving apart. We can also see that for the sequence /xi/, one noise focus is shifting downwards and it is situated between approximately 2,000 and 6,500 Hz, whereas the other noise focus starts at about 9,000 Hz and continues upwards.

A similar upward shift can be observed for the bursts of plosive consonants when followed by palatal sounds. The following figure demonstrates this phenomenon, i.e. the frequency of the explosion noise focus of [g] is much higher when [g] is followed by /i/. This fact has been demonstrated by a number of studies of English consonants (Brosnahan – Malmberg, 1970, p. 129; Sereno – Lieberman, 1987, p. 250).

![Figure 10. Spectrograms of the syllables [q], [q'Hx1], and [q'Hx2] with a palatalized /g/ in the second and third sequence (in the pronunciation of the author).](image)

![Figure 11. Spectrogram of the phrase attack in a with a palatalized (and affricated) /k/ (speaker A. Y. – male, BBC World, newsreading).](image)
Figures 10 and 11 also demonstrate the influence of palatalization on the length of the noise component – affrication – following the burst. Affrication of velars is expressed by means of the symbol [X]. It is evident that the duration of affrication increases with the degree of palatality. This is indicated by the double-pointed horizontal arrows. Also note that for velars, the advancement ([*]) and palatalization ([j]) are related, i.e. when a velar consonant is advanced it is also palatalized and vice versa.

**A TYPOLOGY OF PALATALIZATION PROCESSES IN ENGLISH AND SLOVAK**

After the brief acoustic analysis of some cases of palatalization, a general overview of the possible cases of the regressive palatalization of consonants in English and Slovak is in order. The speech sounds capable of causing palatalization are [j], [i], and [ːi] (or [ːii]) in English, and [j], [i], and [ːi], and also [ɛ] in Slovak (the Slovak [ɛ] is more palatal than the English [ɛ]).

<table>
<thead>
<tr>
<th>Palatalization in English</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>[p] + [j], [i], or [ːi] → [pʰj] + [j], [i], or [ːi]</td>
<td>keep your, rip it, chip easily</td>
</tr>
<tr>
<td>[b] + [j], [i], or [ːi] → [bʰj] + [j], [i], or [ːi]</td>
<td>bob your, rub it, Bob eats</td>
</tr>
<tr>
<td>[k] + [j], [i], or [ːi] → [kʰj] + [j], [i], or [ːi]</td>
<td>thank you, the lock is, like eating</td>
</tr>
<tr>
<td>[ɡ] + [j], [i], or [ːi] → [ɡʰj] + [j], [i], or [ːi]</td>
<td>rig your, the pig is, big easel</td>
</tr>
<tr>
<td>[f] + [j], [i], or [ːi] → [fʰj] + [j], [i], or [ːi]</td>
<td>tough youth, if it, if Ethan</td>
</tr>
<tr>
<td>[v] or [v] + [j], [i], or [ːi] → [vʰj] or [vʰːi] + [j], [i], or [ːi]</td>
<td>love you, give it, have eaten</td>
</tr>
<tr>
<td>[m] + [j], [i], or [ːi] → [mʰj] + [j], [i], or [ːi]</td>
<td>seem young, Tim is, some easels</td>
</tr>
<tr>
<td>[n] + [j], [i], or [ːi] → [nʰj] + [j], [i], or [ːi]</td>
<td>bring your, the thing is, sing easily</td>
</tr>
<tr>
<td>[h] + [j], [i], or [ːi] → [ʰɛ] + [j], [i], or [ːi]</td>
<td>huge, hit, heel</td>
</tr>
</tbody>
</table>

**Table 1.**

An analysis of regressive palatalizations in English.

<table>
<thead>
<tr>
<th>Palatalization in Slovak</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>[p] + [i], or [ːi] → [pʰi] + [i], or [ːi]</td>
<td>písat, piatok</td>
</tr>
<tr>
<td>[p] + [ɛ] → [pʰɛ] + [ɛ]</td>
<td>pes, pekný</td>
</tr>
<tr>
<td>[b] + [j], [i], or [ːi] → [bʰj] + [j], [i], or [ːi]</td>
<td>chlap jedol/išiel/iskal</td>
</tr>
<tr>
<td>[b] + [ɛ] → [bʰɛ] + [ɛ]</td>
<td>rob ešte</td>
</tr>
</tbody>
</table>
A Typology of palatal assimilations in English and Slovak

<table>
<thead>
<tr>
<th>Rule</th>
<th>English Example</th>
<th>Slovak Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>[k] + [i], or [i:] → [kǐː] + [i], or [i:]</td>
<td>kilo, kývať</td>
<td></td>
</tr>
<tr>
<td>[k] + [ɛ] → [kǐː] + [ɛ]</td>
<td>keby, keramika</td>
<td></td>
</tr>
<tr>
<td>[g] + [i], or [i:] → [gǐː] + [i], or [i:]</td>
<td>vlak jazdí/ide, tak ískal</td>
<td></td>
</tr>
<tr>
<td>[f] + [i], or [i:] → [fǐː] + [i], or [i:]</td>
<td>ak ešte</td>
<td></td>
</tr>
<tr>
<td>[f] + [ɛ] → [fǐː] + [ɛ]</td>
<td>fjord, film</td>
<td></td>
</tr>
<tr>
<td>[v] or [u] + [i], or [i:] → [vǐː] or [vỉː] + [i], or [i:]</td>
<td>Jozef jedol/íšiel/ískal</td>
<td></td>
</tr>
<tr>
<td>[v] or [u] + [ɛ] → [vǐː] or [vỉː] + [ɛ]</td>
<td>gróf ešte</td>
<td></td>
</tr>
<tr>
<td>[m] + [i], or [i:] → [mǐː] + [i], or [i:]</td>
<td>tam je/ide, som Ír</td>
<td></td>
</tr>
<tr>
<td>[m] + [ɛ] → [mǐː] + [ɛ]</td>
<td>som ešte</td>
<td></td>
</tr>
<tr>
<td>[w] or [u] + [i], or [i:] → [wǐː] + [i], or [i:]</td>
<td>sprav jedlo, postav ich, dav Írov</td>
<td></td>
</tr>
<tr>
<td>[w] + [ɛ] → [wǐː] + [ɛ]</td>
<td>otcov experiment</td>
<td></td>
</tr>
<tr>
<td>[x] + [i], or [i:] → [xǐː] + [i], or [i:]</td>
<td>chichot, chýba</td>
<td></td>
</tr>
<tr>
<td>[x] + [ɛ] → [xǐː] + [ɛ]</td>
<td>chémión, chémia</td>
<td></td>
</tr>
<tr>
<td>[y] + [i], or [i:] → [yǐː] + [i], or [i:]</td>
<td>prach je, strach išiel, ich Írsko</td>
<td></td>
</tr>
<tr>
<td>[y] + [ɛ] → [yǐː] + [ɛ]</td>
<td>dvoch elektrikárov</td>
<td></td>
</tr>
<tr>
<td>[f] + [i], or [i:] → [fǐː] + [i], or [i:]</td>
<td>história, hýrič</td>
<td></td>
</tr>
<tr>
<td>[f] + [ɛ] → [fǐː] + [ɛ]</td>
<td>herc, heslo</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.
An analysis of regressive palatalizations in Slovak.

Comparing the tables of palatalization in English and Slovak above, we can see that there are some differences as well as similarities. First of all, the number of consonants that can be palatalized regressively is smaller in English than in Slovak (9 vs. 11). Also, the overall number of the individual cases (possible combinations) is higher in Slovak, because it has one more palatalizing assimilator – [ɛ]. On the other hand, English can combine both voiced and voiceless sounds with the palatalizing assimilators at morpheme boundaries, whereas in Slovak the voiceless assimilees are assimilated into voiced ones in such combinations. Finally, the phonemic inventories of the two languages have some specific segments, e.g. Slovak has [x] (assimilated to [y]), English can combine [ŋ] freely with all possible assimilators, etc. In addition to that, the phonotactic constraints of the two languages differ. All this gives rise to specific sound combinations.

The degree of palatalization has been determined indirectly (and, necessarily, only tentatively) on the basis of the palatality of the assimilators. The assimilators
[j], [i], [iː], and [ɪ], being more palatal than [ɛ], received the degree 2 (with the exception of the English [ɛ̃]), while the assimilator [ɛ] is hypothesized to cause palatalization of the degree 1. Precise and objective determination of these degrees requires establishing rigorous criteria and empirical articulatory (X-ray and EPG) research.

The palatalizations in English and Slovak are usually less prominent auditorily than other types of place assimilations. Nevertheless, we have selected as auditorily prominent those cases, where there are clear acoustic correlates of palatalization, and, in addition to that, the original (lingual) place of articulation is replaced with the palatal tongue body gesture. These cases have been highlighted.

The two tables are focused on regressive palatalization only, but it is certain that there exist also progressive coarticulatory processes, both in English and Slovak. It has been documented in the phonetic literature (Ladefoged, 1967; Bladon – Al-Bamerni, 1976; Ladefoged – Johnson, 2011) that progressive palatalization (and advancement) exists in all languages, but the degree of this assimilatory process may differ from language to language. For example, according to Ladefoged (1967, pp. 62–64), the progressive palatalization of /k/ in the sequence /ik/ is much more prominent in French than in English. In other words, such palatalization has probably been exaggerated and reinterpreted (phonologized) by the French speakers, and now seems to be orthoepically required. In Slovak, impressionistically speaking, such forward assimilations usually tend to be less prominent auditorily, and, to date, no research in this area has been carried out concerning the progressive palatalization (or any other progressive assimilation) of Slovak speech sounds. The aim of this paper has been to find and describe qualitatively the main types and cases of palatal assimilations. Quantitative (statistical) research of these phenomena is beyond the scope of this article.

As far as the palatalization of vowels is concerned, we have shown that there are clear influences of palatal sounds on the formant structure of vowels, but, normally, such formant transitions are not perceived auditorily as prominent – they are perceptually filtered out (neutralized). That is to say, speakers, it would appear, are not usually aware of any dramatic changes in the quality of vowels preceded or followed by palatal sounds.

CONCLUSION

The main aim of this paper has been to give a systematic description of all possible types of (regressive) palatalization found in English and Slovak. The
assimilatory phenomenon of palatalization can be characterized as a process in which a sound without the feature [+palatal] assimilates to a sound with palatal characteristics. It occurs in both English and Slovak, and the mechanisms underlying this process are more or less identical. Nevertheless, the degree and direction of palatalizations in the two languages is not necessarily the same.

Due to specific constraints of sequential combinatoriality and voicing assimilation, different possibilities of combinations are available in Slovak in comparison with English. For example, Slovak has more assimilators (sounds causing assimilation) than English, and, at the same time, it has more possible combinations of consonants with [j], [i], [i:]. On the other hand, since all Slovak voiceless consonants assimilate to voiced ones at the morpheme boundary, some combinations possible in English do not occur in Slovak. Even though palatal assimilations are reasonably well identifiable spectrographically, their perceptual prominence is generally low. The exceptions are fronted velars [k̞̊] and [g̞̊] in both English and Slovak, and [c̞̊] being the most prominent type of palatalization in English.

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**Bibliography**


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Radoslav Pavlík
Katedra anglického jazyka a literatúry
Ústav filologických štúdií PdF
Univerzita Komenského v Bratislave
Račianska 59, 813 34 Bratislava
pavlik@fedu.uniba.sk