Coronal classes and features in Indo-Aryan languages

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1. Introduction

• In this paper I advocate an alternative approach to coronal place features in which all so-called posterior coronals (palatal & retroflex) are distinguished by inherent secondary articulations represented by the feature [±back].
• This is a departure from most standard feature theories in which these coronals are distinguished by the feature [–anterior].
• I survey evidence from Indo-Aryan languages demonstrating that coronals pattern according to 4 natural classes predicted by 2 binary features:
  i. Laminal and apical classes predicted by [±distributed]
  ii. Fronted and retracted classes predicted by [±back]
• Significantly, they do not pattern according to the anterior and posterior classes predicted by the traditional feature [±anterior].
• These points will be demonstrated with evidence from 3 case studies:
  i. Loanword adaptation in Hindi
  ii. Retroflex variation in Nepali
  iii. Palatalization & gemination in Dhivehi

2. Empirical & theoretical background

• Phonological inventories can distinguish up to 4 coronal places of articulation including: dental, alveolar, retroflex, and ‘palatal’ (i.e., some form of laminal postalveolar, either alveo-palatal or palato-alveolar).
• Maximal 4-way coronal systems are common in Australian and some Dravidian languages.
• Standard approaches to feature theory assume two binary features: [±distributed] and [±anterior] as shown in (1) (e.g., Chomsky & Halle 1968, Sagey 1986, Lahiri & Evers 1991, Clements & Hume 1995, and others).
I advocate the ‘secondary articulation’ alternative sketched in (2).

Each feature predicts natural classes:
- [±coronal]: {dental, alveolar, palatal, retroflex} vs. {labial, velar}
- [±distributed]: {dental, palatal} vs. {alveolar, retroflex}
- The standard model predicts the following natural classes:
  - [±anterior]: {dental, alveolar} vs. {palatal, retroflex}
  - If front vowels are [+coronal, –anterior] (e.g., Lahiri & Evers 1991), then they form a natural class with both palatal and retroflex consonants.
- The proposed alternative predicts these natural classes:
  - [±back]: {palatals & front vowels} vs. {retroflex & back vowels}
  - Retroflexes do not form a natural class with palatals or front vowels/glides, and are incompatible with palatalization.

3. Loanword adaptation

Indo-Aryan languages typically have near-maximal systems that include dental, retroflex and palatal articulations (t – ñ – ʃ). In loanword adaptation, the apical alveolar stops of English are adapted as retroflex, not dental. E.g., Hindi (Koshal 1978, Ohala 1978).

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Hindi</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>taxi</td>
<td>/tæksi/</td>
</tr>
<tr>
<td></td>
<td>hotel</td>
<td>/hoʊtɛl/</td>
</tr>
<tr>
<td>d</td>
<td>coat</td>
<td>/kɔt/</td>
</tr>
<tr>
<td></td>
<td>doctor</td>
<td>/dəkɔtɛr/</td>
</tr>
<tr>
<td>d</td>
<td>soda</td>
<td>/soʊda/</td>
</tr>
<tr>
<td>d</td>
<td>pad</td>
<td>/pɛd/</td>
</tr>
</tbody>
</table>
• This pattern also occurs in non-Indo-Aryan languages with similar inventories. Eg., the Dravidian language Telugu (Jagannath 1981).
• Adaptation may be driven by acoustic and/or articulatory similarity.
• Acoustic properties cannot explain the pattern. Retroflexes have a low F3, but dentals & alveolars have “identical” formant transitions. Alveolars are more like dentals than retroflexes (Hamilton 1996: 49, Hamann 2003: 62).
• [±anterior] cannot explain the pattern. It predicts that alveolars are more like dentals because both are [+anterior], while retroflexes are [–anterior].
• Only [±distributed] predicts the pattern. Alveolars and retroflexes are both apical ([–distributed]), but dentals are laminal ([+distributed]).
• Point: Coronals are sensitive to the laminal/apical distinction ([±distributed]), but ignore the anterior/posterior distinction ([±anterior]).

4. Retroflex variation

• Retroflexes are normally described as post-alveolar, but palatographic studies reveal intra-speaker variation conditioned by vocalic context.
• Khatiwada (2007): Retroflex stops in Nepali are apical-alveolar in the context of front vowels, and post-alveolar in the context of back vowels.

  (4) /t/ → [t] / i
          → [t] / u, a

  (5) mi[t]i (nonsense word)
       mu[t]u ‘heart’
       ba[t]a ‘vessel’

• Dixit & Flege (1991): Retroflex stops in Hindi range from dental to post-alveolar. Retroflexion decreases systematically from the context of /a/ to /u/ to /i/. No such variation for dentals (Dixit 1990).
• Same pattern in Australian languages (Evans 1995, Dixon 1980, 2002).
• [±anterior] cannot explain the pattern:
  o If retroflexes are distinctively [–ant], why the variation?
  o If front vowels are [–ant], why do they induce a shift toward [+ant]?
• [±distributed] and [±back] explain the pattern:
  o If retroflexes are distinctively apical ([–dist]), then variation in place is expected and phonologically irrelevant.
o If retroflexes are phonetically [+back], then loss/reduction of retroflexion in the context of [–back] vowels is expected.

- Point: Retroflexes & alveolars form a natural class of apicals ([–dist]). Variation is conditioned by [±back]. No evidence of [±anterior].

5. Palatalization & gemination in Dhivehi (data from Cain & Gair 2000)

- When noun stems ending in /i/ are followed by a vowel-initial suffix:
  a. The vowel coalesces with a preceding segment, causing ‘palatalization’.
  b. The preceding consonant is geminated (i.e., compensatory lengthening).

- Palatalization is manifested in two ways:
  a. If the preceding consonant is labial or velar, palatalization produces an off-glide on the vowel of the preceding syllable (6).

(6) /j/ off-glide with gemination (VCi+V → VjCC+V)

<table>
<thead>
<tr>
<th>Noun</th>
<th>Noun-INDEF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labials</strong></td>
<td></td>
</tr>
<tr>
<td>loobi</td>
<td>loojbb-ek</td>
</tr>
<tr>
<td>aⁿbi</td>
<td>ajmb-ek</td>
</tr>
<tr>
<td>nijami</td>
<td>nijajmm-ek</td>
</tr>
<tr>
<td>kurafi</td>
<td>kurajpp-ek</td>
</tr>
<tr>
<td>avi</td>
<td>ajvv-ek</td>
</tr>
<tr>
<td><strong>Velars</strong></td>
<td></td>
</tr>
<tr>
<td>boki</td>
<td>bojkk-ek</td>
</tr>
<tr>
<td>buraki</td>
<td>buraqkk-ek</td>
</tr>
<tr>
<td>vaagli</td>
<td>vaajgg-ek</td>
</tr>
<tr>
<td>fulaⁿgi</td>
<td>fulajjgg-ek</td>
</tr>
</tbody>
</table>

b. If the consonant is dental, it becomes palatal (7).

(7) Palatalization of dentals with gemination (ti+V → tʃ+V)

<table>
<thead>
<tr>
<th>Dentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>eti</td>
</tr>
<tr>
<td>rodi</td>
</tr>
<tr>
<td>doodi</td>
</tr>
<tr>
<td>fani</td>
</tr>
<tr>
<td>duni</td>
</tr>
<tr>
<td>duuni</td>
</tr>
<tr>
<td>haⁿdi</td>
</tr>
<tr>
<td>fali</td>
</tr>
</tbody>
</table>
• Palatalization and gemination are interdependent: the consonant can only geminate if /i/ vacates its timing slot; /i/ can only vacate its timing slot if it can pass its features to another segment (via palatalization).
• Thus, palatalization & gemination are both blocked if:
  a. The preceding consonant is already geminate (8).

(8) No palatalization or gemination after closed syllables

nappi  nappi-j-ek  ‘bad food’
bimbi  bimbi-j-ek  ‘millet’
batti  batti-j-ek  ‘light’
buddi  buddi-j-ek  ‘mind’
bonti  bonti-j-ek  ‘unopened frond’
kulli  kulli-j-ek  ‘emergency’
dʒinni  dʒinni-j-ek  ‘jinni’
fungi  fungi-j-ek  ‘frond’

b. The preceding consonant is retroflex (impervious to palatalization) (9).

(9) No palatalization or gemination after retroflex consonants

badji  badji-j-ek  ‘gun’
falji  falji-j-ek  ‘slice’
buri  buri-j-ek  ‘tier’

• What do these patterns tell us about natural coronal classes?
• Coronals form a natural class consisting of dentals, palatals, and retroflexes: labials & velars are transparent to palatalization, but coronals are opaque.

(10)  \[\begin{array}{c}
+\text{cor} \\
+\text{cor} \\
+\text{cor}
\end{array}\]

• Dentals & palatals form a class distinct from retroflex: palatals are derived from dentals. This is predicted by \([\pm\text{dist}]\) and reflects the fact that dentals & palatals are laminal, while retroflexes are apical.

(11)  \[\begin{array}{c}
+\text{cor} \\
+\text{cor} \\
+\text{cor}
\end{array}\]
    \[\begin{array}{c}
| \\
| \\
[+\text{dist}] \\
[+\text{dist}] \\
[-\text{dist}]
\end{array}\]
• Palatals & /i/ form a class: the spreading of some feature(s) from /i/ to a dental yields a palatal. Palatals share some feature with /i/, and this feature distinguishes them from dentals (they are dentals plus something).

(12)  

\[
\begin{array}{cccc}
\text{t} & \text{ʃ} & \text{t} & i \\
[+dist] & [+dist] & [-dist] & [+] \\
\end{array}
\]

• The class that includes palatals and front vowels excludes retroflexes: retroflexes resist palatalization.

• In the proposed model, [±back] predicts these natural classes.

(13)  

\[
\begin{array}{cccc}
\text{t} & \text{ʃ} & \text{t} & i \\
[+dist] & [+dist] & [-dist] & [+] \\
\end{array}
\]

• The spreading of [–back] from /i/ to a dental correctly yields a palatal. Retroflexes block palatalization because they are inherently [+back].

• In the standard model, [±anterior] does not predict these classes. [–ant] predicts that retroflexes form a natural class with palatals & front vowels, and that they should be compatible with palatalization.

• Point: coronals in Dhivehi pattern according to the laminal/apical classes predicted by [±dist] and according to the fronted/retracted classes predicted by [±back], but not according to the classes predicted by [±anterior].

6. Secondary palatalization & velarization

• If posterior coronals have inherent secondary articulations represented by [±back], then we predict no contrast between:
  i. velarized vs. non-velarized retroflexes (\text{/t\text{ʃ}\text{y}/} vs. \text{/t/})
  ii. Palatalized vs. non-palatalized palatals (\text{/tʃ\text{ʃ}/} vs. \text{/tʃ/})
• This appears to be borne out: I know of no languages that contrast velarized and non-velarized retroflexes.
• Indo-Aryan languages with secondary palatalization fail to palatalize palatals. E.g., Konkani (Miranda 2003), Kashmiri (Bhat 1987).

    **Konkani** (Miranda 2003):
    o 4-way coronal contrast: ġ – ts – tf – š
    o All obstruents are capable of distinctive secondary palatalization except palatals (*tf).  
    o /tf/ functions as the palatalized counterpart of /ts/. Where phonological patterns predict /ts/, [tf] occurs.

• What about contrast between:
  o Velarized denti-alveolar vs. retroflex (e.g., /tʃ/ vs. /ʈ/)?
  o Palatalized denti-alveolar vs. palatal (e.g., /tʃ/ vs. /ʃ/)?
• Some cases may be different phonetic implementations of the same phonological reality. E.g., variation between velarized and retroflex laterals in the Dardic sub-group of Indo-Aryan (e.g., Heegård & Mørch 2004).
• The phonetic difference between /ʈ/ and /ʃ/ lies more in the timing of the gestures than in the gestures themselves.
• Claim: Any contrast between palatalized denti-alveolars and palatales lies not in the articulatory features (which represent gestures) but in some other aspect of representation responsible for the timing/sequencing of gestures.

7. Conclusion

• Evidence from Indo-Aryan supports the following natural classes:
  a. Laminal articulations: dentals & palatales
  b. Apical articulations: alveolars & retroflexes 
  c. Fronted articulations: palatales & front vowels 
  d. Retracted articulations: retroflexes & back vowels 
• These classes are predicted by the features [±distributed] and [±back] 
• There is little or no evidence for the natural classes predicted by [±anterior].
• Similar facts have been reported in Australian & Dravidian (e.g., Hamilton 1993, Gnanadesikan 1994).
• These conclusions support the proposed alternative to coronal place features in which all so-called posterior coronals (retroflex & palatal) are distinguished by inherent secondary articulations represented by [±back].
References


