Is [+Back] Feature Enough To Distinguish Retroflex Consonants From Other Coronals?

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Abstract

The study presents that retroflex can be non-back and palatalized in Saraiki language. In this article it is claimed that phonologically to assign [+back] feature to retroflex is unsound. It is because retroflex consonants are coronal and only coronal features should be listed. Furthermore, phonetically low F3 is not a distinctive quality of retroflex rather it is context and language dependent. Therefore, instead of using [+back] as a distinctive feature, a feature [+retracted] is used to specify retroflex from other coronals as this feature is common to all retroflex sound.

Keywords: retroflex, non-back, palatalized, F3.

1. Introduction

The Latin word ‘retro+ flectere’ means ‘backward + to bend’ is the derivation of term ‘retroflection’. This word is in effect of articulatory gestures of tongue in the production of these sounds (retroflex). Other sounds such as palatal have fixed active and passive articulators while retroflex segments show a wide range of articulatory variations throughout languages. For that reason, one can notice ‘retroflex’ along with other places of articulations like dental, velar etc, (check, IPA chart). Likewise, phonetically, the place of active articulator for retroflex varies in different studies. The terms like, apical, sub-apical (active articulators) are used to touch the ‘alveolar’, post-alveolar, or pre-palatal (passive articulators) in the production of retroflex. The fact of interest is that all retroflex segments show bending of tongue (apical or sub-apical) as shown below in the figures based on Ladefoged and Maddieson (1996).
Since phonetically, there is no fixed place of articulation for retroflex, but languages can discriminate retroflex in all manners. Hamann (2003), introduced four articulatory properties to define retroflex phonetically;

1) Apicality: the involvement of tongue tip/underside part.
2) Posteriotry: articulation behind the alveolar region.
3) Sub-lingual cavity: a cavity between lower teeth and beneath the tongue.
4) Retraction: retraction of tongue towards back.

Among all, according to her, posteriority is inconsistent and retraction is an essential property to retroflex segments. Whereas, phonologically, Hamann describes four features to represent retroflex consonant, [CORONAL], [-anterior], [-distributed] and [+back]. The feature [+back] distinguished retroflex consonants from rest of the coronal consonants in the literature (Arsenault, 2009; Hamann, 2003; Ohala, 1993). However, Arsenault (2009) claimed that the feature [+anterior] is redundant and unessential to elaborate retroflex sounds. Whilst, in this article I argue that the feature [+back] is superfluous and inappropriate for retroflex consonants. This seems unsound that a CORONAL consonant used a DORSAL feature for distinction while all other coronal consonants have sub-coronal distinct features.

This article is organized as; historical origin of retroflex is elaborated in the next section. After that the phonological representation is given in 3 while phonetic evidences are distended in the second last section and finally Saraiki retroflex are phonetically explained to support the idea.

2. Historical perspective of retroflex consonants and coronal feature
The diachronic development of retroflex consonants shows a wide range of variations, cross linguistically. The worldwide attested sprouting process is the change of anterior coronal into retroflex in the environment of ‘rhotics’ mostly post rhotic. It can be commonly found in Indo-
Aryan, many Australian, Norwegian and Dravidian languages (Hamann, 2003). In these languages (for details see, (Bhat, 1973; Kristoffersen, 2000) the clusters in (a) are realized as retroflex:

(a) /rt/ → [ʈ]
   /rd/ → [ɖ]
   /rs/ → [ʂ]

Another process that is conscientious for the evolution of retroflex is the back vowels as shown below in (b), a process in Dravidian languages,

(b) /t/ → [ʈ] / o, u a

In Indo-Aryan, a most common developmental process of retroflex is the ruki rule ((Bhat, 1973; Maddieson, 1984).

(c) IE s, z → IA ʂ, ž / r, u, k, i ____
    n →ɳ / r, ʂ

Except ‘u’ k’ in the ‘ruki’ situation, the rest of the sounds which caused retroflex are coronal in the above examples. Since from this so called ‘ruki’ rule, no generalization couldn’t derive ever in the literature as these sounds have nothing in common. Nevertheless, in the comparative analysis of the development of retroflex consonants, mostly there is a coronal environment which caused retroflexion. In Indo-European ‘l’ merged or assimilates with dental stops, sibilants and nasals and as a result emerged as an independent retroflex phoneme (refe Boersma).

(d) lt, ls, ln → lʈ, ɭʂ, ɭɳ → /ʈ/, /ʂ/, /ɳ/

Likewise, in Indo-Aryan the retroflex consonants are primarily developed in dental and alveolar environment. Since the synchronic status of consonants had a long history of developmental changes and phonologically these revolutions are results of merger/coalescence or assimilation. Of interest in the development of retroflex consonants is that mostly such historical processes involved COR and results COR;

Coronal +coronal = coronal, i.e., (l+t= ʈ), (l+n= ɳ)
Coronal + velar = coronal, i.e., (s+k= ʂ)
Coronal + back vowel= coronal i.e., (u+t= ʈ)

If we considered the process of assimilation or coalescence in the historical perspective of retroflex consonants, we get coronal features and didn’t get dorsal/ [+back] feature as a result. Even the process of retroflex consonants is very complex yet we can make some generalizations from the above examples. The evidences from Indo-Aryan and Dravidian retroflex suggest that primarily the retroflex consonants are developed from dental and alveolar consonants in the environment of post-liquid, pre-rhotic and post-vocalic/velar. It is interesting to know that all the above historical developments lack the presence of [+back] feature in retroflex consonants. In the section below we will adhere to the phonological presentation of retroflex consonants.
3. **Phonological Representation of Retroflex Consonants**

In the phonological literature there are three main class features to describe the place of segments, LABIAL, CORONAL and DORSAL. Within the main classes, sub-class features are used to distinguish segments. Like for instance, the feature [±distributed] is used to tell apart dentals from alveolar. Such features are the basic unit of any segments and are given in the form of feature geometry by different researchers (for details see, (Chomsky & Halle, 1968; Clements, 1985; Clements & Hume, 1995; Sagey, 1986). In their landmark work, Chomsky and Halle (1968) distinguished six binary features in which three tongue body features [±high], [±low] and [±back] are exclusively used for vowel place features and dorsal consonants. These tongue features have negative redundant values for all consonants except plato-alveoler which has the [+high] feature because of its extensive palatalization. These tongue body features are also used for secondary articulation consonants. For instance, the feature [+back] is used for velarization and velar segments but no other tongue body feature is used to distinguish CORONAL consonants. However, a new coronal feature [±distributed] had used to discriminate Coronal from Labial consonants. The sounds having small stricture in tongue along the direction of airflow are [-distributed] while others which have a considerable restriction against airflow are [+distributed]. The most interesting actuality derived from Chomsky and Halle is that they did not use any redundant feature for retroflex consonants. Coronal consonant’s place features, according to Chomsky’s six binary features are recapitulated as:

<table>
<thead>
<tr>
<th>distinct features</th>
<th>dental</th>
<th>alveolar</th>
<th>retroflex</th>
<th>plato-alveoler</th>
</tr>
</thead>
<tbody>
<tr>
<td>anterior</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>distributed</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>High</td>
<td>-</td>
<td>-</td>
<td>(nill)</td>
<td>+</td>
</tr>
<tr>
<td>Low</td>
<td>-</td>
<td>-</td>
<td>(nill)</td>
<td>-</td>
</tr>
<tr>
<td>Back</td>
<td>-</td>
<td>-</td>
<td>(nill)</td>
<td>-</td>
</tr>
</tbody>
</table>

Gradually, the literature in feature geometry shows developments by introducing one or two new features or places. The feature model of Clements (1985) distinguished features on the basis of laryngeal, supralaryngeal, place and manner. In the same way the feature model given by Sagey (1986) also presented three distinctive place features and specified [±back] along with [±low] and [±high] for dorsal consonants and primarily for vowels only. Sagey introduced non-terminal and terminal nodes of place features for better place division. Later on, it is suggested that vowels and consonants share a unary place feature (Clements, 1990; Lahiri & Evers, 1991). According to them the Labial consonant feature is shared with rounded vowels, coronal consonants share coronal feature with front vowels and back vowels share dorsal feature with dorsal consonants. The purpose to share such features is to overcome the repetitions of same features, nonetheless, [±back] feature never used for coronal consonants. Lahari and Evers
(1991) introduced another sub-coronal feature [±strident] to make fricatives distinct from rest of the coronals.

![Place feature diagram]

The feature strident introduced for fricatives and distributed for laminal sounds while dentals and alveolar are specified for anterior. Even so in a few studies (Boersma & Hamann, 2005; Hamann, 2003; Lin, 1989) retroflex are assigned [+back] for the reason that in some historical context dental-alveolar emerged as retroflex before back vowel (as given above). Since the theory of under-specification recommends that only contrastive features should be listed to represent a sound. Yet the [±strident] feature is prominent feature of fricative sounds; this feature is introduced to them due to their turbulence noise and is enough to distinguish fricatives from other sounds. The apical sounds involved dental and alveolar have [+anterior] feature. In view of the fact the [+distributed] is used for laminal (dental and plato-alveolers) consonants. Up till now, the problem holds for retroflex in these circumstances, which prominent feature discriminates ‘retroflex’ to other alveolar sounds? Is [+back] feature enough contrastively for retroflex sounds, as stated in literature? Importantly, here, the sounds discussed are COR and only COR place features (anterior, distributed and strident) are logically accepted for discrimination. On the other hand, the [±back] feature is specified for DOR and back vowels only. How studies justified assigning [±back] feature to retroflex, is given in the next section.

4. **Phonetic evidences to assign [+back] feature to retroflex**

Phonetically, the retraction is the backing of the tongue body (Bhat, 1974) which takes place in the vocal tract towards velum or pharynx. In the meanwhile, the sounds which use pharynx and velum in their place of articulation are referred to pharyngealization (Ladefoged et al., 1996) and velarization (Trask, 1996) respectively. It seems that the tongue body retraction involves both pharyngealization and velarization. There is little difference between velarized and pharyngealized sounds that’s why no language differentiates them (Ladefoged, 1971). Since the term ‘velarization’ itself is the tongue back’s elevation towards soft palate or pharynx. However, the term retraction (for retroflex only) is not explicitly explained in the literature. According to (Hamann, 2002) retraction correlates with the displacement of tongue dorsum towards velum (she used the word displacement instead of backing or retracting) and due to this tongue gesture [+back] feature is assigned to retroflex. On the other hand, retroflex are linked with bending of apical or sub-apical part of tongue as obvious by the term itself (see above) and therefore, coronal features are associated to them. In this situation, one can feel oneself in trouble to which class-features the
retroflex actually belong. Hence, first we need to fix that which part of tongue is responsible to distribute features to retroflex. If the elevation of back of the tongue is the criterion to judge the retroflex and assign features than the rest of coronal features seem redundant and irrelevant, as for example, all velar sounds and back vowels do. Nevertheless, in the previous studies, this is not the situation but rather mostly the coronal place features are used to explain retroflex along with [+back] feature.

The interesting fact is that retraction of tongue body is not specified to retroflex rather it is associated with other apical alveolar sounds too (Bhat, 1974). Though such arguments are criticized in the literature, like for instance, Stevens et al. (1986), proposed that apical alveolar are better produced by fronting or non-backed tongue body (no dorsum retracting) position. Likewise, Hamann (2003) claimed that although retraction is not sufficient criteria to judge retroflex but it is an important characteristic to denote them. Thus, we can say that retraction is an enough criterion to differentiate retroflex. However, the purpose to discuss all these points of views is to make the idea clear that which phonetic property employs retroflex to make it compatible with back feature? If phonetically, rise of tongue root is decisive property then the retroflex should be dorsal rather than coronal as discussed before. Taking into account Bhat’s argument of tongue retraction for both apical and retroflex, it would be admitted that both these (apical alveolar and retroflex) sounds do have retraction but their nature of retraction slightly differs. The implication given below indicates the increase of retraction of tongue root (though we don’t have any sagittal X-ray to phonetically proof this\(^1\) but with the help of scale we can clearly indicates the difference of tongue root),

\[ \text{sub-apical} \quad \rightarrow \quad \text{Apical} \quad \rightarrow \quad \text{retroflex} \]

The apical and sub-apical non-retracted sounds produced by flatting the tongue dorsum and slightly rising the tongue root, whereas, the tongue gesture for retroflex varies from apical to sub apical. If the apical part is retracted (like in Hindi retroflex) the tongue root rises relatively up from the apical non-retracted sounds. Contrary, the retroflex produced by sub-apical (like in Tamil) shows relatively less elevation of tongue root and extra lowering the dorsum. This little tongue root elevation makes question for sub-apical retroflex to have [+back] feature.

However, in reality, this is not the case to differentiate retroflex from other coronals. The difference in tongue root elevation involves the muscular efforts to pull the tongue tip forward and retract. The apical non retracted sounds need relatively less force while fronting the tongue and curling of tongue tip in retroflex requires more muscular efforts to involve more front part of the tongue. It is very fascinating to know that the actual trigger to tongue root elevation is the retraction of apical part of the tongue.

Therefore, the above discussion makes the idea clear that the involvement or rising of tongue root is not the basic notion to assign [+back] feature to retroflex but rather it’s all about the fronting of the tongue. Therefore, all those features which are associated to front part (i.e. coronal) should be

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\(^1\) The above given sagittal X-ray from Ladefoged indicates the involvement of different parts of tongue i.e.apical and sub-apical)
listed to represent retroflex. In order to further clarify whether fronting is the key part to assign features, we take into account the Saraiki retroflex in the next section.

Retroflex in Saraiki language
Saraiki is the Indo-Aryan language spoken in Pakistan (Atta et al., 2020; Bashir et al., 2019; Shackle, 1976). Mostly, the Saraiki speaking population resides in southern Punjab. With the four-way laryngeal contrast the language is rich in phonemic inventory. The uniqueness of the language is four implosive and 8 retroflex consonants (Atta, 2019). The aspiration and breathy voiced consonants have phonemic contrast in Saraiki. Likewise, all the retroflex have aspirated phonemic contrast as indicated below with different manners:

<table>
<thead>
<tr>
<th>MANNER</th>
<th>RETROFLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>ʈ, ʈʰ, ɖ, ɖʰ</td>
</tr>
<tr>
<td>nasal</td>
<td>ɳ, ɳʰ</td>
</tr>
<tr>
<td>tap or flap</td>
<td>ʈ, ʈʰ</td>
</tr>
</tbody>
</table>

Like Hindi, the retroflex consonants in Saraiki are apical2 which means they need relatively less force to produce, as discussed before. The tip of tongue in apical retroflex is slightly bended as compared to the retroflex sounds produced by sub-apical. The apical sounds are relatively close to alveolar than palatal. Here, importantly, it is crucial to keep in mind that in Saraiki, palatalization is a common phenomenon and it is triggered by front vowels and high vocoids (especially j). The examples in (1) indicate the palatalization in Saraiki:

(1) /kas/  ‘tight’  kas+i—a~kas>i a
/kali/  ‘black’  kali+a~kal>a
/suçi/  ‘slept’  suçi+a~ suçi>a
/kəni/  ‘egde’  kəni+a~ kəni>a

The process of palatalization is so extensive in Saraiki that all retroflex consonants seem compatible to it. The below examples in (2) show Saraiki retroflex-palatalization:

(2) /sat/  ‘throw’  sat+i—a~ sat>i a
/katʰ/  ‘gather’  katʰ+i—a~ katʰ>i a
/kədʰ/  ‘out’  kədʰ+i—a~ kədʰ>i a
/ɖuçi/  ‘dwarf’  ɖuçi+ a~ ɖuçi>a
/rət/  ‘cry’  rət+i—a~ rət>i a

2 Being a native speaker of Saraiki, the author can better realize that which apart of tongue is involved in the production of retroflex consonants.
In the above examples, it is very much clear that all coronals including retroflex are palatalized in a same context. Although, phonetically Hamann (2004) claimed that retroflex are incompatible for palatalization but in Saraiki, Kashmiri (Bhat, 1987) and Toda (Spajić et al., 1996) the phenomenon is frequently observed. The process of palatalization involves CORONALS and [+high] features whereas other DORSAL features are not involved. So, it can be confirmed that retroflex are the part of coronal sounds and any dorsal feature couldn’t be used as a distinctive feature. Now the question is which coronal feature do we use contrastively for retroflex, if dorsal features are incompatible? We account Saraiki retroflex phonetically.

As given above Saraiki retroflex are divided into two classes, we take a comparative analysis of retroflex and dental stop for phonetic analysis. From stops series, let’s take voiceless unaspirated retroflex /ʈ/ and dental /ʈ/ and sonorant retroflex /ɽ/ and alveolar /ɿ/. In the literature, it is claimed that the formant trajectories of adjacent vowels of retroflex consonants might be lower than that of non-retroflex sounds (Hussain, 2018) and this is one of the phonetic reasons to assign [+back] feature to retroflex. In order to confirm this, we take into account the formant values of preceding and following vowels of Saraiki retroflex. Three peripheral vowels (a, i, u) are targeted for this. Stimuli pairs for following vowels for stop retroflex and dental are;

\[
\begin{align*}
(i) & /kiṭa/ \quad ‘bald M’, & /kiṭa/ \quad ‘did’ \\
& /kiṭi/ \quad ‘bald F’ & /kiṭi/ \quad ‘she did’ \\
& /kiṭu/ \quad ‘you bald’ & /ṭu/ \quad ‘you’ \\
\end{align*}
\]

Since formant transitions are particularly used to discriminate place in research (Halle et al., 1957; Iskarous et al., 2010). The most important phonetic cue of retroflex consonant is the lowering of F3 in preceding vowels (Hamann, 2003; Hamilton, 1996). It is because retroflex are located more towards palatal/ posterior which lengthened the front cavity and shortened the back cavity. Therefore, lowering F3 is noted in retroflex and alveolars show raising F2. Apart from place discerning, the lowering third formant of adjusting vowel is also used to assign [+back] feature to retroflex to distinguish from other coronals. The stimuli in (i) are recorded by a forty-year Saraiki native speaker and each stimulus repeated thrice. The mean formant values of F2 and F3 are given in the table below to note the difference between retroflex~dental/alveolar.

### Retroflex Stops/dental following ‘a,i,u,’ vowels

<table>
<thead>
<tr>
<th>Formants</th>
<th>Retroflex ‘a’</th>
<th>Dental ‘a’</th>
<th>Retroflex ‘i’</th>
<th>Dental ‘i’</th>
<th>Retroflex ‘u’</th>
<th>Dental ‘u’</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>2226</td>
<td>2402</td>
<td>2551</td>
<td>2006</td>
<td>2164</td>
<td>1641</td>
</tr>
<tr>
<td>F3</td>
<td>3343</td>
<td>3107</td>
<td>3125</td>
<td>3231</td>
<td>2805</td>
<td>3201</td>
</tr>
</tbody>
</table>

F2 < F2
F3 > F3
F2 > F2
F3 < F3
F3 < F3
In the table above the formant values of F2 and F3 of dental/alveolar following front and back vowels are high than that of retroflex. However, retroflex following low vowel shows low F2 and high third formant values than that of its dental counterpart. If we consider the lowering F3 of the following vowels as a phonetic cue of retroflex the third formant values of ‘a’ doesn’t follow the same pattern. Likewise, if raising of the F2 for dental is considered as one of the phonetic cues, again the F2 values of ‘a’ isn’t tailback. Therefore, we couldn’t assume any generalization for retroflex stops in the context of following vowels while taking into account the values of two (F1 & F2) formants. In the next table, we consider the formant values of preceding vowels from the following stimuli:

<table>
<thead>
<tr>
<th>Formants</th>
<th>‘a’ retroflex</th>
<th>‘a’ dental</th>
<th>‘i’ retroflex</th>
<th>‘i’ dental</th>
<th>‘u’ retroflex</th>
<th>‘u’ dentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>1479</td>
<td>1303</td>
<td>2320</td>
<td>1055</td>
<td>1211</td>
<td>1161</td>
</tr>
<tr>
<td>F3</td>
<td>2842</td>
<td>2786</td>
<td>3392</td>
<td>2288</td>
<td>2570</td>
<td>2422</td>
</tr>
</tbody>
</table>

The results of the preceding vowels show the consistency of the F2 and F3 values as given in table (2). All the preceding vowels of retroflex show high values of F2 and F3. Because of this uniform behavior, a generalization for stops retroflex identity in the context of preceding vowel is borne out. The high values of F2 and F3 in the preceding vowels of retroflex can be assumed as phonetic cues in Saraiki. Let’s take a look at sonorant retroflex and non-retroflex to confirm this assumption. Following stimuli were recorded for sonorants:

<table>
<thead>
<tr>
<th>/ʊɾa/</th>
<th>‘you’</th>
<th>/tʊɾa/</th>
<th>‘swimmer’</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ʊɾi/</td>
<td>‘you’</td>
<td>/tʊɾi/</td>
<td>‘swimmer’</td>
</tr>
<tr>
<td>/ʊɾu/</td>
<td>‘stubborn’</td>
<td>/tʊɾu/</td>
<td>‘swimmer’</td>
</tr>
</tbody>
</table>
Sonorants retroflex/ non-retroflex following ‘a,i,u,’ vowels

<table>
<thead>
<tr>
<th>Formants</th>
<th>retroflex ‘a’</th>
<th>alveolar ‘a’</th>
<th>retroflex ‘i’</th>
<th>alveolar ‘i’</th>
<th>retroflex ‘u’</th>
<th>alveolar ‘u’</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>1480</td>
<td>1285</td>
<td>1765</td>
<td>1462</td>
<td>1312</td>
<td>1345</td>
</tr>
<tr>
<td>F3</td>
<td>2554</td>
<td>2767</td>
<td>2561</td>
<td>2758</td>
<td>1422</td>
<td>2581</td>
</tr>
<tr>
<td>F2 &gt; F2</td>
<td>F2 &gt; F2</td>
<td>F2 &lt; F2</td>
<td>F2 &lt; F2</td>
<td>F2 &lt; F2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In case of sonorant retroflex the low F3 values are consistently observed from its counterpart sonorant non-retroflex. The vowels ‘a’ and ‘i’ have high F2 while the back vowel ‘u’ has low F2 when followed by retroflex. However, this difference (1322-1345) is not much significant on the basis of which we can assign a distinctive quality to a sound. Therefore, it can be assumed that sonorant retroflex has low F3 and high/equal F2 values as compared to their non-retroflex counterpart in the context of following vowels. In order to confirm whether the preceding vowels of sonorant retroflex and non-retroflex follow the same results, we used following stimuli:

'/pi:r/' ‘saint’    /pi:t/ ‘pain’
'/par/' ‘across’   /pa:t/ ‘root’
'/pur/' ‘revenge’  /tu:t/ ‘antidot’

Preceding ‘a, i, u’ for sonorant retroflex and non-retroflex

<table>
<thead>
<tr>
<th>Formants</th>
<th>‘a’ retroflex</th>
<th>‘a’ alveolar</th>
<th>‘i’ retroflex</th>
<th>‘i’ alveolar</th>
<th>‘u’ retroflex</th>
<th>‘u’ alveolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>1104</td>
<td>1012</td>
<td>1902</td>
<td>1938</td>
<td>922</td>
<td>2572</td>
</tr>
<tr>
<td>F3</td>
<td>2714</td>
<td>2748</td>
<td>2214</td>
<td>2741</td>
<td>2712</td>
<td>2880</td>
</tr>
<tr>
<td>F2 &gt; F2</td>
<td>F2 &lt; F2</td>
<td>F2 &lt; F2</td>
<td>F2 &lt; F2</td>
<td>F2 &lt; F2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td>F3 &lt; F3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Like vowels, following sonorant retroflex, the formant values of F3 of preceding vowels are low but the finding of second formant values are inconsistency. Therefore, in the case of sonorant retroflex the lowering F3 is consistently observed to distinguish retroflex.

The Saraiki retroflex from the above analysis, shows inconsistent values of first two formants. The formant values of retroflex stops following/ preceding vowels show variations in their first two formant values. Even the phonetic cues of obstruent and sonorant retroflex are not same in Saraiki while in the literature stops and sonorants are differentiated because of their low F3 values and fricatives retroflex have different phonetic cues from stops and sonorants (for details see, (Hamann, 2003; Zygis & Hamann, 2003). Though phonetically, the lower formant values of F3 and F2 are the quality of retroflex stops and sonorants but it could only be realized in the presence of COR feature (Stevens & Keyser, 1989) and in the particular environment of vowel (i.e., in the presence of ‘a’). However, in Saraiki, the lower formant values of sonorants are consistently observed but
stops show variations repetitively. The most interesting fact is that higher values of F3 in stops preceding vowels is the phonetic robust in Saraiki.

Though the raising and constriction of tip tongue can affect the third formant but in Saraiki, this affect only realized in sonorant retroflex. In addition, there is a controversy at the status of formant frequencies of F2 and F3 in literature, in Hindi, retroflex stops show convergence of F2 and F3 (Ohala, 1993) while in Malayalam nasals and stops retroflex are distinguished from other manners by a low F2 (Dart & Nihalani, 1999). Keeping in view all these facts of not supporting the claim of lowering F3 for retroflex, we cannot come up with one conclusion. If retroflex stops, sonorants, fricatives and other manners have different phonetic cues then how a single cue of low F3 can be considered the only distinctive property. In order to assign a distinctive characteristic to retroflex, there are two possibilities, either all these have same phonetic cues or they have same phonological association. So, for the phonetic cues, the existing literature and Saraiki data do not support the same generalization and not a phonological association (means place of active and passive articulation) either. Therefore, in order to assign a universal and unique characteristic, the term itself might be used to distinctive retroflex from other coronals. So, the term ‘retraction’ is the only physical property that is common in all retroflex sounds. As the trigger of this retraction is the tip of the tongue, therefore, the feature ‘retraction’ should be listed with other coronal sub-features as indicated below:

Coronal
[± retraction ± strident, ±anterior, ±distributed]

This is obvious from this study and existing literature that phonetic feature of retroflex is mostly language-dependent and different manners have different phonetic cues therefore, cannot be oversimplified in a general way. Correspondingly, [+back] feature is not consistent to all manners or retroflex in most of the languages, like in Australian aboriginal language Lardil, retroflex supposed to have [-back] (Hall, 1997, 2000). In order to further continue this claim and associates [+back] feature with retroflex, needs a corpus study on phonetics and phonological grounds.

REFERENCES


