CHAPTER III

NASALIZATION IN GUJARATI

anusvāro vyañjanam vā svaro vā.
sakaścid svaradharmān gṛhṇati,
kāścid vyañjanadharmān.

(Uvaṭa : RP.I.5)

Nasalization in Gujarati

3.0 Introduction

This Chapter tries to study the issue of nasalization in Gujarati. Turner and Bloch have noted that "from the earliest time" there was a "tendency to pronounce vowels with the velum incompletely raised" or with the "relaxed velum". This resulted in nasalization of vowels in IA.[1] Apart from such a tendency Bloch notes that the general nature of IA is more conducive to nasal vowels. He attributes this nasality in vowels "to the fact that the nasal resonance innate in vowels asserts itself in favourable circumstances and particularly in connexion with long vowels and 'a'".[2] The nasals in Pali such as 'ghamsati', 'hamsati' (ghars, hars-) and in prākṛt such as 'amsu' (asru-) 'pamkhi' (paksin) etc, indicate the relaxed state of velum in the history of IA. Gujarati certainly conforms to this tendency and we are disinclined to agree with Turner when he says that "in Gujarati this tendency to nasalize though present, is less in evidence than in other MI languages."[3] Out of the examples of nasalization given by him two are doubtful as they have either '$\tilde{V}$ + consonant' sequence or 'V + N + consonant' sequence dialectally.

Turner: māgwũ D_1: [mãgwũ] D_2: [maŋgwũ]

mādʒwũ D_1: [mãdʒwũ] D_3: [maɲdʒwũ]

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[1] Turner, 1975, p. 99, Bloch, 1965, p. 49.

[2] Bloch, 1965, p. 49.

[3] Turner, 1975, p. 99.

His other examples are non-nasalized in Marathi too.

Gujarati	Marathi
sāp	sāp
kākdi	kākdi
ōth	ōth
ūbhũ	ubhe (transcribed as in Turner)

In fact there are many words where Gujarati has nasalized vowels and Marathi has non-nasalized ones:

Gujarati		Marathi
[kãʈo]	'thorn'	[kaʈa]
[dãt]	'tooth'	[dat]
[vãkũ]	'bent'	[vakɖe]
[sãkəl]	'chain'	[sakʰəl]
[ʈãki]	'tank'	[ʈaki]
[pãtʃ]	'five'	[pats]
[tʃãpo]	'flower'	[tsapʰa]
[kʰãtʃo]	'corner'	[kʰatsa]
[ɖãs]	'mosquito'	[ɖas]
[gãʈʰ]	'knot'	[gaʈʰ]
[vãtʃwũ]	'to read'	[vatsɳe]
[ɦãkwũ]	'to drive'	[hakɳe]

Many more words of this type could be listed. Moreover, where Marathi has 'N + C' sequence Gujarati has 'N-loss nasalization'.

Gujarati		Marathi
[ũʈ]	'camel'	[uʈʰə]
[pãkʰ]	'wing'	[pəŋkʰə]
[ãk]	'number'	[əŋkə]
[ũtʃũ]	'high/tall'	[unʈsə]
[tʃʰĩk]	'sneeze'	[ʃiŋkə]
[bʱĩt]	'wall'	[bʱintə]
[sũʈʰ]	'ginger'	[sunʈʰə]
[vĩtʃʰi]	'scorpion'	[vintsʰu]

It is not clear on what basis Turner finds nasalization less evident in Gujarati. More evidence can also be produced from Bengali to disprove Turner.

Gujarati		Bengali
[ãk]	'number'	[ak]
[sãkəl]	'chain'	[ʃikəl]
[sãtʃwũ]	'to collect'	[ʃatʃan]
[mãtʃɖo]	'platform'	[maʈʃa]

As nasalization of vowels in Gujarati is a crucial issue, it would be worthwhile to go through the ancient as well as modern approaches to the phonetics of nasality.

3.1 Views of ancient Indian treatises:

Phonetically nasality is an interesting process. Bloch has drawn attention to the innate nasal resonance of vowels. The various obstructions in the oral cavity required for the production of consonants help to control the lowering of the velum, but there being no obstruction in the oral cavity for

vowels there is a possibility of the velum being relaxed and in such unconsciously relaxed position of the velum a little air may escape through the nasal passage. This feature of vowels may get a predominant manifestation in some dialects/ languages. At MI stage there are various indications that the equivalence of long vowel was nasalized vowel in the vicinity of a sibilant, r and l, (i.e. non-occlusive consonants). RP suggests nasality in the first eight vowels when they are in the final position (avasāne) and when they are unchangeable (apragṛhya) I:63. RP quotes śākala's view that vowel 'u' is prone to nasalization.[4] Pāṇini recommends nasalization to 'a: ,i,u' when at the end of a sentence. The most interesting comment made by Bloch is: "these exceptional facts are of interest as confirming the tendency of the velum to relax resulting in nasalization of long vowels and in certain endings, even of short vowels as the most important consequence."[5] The treatises describe nasal sound as 'nāsikya' or 'anunāsikya.' Except TP all other prātiśākhyas accept that nose and mouth both are involved for nasal sounds.[6] For these sounds RP uses the term 'rakta'.[7] Allen quotes from sarvasammata śikṣa the picturesque description of such

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[4] See also, AP, I, 72. ukārasyetāvaprktasya.
VP, IV, 73. ukāro'prkte dīrghamanunāsikam.

[5] Bloch, 1965, p. 49.

[6] TP, II, 52. nāsikāvivaranādānunāsikyam.

[7] RP, I, 36. raktasamjño'nunāsikaḥ

nasality in the vowels uttered by women of Saurashtra.[8] This is perhaps the only clear reference to regional speech habits. Having noted this innate nasal resonance our treatises have referred to coarticulatory nasalization in the vowels and the assimilation of nasals to the following stops (homorganicity). Before classifying these references it is essential to note one complicated nasalization process of Sanskrit called 'anusvār' (ṁ, ṃ). It was restricted to post vocalic position, before fricatives, 'l' and glides. As Allen has said the phonetic value of this feature is difficult to decide. Especially, 'ṁ, ṃ' before fricatives, 'l' and glides have created difficulties in solving nasalization issues in NIA languages. The theoretical suggestion of considering anusvār as the nasalized fricative may not be so acceptable as its behaviour is complicated. When it is followed by 'l' and glides the duplication of 'l' and glides is recommended.[9] The nasalization of this anusvār creates a diphthongal element by joining with the preceding vowel i.e. vowel + nasalized anusvār + the duplicated 'l' or glides gives $\tilde{V}$: + duplicated 'l' or glides. The anusvār turns into a nasalized sonorant

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8 Allen, 1953, p. 40 kāṁsya-dhvani samam raṅgam hṛdayādutthitaṁ bhavet, yathā saurastrikā nāri takrāṁ4 ity abhibhāṣate| evaṁ raṅgāḥ prayoktavyāḥ.

9 RP, IV, 7 antasthāsu rephavarjaṁ parāsu
tāṁ tāṁ padādisv anunāsikāṁ tu.
8 tathā nakāra udaye lakāre

TP, V,25 laparau lakāram.
26 nakāro 'nunāsikam.
28 antasthāparaś ca savarnamanunāsikam.

and perceptibly results into 'ũ' when followed by fricatives i.e. vowel + nasalized anusvār + fricative gives Ṽ + ũ + fricative. RP compares the union of 'a' and anusvār with 'ai/au', thus implying that 'aṃ' resembles diphthong.[10] It is also suggested that even when anusvār is followed by 'l' or glides, along with the duplication of 'l' or glides anusvār turns into 'ũ'. All these observations show that anusvār in Sanskrit had a very crucial role (i) in spilling the nasalization on the preceding vowel and (ii) in itself becoming a nasalized vowel 'ũ'.

Anusvār turning into 'ũ' asks for a little diversion. It is noted that 'u' vowel is prone to nasalization. The oral cavity opening is minimal for 'u'. 'm', the bilabial nasal occlusive and nasalized 'ũ' vowel have very close substitutable neighbourly positions in the mouth. In Kibena (Africa-Tanzania) when the word begins with the 'labial nasal + labial stop' ([✱ mb-]) sequence the nasal becomes syllabic and the phonetic product of the same will be [✱^{u}mb-] when the sequence is [✱ŋg-] the phonetic result is [✱^{ə}ŋg-] (here 'ə' is the back short vowel) and when the sequence is [✱ nd-] the result is [✱$^{+}$nd-] . The associated vowels with these sequences indicate that

(i) articulatorily they have a close relationship with the respective nasals.

(ii) the innate sonority in nasals can result into syllabicity which in turn may result into nasalized vowels.

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10 RP, XIII, 41 hrasvānusvāravyatisaṅgavatpare.

Hence, there are two innate processes.

(a) where innate nasal resonance of vowels may result into 'V + N' as one of its developmental possibilities: e.g.

Sanskrit	Marathi
utʃ tʃə	untsə
usʈ̺rə	unʈ̺ə

(b) where innate sonority of nasals may result into a syllabic nasal and that in turn may result into a nasalized vowel e.g.

səm+vad

sə̃+ᵘvad

sə̃ũvad

sə̃ũvad

Such phonetic processes (which are bāhya-prayatna), play a very important role in modifying the segmental sounds. Nasalization in Gujarati though initiated by a segment, spreads over the sequence like murmur. But the differences between murmur phenomenon and nasalization phenomenon are like this:

Nasalization:

(1) Besides the nasalization in indigenous words there is nasalization which results from the diachronic N-loss i.e. sound change.

(2) The N-loss-'anusvār' deletion - (before fricatives, 'l' and glides) recommended by prātiśākhyas is carried over in various different ways in other NIA languages too (besides Gujarati).

(3) Nasalization is common to all the dialects of Gujarati.

Murmur

(1) It is not the result of a sound change.

(2) Though voiced 'ɦ' spilling 'breathy voice' is a natural phonetic consequence found in most NIA languages it does not result into murmur prosody in other languages as it does in Gujarati.

(3) Murmur is restricted only to some dialects of Gujarati.

After this diversion we come back to the issue of coarticulation. RP[11] in the chapter on faulty pronunciation condemns the habit of nasalizing the vowels when adjacent to nasal sounds. What the prātiśākhyas feared in Sanskrit is a natural phonetic possibility and that can happen in any language. They have indicated all the possible contexts of nasality spread.[12] RP particularly mentions that the stop sound decidedly becomes a nasal stop when followed by a nasal stop.[13] TP notes views of various scholars regarding the degree of nasality. RP recommends 'heaviness' in vowels when followed by the anusvāra.[14] Allen has quoted Sweet's remarks with regard to Latin where "m before the hisses and semivowels represented a nasal lengthening of the preceding vowel".[15]

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[11] RP, XIV, 56, raktai rāgaḥ samavāye svarāṇam na
nūnam nṛmnam nṛmaṇā nṛbhirnṝn

[12] TP, X, 11, anunāsike anunāsikam
AP, I, 69, anunāsikasya ca pūrvenaikādeśe.

[13] RP, VI, 41, nāsikāsthānamanunāsikāccet.

[14] RP, I, 21, tathetareṣām samyogānusvārparāṇiyāni.

[15] Allen, 1953, P.42.

The lengthening of the vowel was for maintaining the syllabic quantitative pattern. The commentators of TP clearly recommend such length.[16] Nasal consonant causing nasality in vowel and in turn vowel getting lengthened was also noted by all the treatises:

(i) V + N

(ii) $\tilde{V}$ + N

(iii) $\tilde{V}$: + N

They also unanimously refer to assimilative sequences such as 'N + C'; if nasal is followed by the stop consonant it becomes the last of the class of the following stop.[17] They seem to have forbidden such homorganicity when nasal is followed by fricatives. The reason for this might be that:

(i) there exists homorganic nasals to each stop class: vargavaccaisu (T.P.II.51).

(ii) between the 'nasal + stop' sequence there is a smooth assimilativeness as there is 'dependency' relation between the components. RP cites a scholar who puts the voicedness of 'akāra' and nasality together saying that just as the 'a' vowel generates voicedness in the sonant sounds the anusvār generates voicedness in nasal consonants.[18]

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16 TP, XXII, 14, sānunāsikam yadaksaram uktāni etāni, sarvāni aksarāni gurūni vidyāt jānīyāt (from Somyārya and Gārgya's commentry).

17 RP, IV, 6, visthāne spars'a udaye makārah sarvesāmevodayasyottamam svam.
TP, V, 27, makāraspars'aparastasya sasthānamanunāsikam.

18 RP, XIII, 15, āhurghosam ghosavatāmakārameke 'nusvāra— manunāsikanam' 'anusvārah svasthānādāgatya ghosatvam janayatīti (commentry)

e.g. N + C

i.e. V + C

C (V)

In Gujarati səm+tulən

(i) N → V + C

b → C (dental)

(bilabial)

(ii) V + C

C dental

dental

bilabialness of the occlusion of nasal, changes to dentalness by assimilation of components.

(iii) n + t

i.e. [səntulən]

(iii) There being less of such dependency relation between the nasal and the other sounds besides stops (i.e. fricatives, 'l', glides etc.) homorganicity is not probable. However, Gujarati dialectally shows such homorganicity

e.g. [vəɲʃ] 'lineage'

[kəns] 'a name'.

The ancient scholars were perhaps aware of the flexible nature of this 'nasal' i.e. anusvāra, which in the context of non-occlusives would leave its consonantal component and make its syllabic component prominent. That is why RP and VP consider this anusvār as either a consonant or a vowel.[19,20]

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[19] RP, I. 5, anusvāro vyañjanam vā svaro vā.

sa kāṅscidsvaradharmān gṛhnāti,

kāṅscid vyañjana dharmān. (from uvaṭa's commentry).

[20] VP, III, 132, 133 svara aupaśavih

anusvarena vyañjana.

Allen has noted Pāṇini's optional use of 'ṃ' in places where earlier treatises recommend homorganic nasal. Such alternative choice might be indicative of these existing dialects. Hence, it is not at all surprising to find variations in the nasality manifestations in NIA languages.

Summing up the views of treatises one can say that:

(1) vowels have innate nasal resonance which shows up in appropriate environment. The innate resonance should be differentiated from the coarticulatory nasalization of vowels.

(2) coarticulatory nasalization can be the assimilative function of adjacent nasal consonant which nasalizes the vowel. The other type of coarticulatory nasalization is the result of sequential behaviour of sounds i.e. in a sequence 'V + N + continuant', 'N' is turned into a nasalized vowel spilling its nasalization to the previous vowel; thus creating a nasalized sequence of vowels.

(3) the nasalized vowels are lengthened.

(4) the nasal is assimilated to the following stop consonant.

(5) the nasal has its innate sonority to help to bring out its possible syllabicity.

3.2. Modern phonetic views

Our treatises have concentrated on the contextual behaviour of the nasal element but they don't describe the production of nasal sounds. Modern phonetics is more clear

about this aspect. Although there are many disagreements amongst the researchers as to which organs are the most active ones in velo-pharyngeal closure, it is agreed upon that "normal velopharyngeal closure for speech involves two components. One is the displacement of the velum posteriorly and superiorly against the posterior pharyngeal wall. The other is movement of tori-tubari and the salpingo pharyngeal folds medially and posteriorly against the sides of the velum.[21] Bjork and Nylen agree that there is a backward and upward movement of the soft palate.[22] Some researchers have correlated pharyngeal movement with different parameters. Harrington correlated it with vowel height and found that high vowels had greater inward movement than low vowels.[23] Bell Berti took EMG readings and concluded that pharyngeal wall activity increased for the low vowels in most of the subjects.[24] (fig. 1 on p. 443 shows different muscles surrounding the nasopharynx.) Most of the researchers have accepted levator palatini as the primary muscle involved in velar closure.

3.2.1 Acoustic researches

Researchers have clearly noted that the occlusive nasal (nasal murmur) is characterized by a spectrum in which F_2 is weak or absent. A formant at approximately 250 c/s

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21. Dickson and Dickson, 1972, p. 372.

22. Bjork and Nylen, 1963, p. 441-442

23. Harrington, 1944, p. 325-345.

24. Bell Berti, 1973.

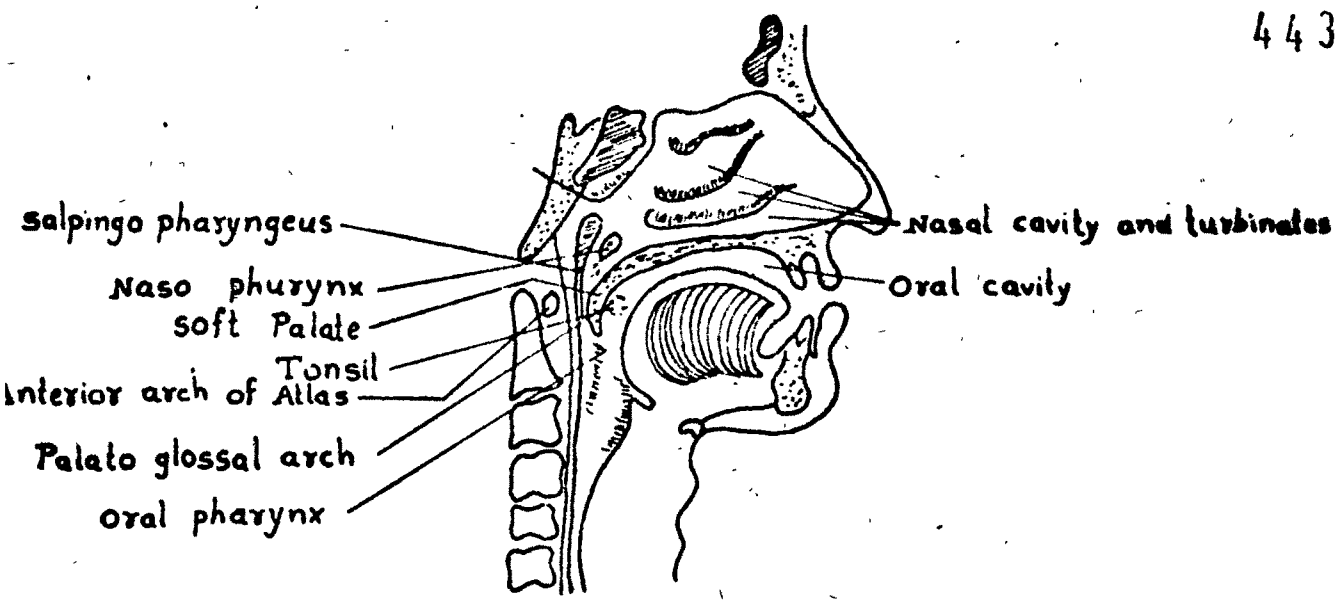

Fig. 1a Sagittal section through nose

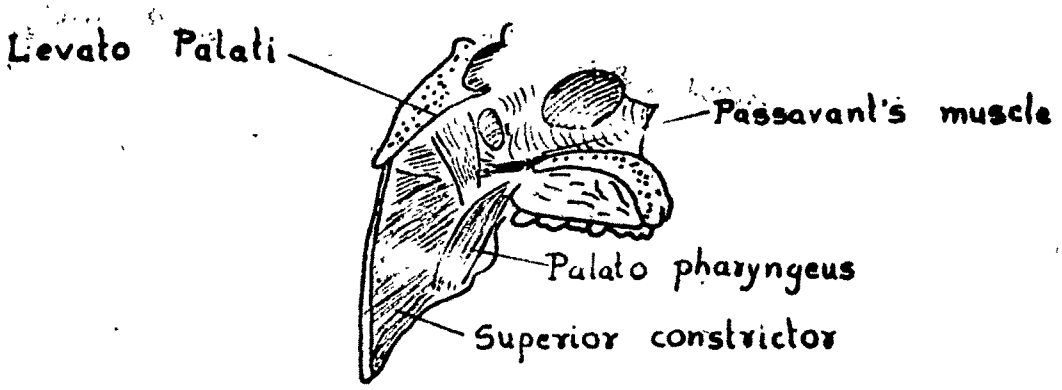

Fig 1b The muscles of the nasopharyngeal isthumus

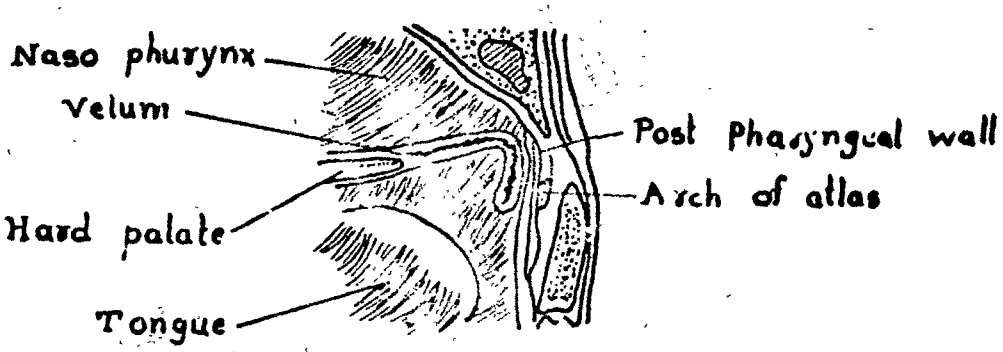

Fig. 1c. The contact of the elevated velum with the posterior pharyngeal wall

generally extending into adjacent vocalic segment dominates the spectrum. Fant has found the bandwidths of nasal formants larger than the other vowel like sounds.[25]

The nasality entering into vowels is a natural process in the neighbourhood of nasal occlusives as indicated by the extended formants. However, if the vowel is nasalized (phonologically too) then it possesses the nasal characteristics as a distortion superposed on the vowel spectrum. "Typical nasalization cues are the addition of the first nasal resonance in the region below the first formant of the vowel like (open) sound and a simultaneous weakening and shift up in frequency of the first formant F_1".[26] Fant shows that in nasalized open vowels there enters a 'baseline formant' below F_1, see fig.2 on p.445.[27] The anti-resonance enters whenever there is a side branch to the acoustic pathway and hence it enters in the transfer function of nasal consonants and nasalized vowels. See fig.3 on p.445.[28]

The zeros or anti-resonance is not a unique property of consonants. For the nasalized vowel a clear resonance and an anti-resonance below the frequency of F_1 and also minor spectral irregularities higher up in the spectrum are visible. Due to nasal coupling we get distributed pole-zero pairs. When zero comes close to a pole the combined effect of the two on the spectrum will be small.

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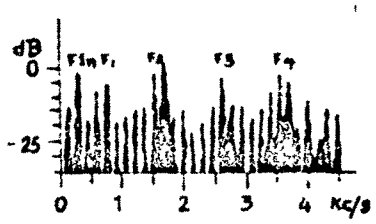
25. Fant (Ed. Malmberg) 1968, p. 237.

26. ibid, p. 237.

27. ibid, p. 184.

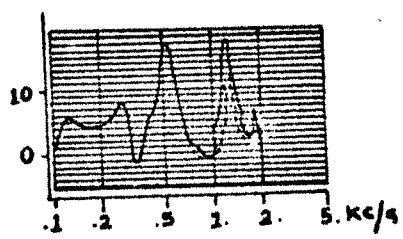
28. ibid, p. 208.



[æ̃] B=45c/s T_a=6msec

The split first formant of the nasalized [æ]

Fig. 2 (Fant 1968 P. 184)



The vowel [ɜ] nasalized

Fig. 3 (Fant 1968 P. 208)

The most interesting result of Fant's work is the 'continuity concept'. The baseline formant of a split first formant of nasalized back vowels having an additional nasal resonance N 1 is continuous with the baseline formant of a nasal consonant [m], [n], or [ŋ].

Fant prefers to preserve this continuity concept of the F-pattern in all possible sound segments by "considering the spectrum to be composed of the basic F-pattern resonances plus additional pole-zero pairs due to the particular articulation and source location."[29] For orally closed nasals and nasalized vowels where resonance frequencies may be equally associated with the nasal and the oral systems, the identification of the F-pattern formants must rely on continuity criteria. The position of complete oral closure for the nasal consonants is gradually changed to the open oral cavity for the vowels - these vowels will have the nasal coupling, and the formants will move accordingly. Fant calls this 'the time-variation of the F-pattern which then becomes a continuous function of time'. In other words nasality is not a static point and the relevance of Fant's conclusions can be seen better when one sees the actual language situation having the sound change as N-loss nasalization in progress.

In spite of all these researches there are many aspects connected with nasalization which have not yet become clear.

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29. Fant (Ed. Malmberg) 1968, p. 220.

There are many complexities attached to the acoustic and physiological studies of 'nasality'. The amount of vagueness and breadth of this term in the linguistic literature is so much that the researchers have concluded that there is no nasality unless someone hears it and such perceived nasality is not necessarily the same as linguistically significant nasality. There are no definite, steady and definable positions of naso-pharyngeal muscles for describing 'nasality'. Entenman refers to Delattre who believes that the main difference between French nasal vowels and English nasality is in pharyngeal adjustments: English nasality is produced only by lowering the velum but the French nasalized vowels require adjustment of pharyngeal cavity in such a way as to create anti-resonances with the nasal cavities.[30]

(Con P. 448-453)

The X-ray photographs produced here clearly show that the nasality in Gujarati is produced not merely by velum lowering but also by other adjustments in naso-pharyngeal muscles. (Picture I shows the position of velum in neutral state. The Pictures II and III show that for nasalized [ã] the velum clearly touches the tongue. The Pictures IV and VI show the nasalized [ĩ] and [ẽ] respectively. The palate/velum depression is comparatively much lesser for these two vowels than for [õ] vowel. (See the picture V). Particularly levato-palati and palato pharyngus muscles' adjustments change a lot for each vowel.

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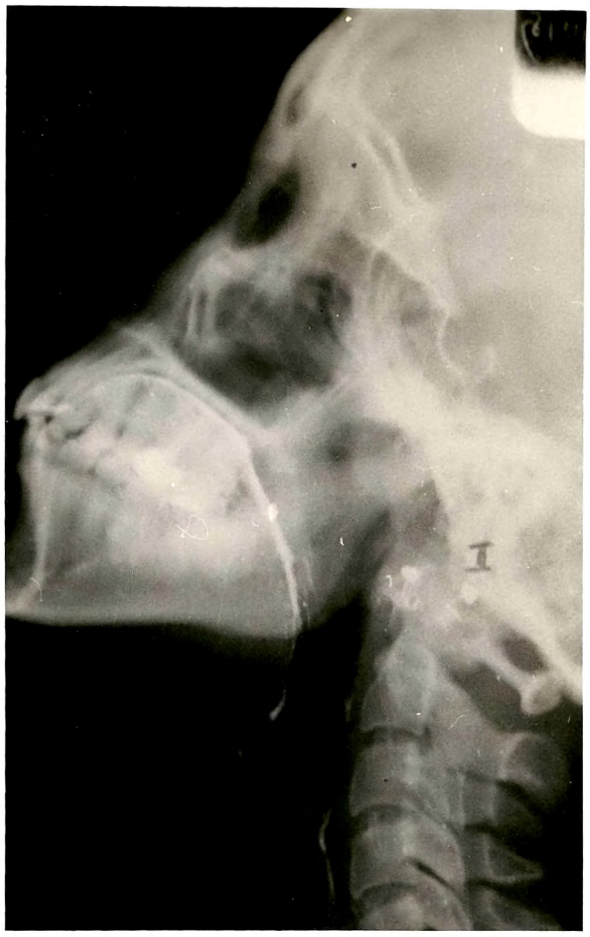
30. Entenman, 1976, p. 45.

Photograph I - The position of velum in neutral state.

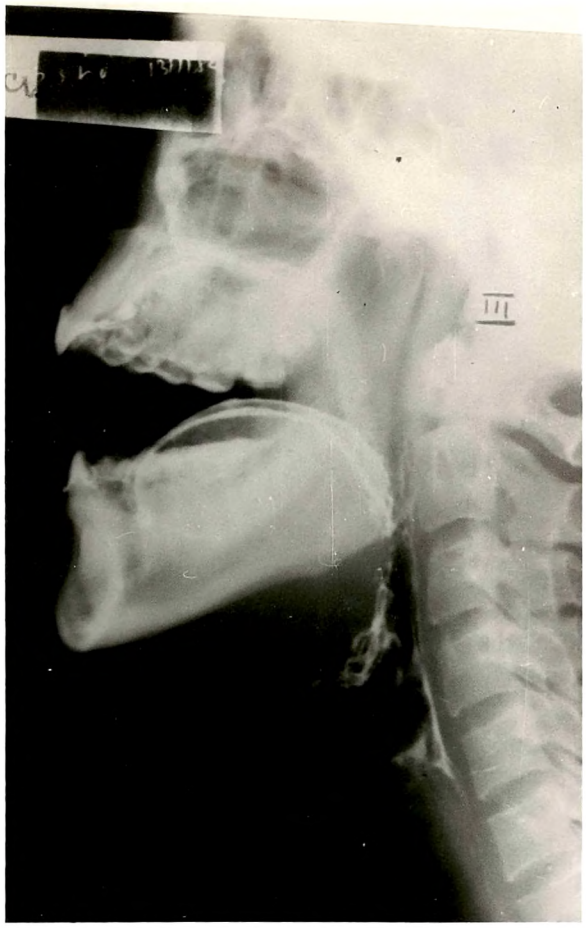
Photograph II - The position of velum for nasalized [ã] as in [vãk].

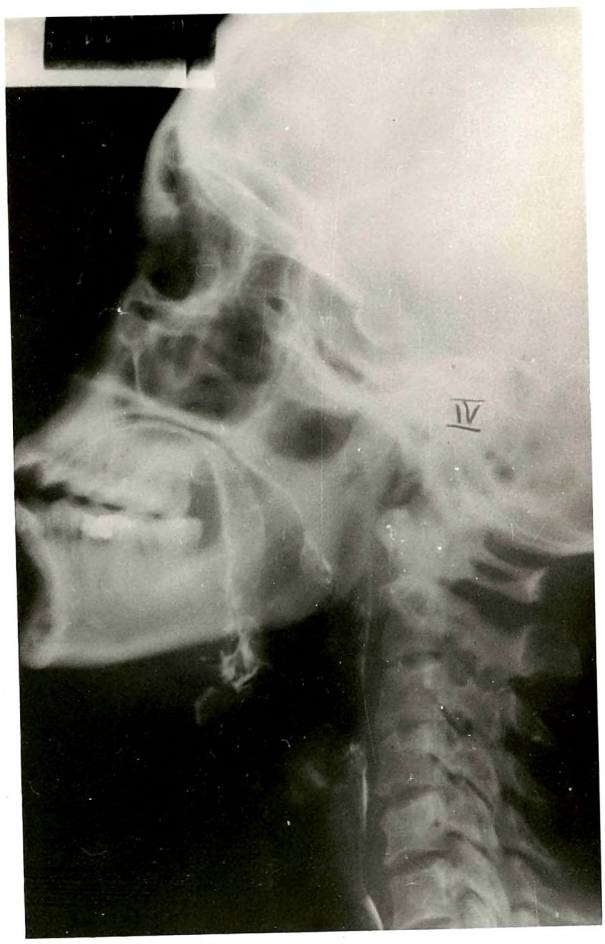

I


II

Photograph III - The position of velum for nasalized [ã] as in [kʰãɾo]

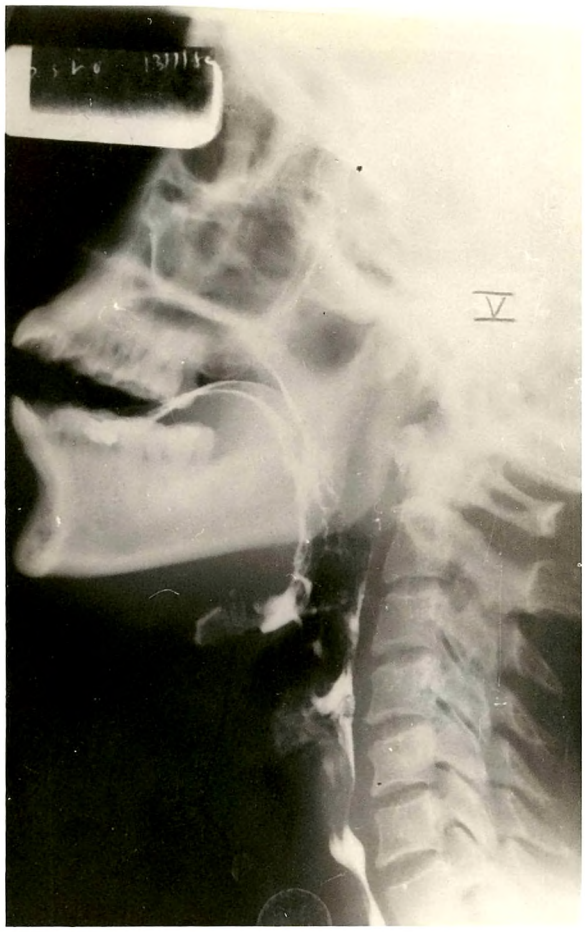
Photograph IV - Lesser velum depression for [ĩ] as in [kʰɾĩi]

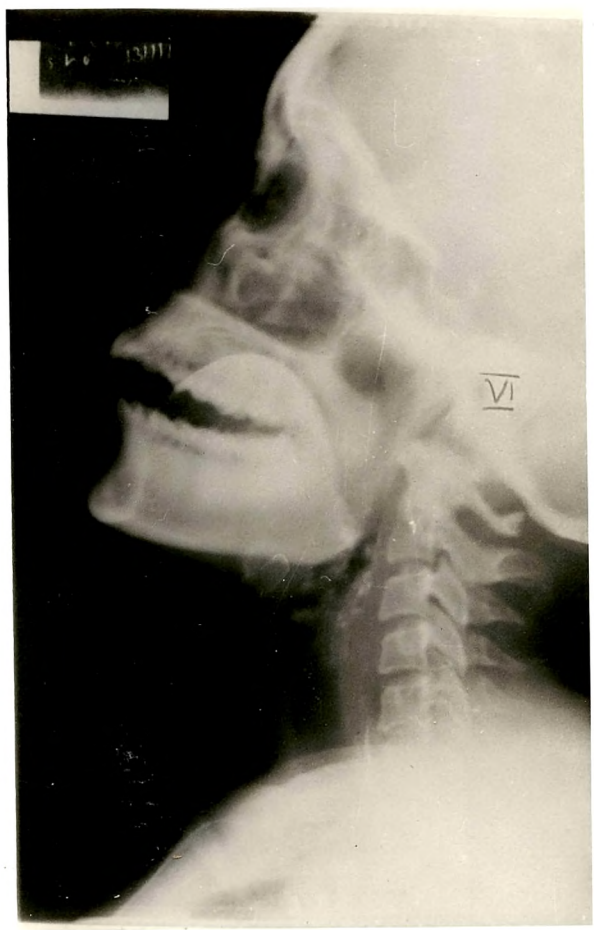

III


IV

Photograph V - Velum is lowered more for [õ] as in [tʃõk] than for [ĩ] and [ẽ].

Photograph VI - [ẽ] as in [k^{h}ẽtʃ] showing lesser velum depression.


V


VI

3.3 Anticipatory coarticulation

One thing is certain that nasality may not be always linguistically relevant. Linguistically non-significant nasalization can be summed up as an anticipatory coarticulation. In the Gujarati word [baɳ] 'arrow' the soft palate must be getting lowered for the nasal, considerably before the tongue rises to make the articulatory contact. As a result much of the vowel is nasalized. In fact Fant shows that there is "the split first formant and the speaker has nasalized the entire [æ] (in the word [sæ̃ntakɔz]) in anticipation of the /n/ and there is no separate [t] segment except for a weak high frequency burst in the latter part of the [n] segment". Fant suggests that one can alternatively argue that there is no separate [n] segment, the intended /n/ being signalled by the nasalization of the [æ̃] and of the voiced nasalized dental stop [d̃]".[31]

3.3.1 Nasalization in Gujarati

Regressive nasalization of vowels is the natural result of the time taken for physiological adjustment in the continuous speech. Being the natural phenomenon such nasalization cannot be the decisive factor of any linguistically significant issue. Gujarati shows regressive as well as progressive nasalization, i.e. of anticipatory or predictive nature. This nasalization is "mild". There is also 'stronger' type of nasalization in Gujarati which is linguistically significant and which is discussed in the sections 3.4 - 3.4.2.

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31. Fant, 1973, p. 97.

3.3.2. Regressive/progressive coarticulatory nasalization in Gujarati:

The mild regressive nasalization due to the nasal consonants can be seen in the words like:

[ʃjam]	'dark'
[kam]	'work'
[banɭ]	'arrow'

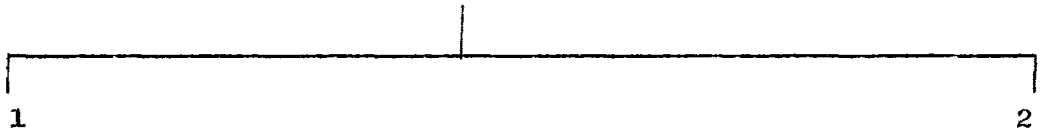
The mild progressive nasalization can be seen in the words like;

[map]	'measure'
[ma]	'mother'
[man]	'honour'
[nak]	'nose'

Both these nasalizations are not indicated in the orthography. Often such nasalizations do not merely depend on the context (i.e. nasal consonants) but also on the syllabic structure of the words. A large data showing regressive and progressive nasalization is presented here. The data where vowels are not nasalized in spite of their being in the context of nasal consonants is also given. See the list on p. 670-708.

It would be helpful to differentiate between two main types of coarticulatory nasality:

Coarticulatory nasality



1	2
Nasality spread in vowels due to organic adjustments in the context of nasal consonants.	Nasalization of vowels which was earlier the nasality spread due to organic adjustments in the contexts of nasal consonants and which is now in the form of stronger nasalization. Because it is also the remainder of the neighbouring nasal consonant which is lost (N-loss); and this N-loss requires the change in syllabic pattern. Balancing of syllabic pattern may result in additional lengthening of the already lengthened nasalized vowel.

The first type of coarticulatory nasality is highly predictable for two reasons. One is when the nasal consonant is in the neighbourhood, the vowels easily get nasalized and the second is that the vowels and consonants themselves possess some intrinsic nasality. Here the past studies where a few inherent characteristics of individual vowels and consonants are noted, should also be taken into consideration, because these characteristics imply conducive contexts for nasality. such as:

(1) Vowel 'u' has greater innate nasal resonance. 'u' is perceived as nasalized 75% of the time with velopharyngeal opening of only 1 cm .

(2) House and Stevens show that for nasalized vowels F_1 shifts upwards. For nasalized 'i' the first formant shifts upward by about 70Hz when the velopharyngeal opening is 25 mm^2 but for 'a' the first formant shifts only about 40Hz at the same opening;[32] i.e. the low vowels need greater velopharyngeal opening to be perceived as nasalized. This can be taken as a proof that 'i' vowel is less tolerant to the nasality position i.e. velopharyngeal opening. 'a' has greater intrinsic nasality than 'i' has.

(3) Ladefoged has noted the variation in the degree of velic opening in accordance with the height of the vowel and that these variations are all easily explicable in terms of the actions of the muscles involved.[33]

(4) Lintz and Sherman show that low vowels have lower fundamental frequency, greater duration and higher average intensity and peak power than high vowels. They hypothesize that these all are responsible for nasality increase in low vowels.[34]

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32. House and Stevens, 1956, p. 218-232.

33. Ladefoged, 1975, p. 81.

34. Lintz and Sherman, 1961, p. 381-396.

From thisedata it was observed that some nasals spill more nasality than the others. This nasality spill from the retroflexed nasal [ɳ] is maximum. The data also shows that the nasals [ɳ] , [ɲ] and [ŋ] by their very nature require a slight support of vowel in the initial position if they are to be pronounced independently (i.e. not within any sequence). This being an articulatory requirement, these nasals do not too often appear as the independent segmental phonemes in languages. The supporting vowels in the initial positions of these nasals obviously have the nasality as the velum is already in the lowered position. Hence when in the midst of the sound sequences whichever vowel precedes these nasals, it is automatically going to take the nasality, and this inevitable nasality is more conspicuous. These back nasals have distinctive phonetic quality as compared with [m] and [n]. It is a known fact that [ɲ] and [ŋ] often appear only as the homorganic nasals with the following stops. Sanskrit received 'n' and 'm' from Indo-Aryan. The ancient grammarians were aware of the manner in which 'Blocked n' adjusted itself. Bloch rightly compliments these grammarians for assigning nasals to each class of consonants and distinguishing "ṅ, ñ, ṇ"[35]. Perhaps because of these nasals they replaced homorganic nasals by anusvāra. No doubt there is a little confusion regarding the phonetic value of anusvāra. But Allen sees justification in the use of this

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35. Bloch, 1965, p. 74.

'sign' because "it incidentally recognizes an important phonological principle namely that the 'n' or 'm' in a sequence 'Vnt' or 'Vmp' is a very different functional unit from that in 'VnV' or 'VmV'. For whereas in the latter case 'n' and 'm' are mutually contrastive this is not so in the former case. The homorganic nasals form a single phonological unit".[36] Our scholars were perceptive to note the strong assimilative results in 'NC' sequences and the phonetic peculiarities of back nasals.

In general the regressive nasality spill is stronger if the nasal consonant is not followed by a vowel i.e. when they don't have a release. In a 'V + N + consonant' sequence in Gujarati the coarticulatory nasality is stronger than in the 'V + N + V' sequence e.g.

[rə̃ŋg]	'colour'
[kə̃ɳʈʰ]	'neck'
[kə̃ɳo]	'corn'
[pɑ̃ɳi]	'water'

Both these nasalities have much to do with the structure of the sound sequences i.e. with the syllabic pattern. As can be seen from the data contextual nasality displays difference in the degree of nasality and at times the nasality disappears inspite of neighbouring nasal consonants. However, Ladefoged notes the difference in the degree of nasality in accordance with the nature of the adjacent consonants.[37]

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36. Allen, 1953, p. 45.

37. Ladefoged, 1971, p. 34.

The examples in the list on p. 461-463 show that the vowels get more nasality when in the context of 'ŋ' than when in the context of 'm' or 'n'.

The greater possibility of proneness to nasality in 'u' than in 'i' can be seen from the data on p. 464-465

3.3.3. The role of perception and identification in phonology

These examples can be doubted on the basis of being totally dependent on perception. The process of coarticulation of nasality is a complex process. As Entenman puts it "we can only know about the coarticulation of various physical and acoustic parameters <u>not</u> about the coarticulation of nasality since we do not really know what nasality is or how it is produced."[38] The data here shows that the degree of nasality in the vowels and coarticulatory spill-over of nasality regressively and/or progressively may be arbitrary to some extent but mostly the nasality is an articulatory requirement. There should be explicit difference between phonetics of the language, articulatory requirements and habits and phonology of the language. Articulatory habits can gradually become significant and then ultimately the part of phonology. Due to these differences there is a scope for variation even in the perception. But inspite of all this, perception and identification do play a role in our studies. Researchers have noted that velopharyngeal closure is a must for the speech perception. Bell Berti has found it necessary to have such closure not less than

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38. Entenman, 1976, p. 6.

n		n	
[ə̤nudʒ]	'younger brother'	[kʰun]	'murder'
[ə̤nnə]	'food'	[ʈ̤ən]	'ton'
[aṇũ]	'his,hers' (neuter)	[pen]	'pen'
[ani]	'his,hers' (fem)	[pan]	'betɐl leaf'
[ane]	'to him/her'	[puṇ]	'to earn merit'
[kə̤ne]	'with/ near'	[bɦen]	'sister'
[gɦen]	'intoxication'	[ban]	'earnest money'
[tʃɛ̤n]	'to be at ease'	[bin]	'a musical instrument'
[dʒə̤n]	'people'		
[den]	'courage'	[bʰan]	'sense'
[dan]	'charity'	[man]	'honour'
[dʒan]	'life'	[və̤n]	'forest'
[kan]	'ear'	[sə̤n]	'year'
[gan]	'music'	[sena]	'army'
[kʰan]	'title'	[sonũ]	'gold'
		[san]	'senses'
m		m	
[am]	'thus'	[dʒə̤m]	'death God'
[ə̤mne]	'to us'	[dʒɦə̤m]	'to drip'
[kam]	'work'	[ʈ̤əmʈ̤ə̤m]	'slow burning of lamp'
[kem]	'why'		
[kom]	'community'	[də̤mru]	'drum'
[gam]	'village'	[tə̤mra]	'insects'
[gom]	'secret'	[tamsi]	'hot tempered'
[tʃamɖi]	'skin'	[də̤m]	'asthama'
[dʒam]	'guava'	[dam]	'money'
[gə̤m]	'understand'	[dɦam]	'place'

m		m	
[nam]	'name'	[rum]	'room'
[nom]	'ninth day'	[ləmɳũ]	'temple'
[nem]	'largest'	[lom]	'body hair'
[pamwũ]	'to attain'	[vam]	'left'
[bam]	'an ointment'	[səm]	'equal'
[bum]	'shout'	[sam]	'to coax'
[bʱəmbʱəm]	'fatty'	[somvar]	'Monday' (moon)
[bʱom]	'land'	[sumsam]	'completely quiet'
[məm]	'food' (for child language)	[ʃam]	'Krishna'
		[ɦom]	'sacrificial fire'
[rəm]	'play'	[ɦam]	'courage'
[ram]	'Rama'	[ɦem]	'gold'
[rom]	'body hair'	[ɦim]	'snow'
ɳ		ɳ	
[əɳũ]	'atom'	[tuɳ]	'darn'
[aɳ]	'oath'	[dʱəɳ]	'cowherd'
[kaɳ]	'mourning'	[dʱoɳ]	'washing'
[kʰaɳ]	'mine'	[neɳ]	'eyes'
[gʱaɳ]	'dirt'	[naɳwũ]	'to evaluate'
[tʃʰaɳ]	'cow-dung'	[pəɳ]	'but'
[ʤaɳ]	'know'	[paɳ (o)]	'stone'
[kəɳ]	'granule'	[peɳ (i)]	'frying pan'
[koɳ]	'who'	[ɸeɳ]	'lather'
[gʱəɳ]	'hammer'	[ɸiɳ]	'lather'
[gəɳ]	'count'	[bəŋgo]	'trumpet'
[təɳ]	'three'	[baɳ]	'arrow'
[taɳ]	'pull'	[bʱaɳ]	'sun'

ɳ		ɳ	
[mə̣ɳ]	'mound'	[vɦạɳ]	'boat'
[mạɳwũ]	'to enjoy'	[vịɳ]	'without'
[mọɳ]	'shortening'	[sọɳũ]	'dream'
[mịɳ]	'wax'	[ʃə̣ɳ]	'jute'
[rə̣ɳ]	'desert'	[ʃạɳ (o)]	'wise man'
[rẹɳ]	'night'	[ʃọɳit]	'blood'
[rụɳ]	'debt'	[ɦọɳ]	'this year'
[və̣ɳ]	'clean'		
[vẹɳ]	'words'		

Even 'i' vowel which normally is less tolerant to nasality gets nasality when in the neighbourhood of 'ɳ'. See the following:

[ạɳị]	'brought'
[tʃʰiɳị]	'shredder'
[dʒʱiɳị]	'small' (fem)
[dọɳị]	'a small pot'
[kọɳị]	'elbow'
[ʃạɳị]	'wise' (fem)
[kạɳị]	'squint'

[ənudʒ]	'younger brother'	[ɜnil]	'wind'
		[əniket]	'houseless'
[ənubʱəv]	'experience'	[dʱəni]	'wealthy'
[dʱənu]	'bow'	[dʒəmi]	'ate' (fem)
[dʒəmu]	'name of the person		

Very often 'i' does not take nasality even when in the environments conducive to such a feature.

[gəmi]	'liked'	[nirəbʱrə]	'cloudless'
[tʃumi]	'kiss'	[niʃa]	'night'
[tʃimni]	'Chimney'	[ni:l]	'blue'
[tʃin]	'China'	[bimar]	'ill'
[tʃimən]	'a name'	[mitrə]	'friend'
[dʒin]	'gin'	[mit]	'measured'
[kʰəmis]	'shirt'	[milən]	'meeting'
[kʰəmir]	'guts'	[mɑ̀tʰja]	'lie'
[tamil]	'Tamil'	[milap]	'meeting'
[dani]	'charitable'	[miʃtə]	'sweet'
[nikas]	'export'	[lin]	'absorbed'
[nitʃod]	'extract'	[vinəj]	'politeness'
[nidʒ]	'own'	[vinod]	'humour'
[nitar]	'to strain'	[vinaʃ]	'destruction'
[nitjə]	'always'	[səmir]	'wind, breeze'
[nidʱi]	'treasure'	[səmip]	'near'
[nijəm]	'rule'	[səmiti]	'committee'
[nipun]	'clever'	[səmikərən]	'consolidation'

'u' develops nasality (in Gujarati words) even when it is not there in Sanskrit words e.g.

Sanskrit	Gujarati	
[utʃtʃə]	[ũtʃũ]	'tall'
[uʂʈrə]	[ũʈ]	'camel'
[gutʃtʃʰə]	[gũtʃ]	'entanglement'
[utʃtʃi+ kru]	[ũtʃakwũ]	'to raise'
[pʰut+ kru]	[fũkarwũ]	'to blow'

Apart from such examples 'u' shows stronger nasality in the neighbourhood of nasal consonants:

Sanskrit		Gujarati	
[ụɳũ]	'lacking'	[dụm]	'belly'
*[ụnaɭo]	'summer'	[dụɳ]	'burn'
*[ụnũ]	'hot'	[dụnija]	'world'
[ụma]	'a name'	[dʱụn]	'obsession'
[kʰụn]	'murder'	[dʱụm]	'much/force'
[gụɳ]	'virtue'	*[pụn]	'good deeds'
[gụm]	'lost'	[pụmɖũ]	'cotton ball'
[gʱụm(wũ)]	'to roam'	[bụm]	'shouting'
[tʃụm(wũ)]	'to kiss'	[bʱụmi]	'land'
[tʃụɳ]	'pleats'	[rụɳ]	'debt'
[dʒụn]	'June'	[rụm]	'room'
[dʒʱụm(wũ)]	'to hover'	[lụm]	'bunch of fruits'
[ʈʰụmri]	'a form of vocal music'	[sụmsɑm]	'quiet'

* These words have strongly nasalized 'u'. Less educated are even tempted to use 'Anusvār' sign on these 'u"s'. while writing.

$20-30mm^2$ or else speech perceptibility begins to decrease.[39] It has been shown that it is difficult to identify nasal consonants in isolation and it is the formant transition that supplies most of the information. Almost all of the acoustic experiments depend on perception-identification tests. Nakata concluded from his synthesized nasal murmur that listeners recognized [m] only 64% of the time and the other nasal consonants were even less recognizable.[40] Ishiki saw that there was consistent substitution of [m] for [b] when velo-pharyngeal opening is far larger than 20 mm^2.[41] Earlier Malecot had referred to the general tendency of judging all questionable cases as 'm'.[42] All these experiments clearly had been planned by taking into consideration the perception of the speakers-listeners. Hence, the role of perception is not discardable, yet one realizes the danger involved in depending entirely on perception based conclusions.

We have noted that for the nasalized vowels the F_1 shifts upwards. Since the identification of vowels depends on F_1 frequencies, it follows that nasalization may cause vowels to be perceived as having a different tongue height than when not nasalized. It is observed that for Gujarati mid and low nasalized vowels, the jaw position is lowered. This lowering affects the quality of vowel. It is not possible to agree fully with Ohala when he suggests that

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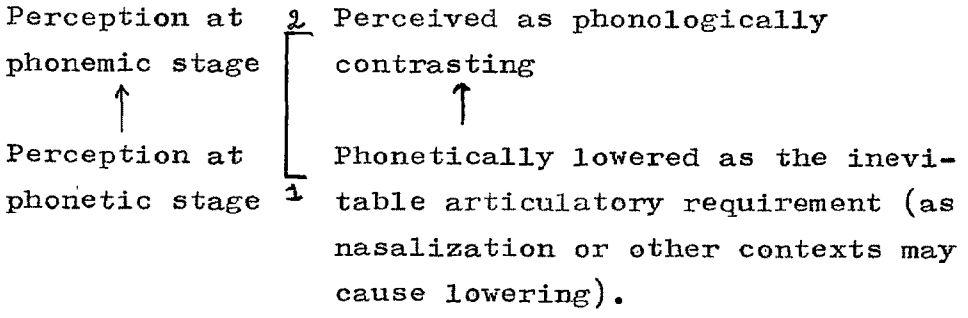
39. Bell Berti, 1973, p. 203-209.

40. Nakata, 1969, p. 661-666.

41. Ishiki, *et al* 1968, p. 297-310.

42. Malecot, 1960, p. 222-229.

the lowering of nasal vowels observed in some languages such as French can be explained as some kind of faulty hearing. He feels that there is no actual change in the articulation of vowels, but auditorily nasalized vowels appear to be lowered.[43] Fant believes that nasality can modify the perceptual quality of vowels. Ohala thinks that this perceptive quality or auditory impressions are negligible or should be treated as negligible. But here once again a subtle theoretical issue is involved such as, 'when does a 'lowering' result into a new contrastive - distinctive-vowel height?' As has already been noted here such negligible perceptual quality has made the linguists add more phonemes to the language. Pandit's treatment of ɛ-ɔ is the result of depending on such auditory quality. The present study stresses the need for differentiating between the phonetic requirement of tongue/jaw lowering, the articulatory habit, the perceptual-auditory results on the one hand, and perceptually contrasting phonemes on the other. Perceptually felt lowering is the process which may develop into distinctive phonemes at the later stage. By this is implied that Gujarati ɛ-ɔ have remained at the first stage only.



43. Ohala, 1971, p. 33.

The data here support the findings of acoustic researchers. It is found that:

(1) The vowels 'u' and 'a' in Gujarati are conducive to greater nasalization than 'i'.

(2) Back nasal consonants spill more nasality in adjacent vowels than the front ones.

(3) Such nasality - a natural nasal prosody - may not be significant at phonemic-perception level.

(4) The degree of nasality varies (at times the nasality may disappear too) when the syllabic structure changes, i.e. when the nasality spilling from the nasal consonant is allowed to spread regressively as well as progressively, the regressive spread becomes weaker and if the vowel carrying the progressive nasality is the stressed one then the weak regressive nasality disappears. e.g.

[tʃʰə̃́m]	'onomatopoetic'	[tʃʰə mə̃́klũ]	'a trivial disturbance'
[dʒə̃́ɳ]	'person'	[dʒəɳə̃́s]	'thing'
[dʒə̃́n]	'people'	[dʒənə̃́m]	'birth'
[də̃́m]	'force'	[dəmə̃́n]	'power'
[dʱə̃́n]	'wealth'	[dʱənṹʃ]	'bow'
[nə̃́m]	'bow'	[nəmə̃́n]	'bowing'
[mə̃́n]	'mind'	[mənə̃́n]	'thinking'
[mə̃́n]	'honour'	[manə̃́s]	'mind'
[rə̃́ɳ]	'dessert'	[rəɳə̃́kwũ]	'to tinkle'
[və̃́ɳ]	'weave'	[vəɳə̃́ʈ]	'weaving'
[sə̃́mta]	'composure'	[səmə̃́dʒʱ]	'understanding'

3.4. N-loss nasalization

The second type of coarticulation is the result of N-loss - nasalization. The data showing this nasalization have to be classified according to different criteria. First of all the data where nasal effacement - nasalization takes place uniformly in all the dialects of Gujarati are sorted out. These words show that N-loss takes place before voiceless consonants in tatsama/tadbhava vocabulary and the vowel in the 'V + N + voiceless consonant' sequence is always 'ə' which after the N-loss becomes 'ə̃'.

Secondly the process of N-loss nasalization is not uniformly present if the said sequence has a voiced consonant after the nasal. Moreover the phonetic manifestations of this sequence are very many in murmur dialects and tight phonation dialects.

Thirdly, the indigenous data shows nasalized vowels and it may appear difficult to extend direct proof in considering this nasalization as the result of N-loss. But there are morphemes having 'ə̃ + voiceless consonant' sequences which become 'ə + N + voiceless consonant' in morphemic extensions. This is also true for some 'V + N + voiced consonant' sequences.

Finally there is a long list of words having nasalization in the final position. This has not resulted out of 'V + N + C' sequence, but out of an inflectional morpheme ' -kam' of Sanskrit.

3.4.1 'ə + N + voiceless consonant':

Here is the list of tatsama/tadbhava words which shows the relationship between 'ə -a';

A		B	
ə + N + voiceless consonant		ã + voiceless consonant'	
[kəŋkəɳʈ]	'bangle'	[kãkəɳʈ]	
[kəmp]	'shiver'	[kãpwũ]	'to shiver'
[kəntai]	'spinning'	[kãtwũ]	'to spin'
[kənsaɾo]	'pot maker'	[kãsũ]	'an alloy'
[kənʈʰ]	'neck'	[kãʈʰo]	'neck'/ 'bank'
*[kəɲtʃuki]		[kãtʃ ɭi]	'blouse'
*[kəɳʈak]		[kãʈo]	'thorn'
[gʱəɳʈ]	'bell'	[gʰãʈo]	'shout'
*[tʃə ntʃu]		[tʃãtʃ]	'beak'
[tʃəmpak]		[tʃãpo]	'flower'
[dʒʱəŋkʰna]	'desire'	[dʒʱ ãkʰi]	'faint image'
[dənt]		[dãt]	'tooth'
[pəŋkʰ]		[pãkʰ]	'wing'
[pəntʰ]	'road'	[pãtʰi]	'parting'
[pəɲtʃ]	'five'	[pãtʃ]	'five'
[məɲtʃ]		[mãtʃi]	'platform'
*[vəɲʃ']		[vãs]	'bamboo'
[səŋkələn]		[sãkəɭ]	'chain'
[əŋk]		[ãk]	'number'
[antraj]	'obstacle'	[ãtərwũ]	'to create obstacle'
[siɲtʃən]		[sĩtʃai]	'sprinkling'**

** Where meanings are common for A and B they are not repeated.

* The words with asterik are not used in the informal use of the language. Rest of the words in A as well as in B are in common usage.

These words have developed nasalized vowels after N-loss from the homorganic nasal + voiceless consonant clusters. Some words do not have N-loss nasalization. The only plausible reason for this could be that the syllabic structure or quantitative pattern of the syllables of these words do not allow N-loss. These words are:

I.	[təntrə]	'formality	[tantrik]	'regarding formality'
	[jəntrə]	'machine'	[jantrik]	'regarding machine'
	[məntrə]	'spell'	[mantrik]	'regarding spell'
II.	[laɲtʃʰən]	'blot'	[laɲtʃʰit]	'one who has blot'
	[vəɲtʃana]	'cheating'	[vəɲtʃək]	'cheater'
	[vaɲtʃʰəna]	'desire'	[vaɲtʃʰit]	'desired'
	[ʃəŋka]	'doubt'	[ʃəŋkit]	'doubtful'
III.	[kant]	'lower' (he)	[kanta]	'lover' (she)
	[ʃant]	'quiet'	[ʃanta]	'name of a girl'

It is clear that no compensatory strengthening - lengthening of the vowel before the nasal consonant can take place as the vowels are already long in some words. Elsewhere the syllabic structure does not call for such a change.

3.4.2. V + N + voiced consonants:

The data here are extremely interesting for phoneticians, phonologists, historical linguists and sociolinguists. The process of N-loss does not take place necessarily when the sequence is 'ə + N + voiced consonant'. The differences found in the phonetic manifestations are dialectal and the

distinction as to tatsama/tadbhava or indigenous is not relevant. The differences follow different lines of sound change in two types of phonations: Murmur and Tight.

The variations from three major murmur dialect areas are given in the data (see p. 473-476.): (1) Surat and down below upto Bombay (2) Baroda to Ahmedabad (3) North of Ahmedabad, North east Gujarat. Tight phonation dialect group also shows interesting variations: either 'V + N + voiced consonant' sequence is retained (Bhavnagar area) or '$\tilde{V}$ + nasalized yod + N + voiced consonant' sequence appears (Porbunder area) or '$\tilde{V}$ + nasalized yod + voiced consonant' sequence appears (Jamnagar area). There may be other variations about which the present author cannot claim to know definitely (see p.477). All these words in this data except one have vowel 'a'. The words with other vowels in the similar type of sequence also show the formation of nasalized yod. However, we don't have sufficient data from tight phonation dialects. The educated speakers of all these dialects (Murmur as well as Tight phonation) show no N-loss in large number of words (see the data on p. 478-479).

It is clear from the list that the sequence 'V + N + voiced consonant' behaves differently from the sequence 'V + N + voiceless consonant'.

3.4.3. Nasalized vowels in indigenous words

The data from indigenous vocabulary are divided into two sections: the first section proves the relationship

D_1		D_2	D_3
V + N + voiced cons.		$\tilde{V}$ + voiced cons.	1) a + N + voiced cons. → $\tilde{ɔ}$ + voiced cons. 2) i + N + voiced cons. → $\tilde{i}$ + voiced cons. 3) u + N + voiced cons. → $\tilde{u}$ + voiced cons. 4) o + N + voiced cons. → $\tilde{ɔ}$ + voiced cons. 5) e + N + voiced cons. → $\tilde{ɛ}$ + voiced cons.
[kaɳɖi]	'small stick'	[kãɖi]	[kɔ̃ɖi]
[kanda]	'onions'	[kãda]	[kɔ̃da]
[kaŋgu]	'meek'	[kãgu]	
[kand^{ɦ}]	'shoulder'	[kãd^{ɦ}]	
[kuɳdʒ]	'grove'	[kũ^{ɳ}dʒ]	
[kuɳɖi]	'basin'	[kũɖi]	[kũɖi]
[kumb^{ɦ}]	'pitcher'		
[k^{h}aɳdʒre]	'barn'	[k^{h}ãdʒre]	[k^{h}ɔ̃dʒre]

D_1		D_2	D_3
[k^{h}anɖɭ]	'sugar'	[k^{h}ãɖɭ]	[k^{h}ɔ̃ɖɭ]
[ganɖo]	'mad'	[gãɖo]	[gɔ̃ɖo]
[ganɲgɖu]	'small stones'	[gãgɖu]	[gɔ̃gɖu]
[ganɖʒo]	'opium'	[gãdʒo]	[gɔ̃dʒo]
[gand^{ɦ}i]	'grocer'	[gãd^{ɦ}i]	[gɔ̃d^{ɦ}i]
[gundwũ]	'to mash'	[gũdwũ]	[gũdwũ]
[gẽɳɖo]	'rhinoceros'	[gẽɖo]	[gẽɖo]
[guɲgɭavwũ]	'to suffocate'	[gũgɭavwũ]	[gũgɭavwũ]
[tʃando]	'moon'	[tʃãdo]	[tʃɔ̃do]
[tʃanɲgɭũ]	'a little'	[tʃãgɭũ]	[tʃɔ̃gɭu]
[tʃundɖi]	'a kind of saree'	[tʃũndɖi]	
[tʃ^{h}inɖũ]	'a hole in the hedge'	[tʃ^{h}ĩɖũ]	[tʃ^{h}ĩɖũ]
[tʃ^{h}anɖwũ]	'to leave'	[tʃ^{h}ãɖwũ]	[tʃ^{h}ɔ̃ɖwũ]
[dʒ^{ɦ}aɲdʒ^{ɦ}ər]	'anklet'	[dʒ^{ɦ}ãdʒ^{ɦ}ər]	[dʒ^{ɦ}ɔ̃dʒ^{ɦ}ra]
[lambu]	'long'	[lãbũ]	[lɔ̃bu]
[londo]	'mashed thing'	[lɔ̃do]	[lɔ̃do]

D_1		D_2	D_3
[linɳɖi]	'goat-dung'	[lĩ$^{\eta}$ɖi]	[lĩ$^{\eta}$ɖi]
[vand^{ɦ}o]	'objection'	[vãd^{ɦ}o]	[vɔ̃d^{ɦ}o]
[vaɲdʒ^{ɦ}ɳi]	'childless woman'	[vãdʒ^{ɦ}ɳi]	[vɔ̃dʒ^{ɦ}ɳi]
[vaɳɖ^{ɦ}o]	'unmarried man'	[vãɖ^{ɦ}o]	[vɔ̃ɖ^{ɦ}o]
[vandro]	'monkey'	[vã dro]	[vɔ̃dro]
[ʃiŋgɖũ]	'horn'	[ʃ̃igɖũ]	[ʃ̃igɖũ]
[saɲdʒ^{ɦ}]	'evening'	[sãdʒ^{ɦ}]	[sɔ̃dʒ^{ɦ}]
[saɳɖsi]	'tongs'	[sãɳsi]	[sɔ̃ɳsi]
[saɳɖ^{ɦ}ɳi]	'she camel'	[sãɖ^{ɦ}ɳi]	[sɔ̃ɖ^{ɦ}ɳi]
[sand^{ɦ}o]	'joint'	[sãd^{ɦ}o]	[sɔ̃d^{ɦ}o]
[sambelũ]	'pounder'	[sãbelũ]	[sɔ̃belũ]
[soŋg^{ɦ}ũ]	'cheap'	[sɔ̃g^{ɦ}ũ]	[sɔ̃g^{ɦ}ũ]
[b^{ɦ}aŋgwũ]	'to break'	[b^{ɦ}ãgwũ]	[b^{ɦ}ɔ̃gwũ]
[b^{ɦ}amb^{ɦ}ɘrwũ]	'mooing'	[b^{ɦ}ãb^{ɦ}ɔrwũ]	[b^{ɦ}ɔ̃b^{ɦ}ɘrwũ]
[b^{ɦ}iŋgɖũ]	'scale'	[b^{ɦ}ĩgɖũ]	[b^{ɦ}ĩgɖũ]
[b^{ɦ}iɳɖa]	'acron'	[b^{ɦ}ĩɖa]	[b^{ɦ}ĩɖa]

D_1		D_2	D_3
[$b^{ɦ}$ uŋgɻũ]	'pipe'	[$b^{ɦ}$ ũgɻũ]	[$b^{ɦ}$ ũgɻũ]
[maɲɖʒwũ]	'to scrub'	[mãɖʒwũ]	[mɔ̃ɖʒwũ]
[maɳɖwũ]	'to begin'	[mãɖwũ]	[mɔ̃ɖwũ]
[mandi]	'sick'	[mãdi]	[mɔ̃di]
[miɳɖũ]	'zero'	[miɖũ]	[miɖũ]
[raɳɖ]	'widow' (derogatory)	[rã^{n}ɖ]	[rɔ̃^{n}ɖ]
[rand^{ɦ}wũ]	'to cook'	[rãd^{ɦ}wũ]	[rɔ̃d^{ɦ}wũ]
[rund^{ɦ}wũ]	'to check'	[rũd^{ɦ}wũ]	[rũd^{ɦ}wũ]
[daɳɖi]	'small stick'	[dãɖi]	[dɔ̃ɖi]
[d^{ɦ}and^{ɦ}ɔl]	'racket'	[d^{ɦ}ãd^{ɦ}ɔl]	[d^{ɦ}ɔ̃d^{ɦ}ɔl]
[d^{ɦ}und^{ɦ}vaj]	'suppress anger'	[d^{ɦ}ũd^{ɦ}vaj]	[d^{ɦ}ũd^{ɦ}vaj]
[nond^{ɦ}wũ]	'to note'	[nɒ̃d^{ɦ}wũ]	[nɔ̃d^{ɦ}wũ]
[piɲʤaro]	'spinner'	[piʤaro]	[piʤaro]
[puɲʤi]	'wealth'	[pũʤi]	[pũʤi]
[peɳɖo]	'a sweet'	[pɛ̃ɖo]	[pɛ̃ɖo]
[piɳɖaɭo]	'a roll'	[piɖaɭo]	[piɖaɭo]
[band^{ɦ}wũ]	'to tie'	[bãd^{ɦ}wũ]	[bɔ̃d^{ɦ}wũ]

Tight Phonation dialects

D_1	D_2	D_3
V+N+voiced cons.	$\tilde{V}$+nasalized yod+N+voiced cons.	$\tilde{V}$+nasalized yod+voiced cons.
[ganɟgɖu]	[gãj̃ɲgɖu]	[gãj̃gɖu]
[gaɲdʒo]	[gãj̃ɲdʒo]	[gãj̃dʒo]
[gandʰi]	[gãj̃ndʰi]	[gãj̃dʰi]
[vaɲdʒʰɳi]	[vãj̃ɲdʒʰɳi]	[vãj̃dʒʰɳi]
[vaɳɖʰo]	[vãj̃ɳɖʰo]	[vãj̃ɖʰo]
[vandro]	[vãj̃ndro]	[vãj̃dro]
[saɲdʒʰe]	[sãj̃ɲdʒʰre]	[sãj̃dʒʰre]
[sambʰərwũ]	[sãj̃mbʰərwũ]	[sãj̃bʰərwũ]
[bʰaɲgwũ]	[bʰãj̃ɲgwũ]	[bʰãj̃gwũ]
[maɳɖwũ]	[mãj̃ɳɖwũ]	[mãj̃ɖwũ]
[sandʰo]	[sãj̃ndʰo]	[sãj̃dʰo]
[nondʰwũ]	[nõj̃ndʰwũ]	[nõj̃dʰwũ]
[raɳɖ]	[rãj̃ɳɖ]	[rãj̃ⁿɖ]
[bandʰ]	[bãj̃ndʰ]	[bãj̃ⁿdʰ]

[kʰəɲdʒən]	'dimple'
[kʰəɲdʒri]	'musical instrument'
[kʰəɲdʒər]	'dagger'
[kʰə ɳɖən]	'destruction'
[kʰəɳɖer]	'remnants'
[kʰəɳɖɳi]	'revenue'
[gəŋga]	'Ganges'
[gənd^{ɦ}]	'smell'
[gənd^{ɦ}ərvə]	'singers in heaven'
[gəɳɖəstʰəl]	'the temples of elephant'
[gəmb^{ɦ}ir]	'serious'
[gəndki]	'dirt'
[gəmmət]	'fun'
[gunɖo]	'rogue'
[gundər]	'gum'
[gumbədʒ]	'dome'
[tʃəndi]	'food for horse'
[tʃəndərvo]	'decorated ceiling of the pendal'
[tʃəmbu]	'a pot with narrow neck'
[tʃumbək]	'attractor'
[tʃumbən]	'kiss'
[tʃuŋgi]	'pipe'
[tʃiŋgus]	'miser'
[tʃʰəndəs]	'regarding meter'
[tʃʰənd]	'meter'
[dʒəŋg]	'war'
[dʒəŋgi]	'enormous'
[dʒəŋgəl]	'forest'
[dʒambuɖi]	'purple'
[dʒindgi]	'life'
[dʒ^{ɦ}əɲdʒ^{ɦ}a]	'storm'
[ɬəŋgavwũ]	'to hang'
[dəɳɖ]	'punishment'
[diɳɖi]	'a meter in poetry'
[dundub^{ɦ}i]	'war bugle'
[dʰənd^{ɦ}o]	'profession'
[ninda]	'criticism'
[nəndvawũ]	'breaking of glass'
[puŋgəv]	'bull'
[pəŋgət]	'row'
[pəɲdʒo]	'palm'
[pəɳɖit]	'scholar'
[pəndər]	'fifteen'
[fəɳɖ]	'fund'
[fənd]	'plot, scheme for cheating'
[fəŋgoɭwũ]	'to throw'
[bəŋgaɭi]	'Bengali'
[bəɳɖəl]	'bundle'

[bəndər]	'monkey'
[bəndegar]	'prisoner'
[bənduk]	'gun'
[bənd^{ɦ}ən]	'bond'
[bəmbo]	'big pot for heating water'
[bənsri]	'flute'
[band^{ɦ}əv]	'friend,brother'
[band^{ɦ}o]	'figure'
[bambu]	'bamboo'
[bundi]	'eatable'
[b^{ɦ}əŋgar]	'junk'
[b^{ɦ}əŋdʒək]	'destructor'
[b^{ɦ}əɳɖar]	'treasury'
[b^{ɦ}əmb^{ɦ}erwũ]	'to instigate'
[məndir]	'temple'
[məŋgəɭ]	'holy'
[məɳdʒri]	'mango blossom'
[məɳdʒuʃa]	'a box'
[məɳɖaɳ]	'beginning'
[məɳɖəɭ]	'a group/unit of people'
[məɳɖuk]	'frog'
[məntrə]	'spell'
[mənt^{ɦ}ən]	'thinking'
[mənda]	'name of a girl'
[məɳdʒən]	'tooth powder'
[rəŋg]	'colour'
[rəɳdʒ]	'grievance'
[rəɳdʒaɖ]	'harassment'
[laŋgul]	'monkey'
[ləŋg^{ɦ}ən]	'fasting'
[ləmbai]	'length'
[limboɭi]	'lemon tree'
[limbu]	'lemon'
[vənd^{ɦ}ja]	'childless woman'
[vəndən]	'bowing'
[ɦəŋgami]	'forth coming'
[ɦindu]	'Hindu'

between 'ã + voiceless consonant' sequence and 'ə + N + voiceless consonant' sequence. The second section gives words showing nasalization in vowels other than 'a'.

These indigenous words in the two sections provide further evidence to the assumption that (a) Gujarati phonology is favourable to nasalization, (b) 'ə' is never nasalized and (c) Nasalization must have been the result of N-loss. (see the data on p.).

3.4.4. Nasalization of the vowel 'u' in the final position

The nasalized 'ũ' in this data is the result of diachronic N-loss-nasalization acquired at an earlier stage. Pischel has noted that "final 'n' and 'm' become anusvāra"[44] and "final '-kam' of SKt becomes '-uṁ', '-u' in A. (i.e. in the nom. acc. sing neuter of the a - stems, in the nom. sing of the pronouns of the first and second persons, in first pers. sing of the indic pres. and in certain adverbs."[45] Over the period of development the final '-kam' of Sanskrit has become '-aũ' and Gujarati provides enough such examples. However, this nasalization of 'u' in the final position was always weak.[46] It has become weaker and weaker to an extent of almost getting denasalized as in this author's dialect. In other dialects it becomes very weak in the informal speech. But in the tight

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44. Pischel, 1957, p. 240. (Hemchandra: prākṛt vyākaraṇam 8:1:23 monusvārāḥ. antyamakārasyanusvāro bhavati.)

45. ibid, p. 243.

46. Divetia, 1915, p. 325.

*[gãʈʰ]	'knot'	[gəɳʈʰamɜɳ]	'charges for the knots'
[vãk]	'fault'	[vəɲkawũ]	'to go astray'
[nãkʰwũ]	'to throw'	[nəɲkʰavwũ]	'to get someone to throw'
[tʃãpwũ]	'to press'	[tʃəmpavwũ]	'to get something pressed through someone'
[tʃʰãʈwũ]	'to spray'	[tʃʰəɳʈavwũ]	'to get something sprayed through someone'
[ʈãkwũ]	'to cite / to stitch'	[ʈəɲkavwũ]	'to get stitched'
[ʈãtʃwũ]	'to shorten'	[ʈəɲtʃavwũ]	'to make short'
[dãfa]	'poking'	[dəmfas]	'boasting'
[ɖʱãkwũ]	'to cover'	[ɖʱəɲkavwũ]	'to get someone to cover'
[ʃãʈ]	'a tear'	[ʃəɳʈawũ]	'to get torn'
*[ʃãso]	'noose'	[ʃənsaj]	'to get torn'
*[vãtʃwũ]	'to read'	[vəɲtʃavwũ]	'to make someone read'
*[sãkʰwũ]	'to tolerate'	[səɲkʰavwũ]	'to make someone tolerate'
*[sãkɖu]	'narrow'	[səɲkɖaʃ]	'shortage of place'
*[ɦãkwũ]	'to drive'	[ɦəɲkavwũ]	'to make someone drive'

*[hãʃwũ]	'to be breathless or 'to get tired'	[həmʃavwũ]	'to make someone tired'

SECTION - II

*[kʰãsi]	'coughing'	[tʃũʈɳi]	'election'
[kʰõ̞tʃwũ]	'to push in'	[tʃĩtʰrũ]	'a rag'
[kʰĩʈi]	'a hook'	[tʃʰĩk]	'a sneeze'
[kʰũʈi]	'a hook'	[tʃʰĩkɳi]	'snuff'
[kʰũpwũ]	'to get stuck in something'	[tʃʰĩʈ]	'a cloth with small print'
[kʰõ̞kʰarwũ]	'to clear the throat'	[dʒʱõ̞so]	'fretting'
		[dʒʱĩkwũ]	'to thrust'
*[gãsɖi]	'a bundle'	[dʒʱãkʰrũ]	'branch'
[gʱũʈwũ]	'to powder, or to copy repeatatively'	[dʒʱĩtʰra]	'uncombed long hair'
		[dʒʱũpɖi]	'hut'
*[gʱẽ̞s]	'an eatable'	[dʒʱũsri]	'yoke'
[gʱõ̞tʃwũ]	'to pierce'	[dʒʱõ̞kwũ]	'to thrust'
*[tʃãtʃijo]	'pirute'	[ʈũpwũ]	'to strangle/to nip'
*[tʃãplũ]	'overwise'		
[tʃãpwũ]	'to press'	*[ʈʰãs]	'boasting'
[tʃũtʰwũ]	'to rummage'	[ʈʰõ̞swũ]	'to eat much'
[tʃẽ̞tʃẽ̞vpẽ̞tʃẽ̞]	'grumbling/ murmur'	*[ʃãʈijo]	'leg' (dimunitive)
[tʃõ̞ʈaɖwũ]	'to stick'	[ʈũkũ]	'short'
[tʃõ̞kwũ]	'to get startled'	[ɖũkʰ]	'stem'
		[dãs]	'mosquito'
[tʃũk]	'pain in stomach'	[dãkʰʃũ]	'stem'

[ɖũʈi]	'navel'
[ɖʰĩtʃəŋ]/ [gʰũʈəŋ]	'knee'
[ɖʰĩknũ]	'something'
[tãsʈi]	'a shallow vessel'
*[tõter]	'seventy three'
*[trẽsəʈʰ]	'sixty three'
[tʰũkwũ]	'to spit'
[ɖʰũsri]	'yoke'
*[pãsʈi]	'lung'
*[pãsrũ]	'straighten'
[pĩkʰwũ]	'to rummage'
[pũtʃʰɖi]	'tail'
[phõtʃwũ]	'to reach'
*[põk]	'roasted grains'
*[fãfa]	'dabble'
*[fãsi]	'to hang'
*[fãko]	'too much self-consciousness'
*[fẽkwũ]	'to throw'
*[fẽslo]	'final decision'
[bʰõkwũ]	'to pierce'
*[bʰẽs]	'buffalo'
[bʰĩt]	'wall'
*[mĩtʃwũ]	'to close'(eyes)
*[mõɖʰũ]	'face'
[rẽkɖi]	'a hawker's cart'
*[rẽʈijo]	'spinning wheel'
*[rũvaʈi]	'body hair'
[rũvaɖũ]	'body hair'
[rĩtʃʰ]	'bear'
[lãtʃ]	'bribe'
[lĩipəŋ]	'cow dung paste'
[lĩʈi]	'a line'
[lũʈ]	'loot'
[lõkɖi]	'fox'
*[vẽtʃwũ]	'to sell'
[vãso]	'back'
[vĩʈi]	'ring'
[vhẽtijo]	'dwarf'
*[sũʈʰ]	'dry ginger'
*[hãsi]	'to laugh ridiculingly'
[hĩtʃwũ]	'to swing'
*[hõʃijar]	'clever'
*[hõʃ]	'enthusiasm'
*[vhẽtʃwũ]	'to distribute'
[vãkɖo]	'dowry'
[vĩkʰwũ]	'to rummage'
[vẽt]	'a measure'
[sãsa]	'difficulty in getting things'
[sẽtʰo]	'parting of hair'
[hãsijo]	'margin on the paper'
*[hũf]	'cosy'
*[hõtʃi]	'braying noise'

phonation dialects this nasalization has conspicuously remained stronger. From the data that follows it would be clear that final 'ũ' is basically a neuter gender singular marker in Gujarati. Some nouns are inherently neuter. While as some nouns used for animate things may require the neuter marker in their relevant contexts. And inherently feminine or masculine nouns in their dimunitive usage take neuter marker. e.g. [tʃopɖũ] 'book' which normally is [tʃopɖi] (fem). Dimunitives are not necessarily derogatory in Gujarati. Very often dimunitive is used for fondling e.g. [tʃəulu] from a proper noun [tʃəula] 'girl's name'. The adjectives qualifying these nouns also take 'ũ' neuter marker, and infinitive forms in Gujarati are always expressed with neuter marker 'ũ'.

One clarification regarding '-ũ' marker is needed here. In Gujarati '-ũ' ending apart from being contrastive neuter marker, has one more function; whenever the gender has to be kept unmarked, neuter marker '-ũ' is used. Perhaps, we can say that in contexts when gender contrast is not required, neuter marker is used. i.e. any verb stem in its infinitive form is expressed with this '-ũ' marker. e.g. kər + w + ũ 'to do' dʒo + w + ũ 'to see' etc. Hence in the list which follows only the nouns which can take neuter are included, (see p. 485 - 488).

3.4.5. Questions from the data.

From this classified data a few questions arise:

1) Why 'V + N + voiceless consonant' sequences uniformly have N-loss and tautosyllabic

Nouns		Nouns	
[kɔ̰ʈʰũ]	'a fruit'	[tʃandũ]	'wound'
[kormũ]	'coarse flour'	[tʃaʈʰũ]	'spot'
[kʰaɳũ]	'food'	[tʃaɖijũ]	'back biter'
[kʰarijũ]	'pickle'	[tʃamɖũ]	'leather'
[kʰasɖũ]	'shoe'	[tʃəvaɳũ]	'an eatable'
[kʰisũ] / [kʰissũ]	'pocket'	[tʃankũ]	'pancake'
		[tʃipɖũ]	'eye mucus'
[kʰuɳijũ]	'corner'	[tʃibʱɖũ]	'a fruit'
[kʰokʰũ]	'box'	[tʃitʰrũ]	'rag'
[kʰoijũ]	'hammock'	[tʃokʈʰũ]	'denture'
[kʰorɖũ]	'hut'	[tʃokɖũ]	'cross/square'
[gədʒwũ]	'pocket'	[tʃogʱəɖiʃ̌ũ]	'an auspicious moment'
[gədʒũ]	'daring'		
[gəppũ]	'bluff'	[tʃoslũ]	'square piece'
[gəɭɳũ]	'cloth for sieving'	[tʃ̰panijũ]	'news paper'
		[tʃopɖũ]	'kind of bread'
[gaŋgɖũ]	'soft stones'	[tʃʰədʒũ]	'balcony'
[gaɳũ]	'song'	[tʃʰiɳɖũ]	'hole in the hedge'
[gəʈʰijũ]	'rogue'		
[gadlũ]	'matress'	[tʃʰapũ]	'news paper'
[gotʰũ]	'mistake'	[tʃʰibũ]	'shallow plate'
[goddũ]	'quilt'	[tʃʰogũ]	'tassel'
[gʱəmelũ]	'big pot'	[tʃʰotrũ]	'skin of the fruit'
[gʱəreɳũ]	'ornament'		
[gʱarũ]	'wound'	[dʒuʈʰũ]	'a lie'
[gʱoɖijũ]	'a crib'	[dʒʱãkʰrũ]	'twig'
[tʃəklũ]	'small sparrow'	[dʒʱulɳũ]	'swing'
[tʃəkamũ]	'spot'	[dʒʱolũ]	'dozing'

Nouns		Nouns	
[ʈoɭũ]	'crowd'	[dʱotijũ]	'dhoti'
[ʈopkũ]	'lid'	[dʱaɖũ]	'crowd'
[ʈolkũ]	'bald'	[notrũ]	'invitation'
[dʒʱəbʱlũ]	'baby frock'	[pəglũ]	'step'
[ɖɔglũ]	'one step'	[pəgərkʰũ]	'shoe'
[ɖətʃkũ]	'gurgling sound'	[tɔɭijũ]	'bottom'
[ɖəblũ]	'box'(dimunitive)	[pəɖikũ]	'packet'
[ɖaɳɖijũ]	'a stick'	[pəɖkʰũ]	'side'
[ɖʱimɖũ]	'bump'	[pətasũ]	'sugar ball'
[ɖʱĩkɳũ]	'anything'	[pətikũ]	'slice'
[ɖʱeʈũ]	'lump of clay'	[pənotũ]	'fortunate'
[ɖʱebrũ]	'an eatable'	[pɔllũ]	'dowry'
[təmarũ]	'yours'	[pəɲtʃijũ]	'small towel'
[tərɳũ]	'straw'	[paɲdʒrũ]	'cage'
[tapɳũ]	'bonfire'	[patrũ]	'leaf'
[teʈlũ]	'that much'	[panũ]	'leaf'
[teɖũ]	'invitation'	[parevũ]	'bird'
[tambũ]	'copper'	[pillũ]	'ball of thread'
[tʰəɖijũ]	'trunk'	[pəiɳɖũ]	'wheel'
[tʰaɳũ]	'police station'	[piʈʰũ]	'pub'
[tʰigɖũ]	'patch'	[pĩtʃʰũ]	'feather'
[tʰaɭũ]	'big lid'	[puʈʰũ]	'cover'
[divɖũ]	'lamp'	[poptʃũ]	'eyelid'
[dudʒʱɳũ]	'yielding milk'	[polkũ]	'blouse'
[devaɭũ]	'bankruptcy'	[peɖʱũ]	'gum'
[devũ]	'debt'	[fumtũ]	'tassel'
[doɖʱijũ]	'a coin'	[bətʃkũ]	'bite'
[dʱiŋgaɳũ]	'riot'	[bəʈkũ]	'bite'

Nouns		Nouns	
[bətʃ tʃũ]	'a little one'	[rəvəijũ]	'stuffed vegetable'
[bɔŋgũ]	'boasting'	[rəsoɖũ]	'kitchen'
[bɔɦanũ]	'excuse'	[rũvaɖũ]	'hair on the body'
[barɳũ]	'door'	[ləɻijũ]	'braid'
[bapɖũ]	'poor soul'	[ləfrũ]	'affair/ detenues'
[bavlũ]	'a statue'	[ləmɳũ]	'temple'
[bitʃʰanũ]	'bed'	[ləbɑ̃tʃũ]	'rag'
[bibũ]	'stamp'	[lakɖũ]	'wood'
[bogdũ]	'tunnel'	[lavrũ]	'little one of the goat'
[bʱədʒijũ]	'fritter'	[lugɖũ]	'cloth'
[bʱiŋgɖũ]	'scale'	[lutʃʰɳũ]	'cleaning cloth'
[bʱuŋgɻũ]	'tube'	[loɖʱũ]	'iron'
[bʱaɳũ]	'meal'	[vətʃkũ]	'objection'
[bʱulkũ]	'small child'	[vəɖũ]	'an eatable'
[bʱedʒũ]	'brain'	[vɦaɳũ]	'early morning'
[məɻkũ]	'a blink'	[vadʒũ]	'musical instrument'
[məɻoɖũ]	'mud'	[vasidũ]	'sweeping'
[məɖdũ]	'dead body'	[vɦɛ̃tijũ]	'dwarf'
[mɦeɳũ]	'taunt'	[ʃikũ]	'sling for hanging things'
[mameɾũ]	'present to the pregnant daughter'	[səgũ]	'relative'
[mɦarũ]/[maɾũ]	'mine'	[ʃəmɳũ]	'dream'
[mavɻʰũ]	'untimely rain'	[səntrũ]	'orange'
[mɦajrũ]	'marriage platform'		
[midʒagrũ]	'a hinge'		
[miɳɖũ]	'zero'		
[rəməkɖũ]	'toy'		

Nouns	
[səmbʱarn̥ũ] 'remembrance'	
[sisũ] 'lead'	
[sonũ] 'dream'	
[sonũ] 'gold'	
[hoḍkũ] 'small boat'	
[pərajũ] 'not one's own'	

nasalization in all the dialects?

If from 'ə + N + voiceless consonant' sequence, 'N' is lost, then [ə] changes to nasalized [ã]. In other words there is never any N-loss nasalization if the manifest vowel remains [ə], i.e. there can never be any nasalized [ə̃]; why?

2) Contrary to this, why in 'V + N + voiced consonant' sequences all vowels get manifested?

Why N-loss nasalization in case of 'V + N + voiced consonant' is not uniformly present in all the dialects?

3) Can the revertible relationship between 'ə + N' and 'ã' in the some morphemes be extended as the evidence for considering every nasalized vowel as the result of N-loss?

4) Does Gujarati data provide proof for Entenman's 'all or nothing' principle? (He proposes that in a language if N-loss nasalization occurs then it occurs in all the vowels at the same time in all the environments. He rejects all other proposals which say that some vowels nasalize earlier in the history than the others and in some contexts N-loss nasalization takes place earlier than in some other contexts.)

5) How do we interpret the nasals [ɲ] and [ɔ̃] which only appear as the components of homorganic 'N + C' sequences?

6) (a) Most of the examples of N-loss nasalization from tatsama vocabulary are of the nature;

ə + N + VL.C → ã + VL.C. why?

(b) Most of the examples of N-loss nasalization resulted from the sequence 'V + N + voiced consonant' have vowel 'ã';

a + N + Vd.C → ã + Vd.C. why?

Before answering these questions we propose to discuss the studies made by the earlier scholars.

3.5. Divetia's view points

Divetia prefers to call nasalization of vowels as 'soft anusvār'.[47] He notices varying degrees of 'softness' in anusvār. But Divetia has not searched for the reasons for such variations nor has he noted any dialect variations. He has connected 'soft anusvār' of Gujarati with the 'strong anusvār' of Sanskrit and prākṛt.

In the next section Divetia notes some words having 'spontaneous' nasalization.

SK	Prā/Ap/Deśya	Gujarati
tʃʰiɖrəkəm	tʃʰiɖɖəũ	tʃʰĩɖũ
məhargʱəkəm	məhəggʱəũ	mə̃gʱũ
mətkuɳə	məkkuɳə	mə̃kəɳ
mərkəʈəkə	məkkəɖəũ	mə̃kɖo
əkʃi	əkkʰi	ə̃kʰ
utʃtʃəkəm	utʃtʃəũ	ũtʃũ
uʂʈrə	uʈʈu	ũʈ
əʃru	əssu	ə̃su
bʱitti	bʱitti	bʱĩt

47. Divetia, 1916, p. 316.

This has also been referred to as 'unconditioned' nasalization by other scholars. Chatterji feels that it is "an old tendency in Indo-Aryan, imposed upon it, it may be, by the non-Aryan speeches towards articulating through both, the mouth and the nose and thus bringing in a nasalization" "....." onomatopoetics are a characteristic class of words in NIA which have nasalized vowels."[48]

Here a little diversion is called for. Labels such as 'spontaneous' or 'unconditioned' nasalization cannot explain the process. It is essentially a natural phonetic process which manifests itself in different ways in different IA languages. The difference between Gujarati, Marathi and Bengali has been noted in 3.0. The process of nasalization gets activated in some environments and though we cannot give any definite condition several suggestions based on phonetic teleologies could be extended. It is shown already that vowel 'a' is prone to nasality as well as it has inherent nasality. Some long vowels - vowels with duration - are also prone to nasalization; Nasalized vowels can spill nasality regressively and nasal consonant nasalizes neighbouring vowels. However for this kind of diachronic sound change one cannot pin-point the exact phonetic process. Hence it is difficult to give 'feeding order' or the rules showing application of phonetic process. Natural phonology insists on taking into account phonetic processes. This

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48. Chatterji, 1972, p. 368.

phonetic awareness is not ready to consider any change as completely 'unconditioned'. Donegan rejects the traditional labels such as 'unconditioned' or 'spontaneous' or 'unexplainable'.[49] From Divetia (or Chatterji) to modern phonology there is a clear difference in approach.

Divetia confuses homorganic clusters and nasalization by putting them under the same label 'anusvār'. He gives principles governing nasalization in Gujarati but his examples for the same are totally ill-classified, e.g. he brings words like [ekant] 'solitude' [pədant] 'word finally' and [kant] 'lover' under one label without considering the fact that [ekant] and [pədant] are compounds. The reason for bringing them together is that they all have 'tivra anusvār' and long preceding vowel. He interprets his 'nasalized soft consonants' like this: "the nasal of a class is changed to a nasalized pure sonant of that class when the syllable containing that nasal is accented" Divetia's data is reclassified below:

I

A		B	
[pan+ɖũ]	'leaf'	[pandɖũ]	A & B, both
[vanər]	'monkey'	[vandəro]	'exist'
[mini]	'cat'	[mindɖi]	
[dʒamɭi]	'purple'	[dʒambuɖi]	
[amɭũ]	'fruit of hog plum'	[ambɭũ]	

49. Donegan, 1978.

II

A (slow pronunciation)		B (quick pronunciation)
[saɳɖsi]	'tongs'	[saɳsi]
[k^haɳɖ]	'sugar'	[k^haɳ]
[raɳɖ]	'widow'	[raɳ]
	(derogatory)	
[k^haɳɖvi]	'an eatable'	[k^haɳvi]

III

A (standard speech)		B (uneducated speech)
[tʃamɖũ]	'leather'	[tʃambɖũ]
[gamɖũ]	'village'	[gambɖũ]
[tamɖi]	'copper pot'	[tambɖi]

IV

A		B	
[kuɭumb]	'family'	[kəɳbi]	'farmer'

(Diachronically changed into two lexical items).

V Marathi

A		B
[ʃeɳɖi]	'tail'	[ʃeɳka]
[daɳɖi]	'stick'	[daɳka]
[tambus]	'red'	[tamɖa]

VI Gujarati

A (careful - slow speech)		B (quick - careless speech)
[dʒindgi]	'life'	[dʒingi]
[pəsəndgi]	'choice'	[pəsəngi]
[gəndki]	'dirt'	[gəŋki]

From these examples it will be seen that when a closed syllable with the nasal consonant as a closing consonant, is followed by a derivational form, it may be required to make the final closure of the first syllable stronger by bringing the class consonant. This stops the formation of the non-homorganic sequence of the final nasal of the first syllable with the first consonant of the second syllable, see I and III. Contrary to this there is a tendency to simplify the cluster from 'N + C' sequence', see II. Such absorption of unreleased final stop is noted by Bloch.[50] He has noted that in 'N + voiced consonant' sequence, voiced consonant gets absorbed in IA languages, e.g. t∫umb > t∫um.

At the end of his section on nasalization Divetia has made an apt remark that d, b, ɖ, "when passed through nose are m, n, ɳ".[51] This can be best explained through Foley's strength parameter.[52]

Strength bond:

γ_1	γ_2	γ_3
Nd	N_d	n

γ_1 : normal bond between two adjacent but separate segments.

γ_2 : stronger bond combining two separate segments into a single segment (diphthong) which still maintains the identity of the original element.

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50. Bloch, 1965, p. 89-90.

51. Divetia, 1985, p. 331.

52. Foley, 1977, p. 43.

γ_3: strongest bond where two elements become one.

This shows that the sequence 'N + consonant' can take the strongest bond and be manifested as the single nasal i.e. γ_3.

3.5.1. Turner's view points:

The next scholarly work on 'nasals' is by Turner.[53] He gives four nasal consonants: 'ŋ, ɳ, n, m' thus excluding the palatal nasal. He considers final occurrences of 'ŋ + g' as 'ŋ' (perhaps, on analogy of English [siŋ]), but fails to note the 'ɲ ' in 'ɲ + dʒ' sequence in words like:

[rəɲdʒ]	'dissatisfaction'
[saɲdʒʰ]	'evening'
[aɲdʒ]	'apply in eyes!'
[maɲdʒ]	'scrub!'

In spite of having noted that "... n̊ is found finally as a current pronunciation of final '-n̊g' in pausa". Turner has not searched for such nasal substitutes for every nasal + voiced stop sequence i.e. 'mb, nd, ɳɖ' etc'. Actually any unreleased stop can become weak in 'pausa' but it doesn't disappear totally in Gujarati. The glottis has to be lowered for accomodating the continuous air-flow in voiced sounds. If the voiced stop is not released the open glottis cannot get closed for the required vibration and there may appear a slight voicing lag. For the voiceless stop the glottis is raised and if the stop is not released there is an absence of air-puff. So in 'pausa' such stops may get

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53. Turner, 1975, p. 26-38.

'unmarked' to a certain extent. However, the preceding vowel will be the indicator of the difference between the voicing of the stops in 'pausa'.[54] Hence, Turner's inclusion of 'ŋ' with 'm, n, ɳ' in Gujarati cannot be accepted. He does not differentiate between 'ãg' and 'ãk'. Actually 'ãg' is a non-Gujarati word; the real word is [əŋg] 'limb'-common to all standard educated dialects. Turner's approach to 'ŋ' remains the same in his 'Gujarati phonology'.[55] He assigns independent existence to it "through the loss of 'g' (final or preceding another consonant) when following a nasalized vowel". His examples are:

ãŋ 'body'

ãŋɳũ 'front of the house'

He considers 'ŋ' parallel to 'm' of 'am' 'mango'. This is surprising because we do have in Sanskrit the word[əŋgə] but never a word *[əmbə](for [amrə]). At prākrt stage we get [ãmb] and in Gujarati it is [amba] which is more frequently used than [am]. Turner's conclusions are mistaken as he has brought incorrect data such as 'sākhəl' 'chain', ãg 'limb' 'khām' 'pillar' (all three are Marathi words'.) and absurd sequence such as 'kãt' 'beloved'.

To sum up, Divetia's and Turner's studies don't throw much light on Gujarati nasals/nasalization.

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54. Contrary was also observed by Maran (1971) that the tone in Tibeto-Burmese is predictable from the voicing of the final consonant.

55. Turner, 1975.

3.5.2. Pandit's view points:

Next major work on nasalization is of Pandit.[56] He is casual about his use of the terminology, when he considers /ɳ/ [57] as a 'retroflex flap'. He has not mentioned the fact that 'flapness' is an allophonic feature of /ɳ/ when it is in medial position, e.g.,

[ʃaɳo]	'wise'
[kəɳki]	'husked rice'
[məɳko]	'bead'

Pandit's remark that "/n/ does not occur before retroflex stops"[58] can be very easily disproved in his own framework. In Gujarati the dimunitive suffix - 'ɖ + gender marker' - goes with any noun, e.g.,

[təndɖũ]	'body'
[məndɖũ]	'mind'
[bʰenɖi]	'sister'
[pandɖũ]	'leaf'

He gives distribution of [ɳ] and restricts its occurrence as a long geminated consonant. But at another place[59] he lists some Sanskritic clusters, in Gujarati having ' n̤ n̤' as in words like 'punn̤yə' 'moral merit'. He gives four nasal

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56. Pandit, 1957.

57. Symbol for retroflexed nasal.

58. Pandit, 1957, p. 165.

59. Pandit, 1963, p. 19 .

phonemes: /m, n, ɳ, N/ (where /N/ is a phoneme having nasal resonance as its distinctive feature). He has listed the contexts of the occurrence of the first three phonemes and given examples to support these contexts. Interestingly enough he has avoided giving examples for 'V + m + bilabial consonant', 'V + n + dental consonant' and 'V + ɳ + retroflexed consonant' (except for the word [pəɳɖit]). His fourth nasal phoneme /N/ has following allophones:

[ŋ] : /ə,əh/ [ɡ] /k,g/

[ɲ] : /ə,əh/ [ɲ]/tʃ,dʒ/

[ə̃] : /ə,əh/[ə̃]/ʃ,s,r,l,j,w/

[~] : occurs as the nasalization of the preceding vowels.

He has left out other environmentsfor the allophones [ŋ] and [ɲ] such as:

[bʰuŋg[ũ]	'pipe'	/u/[ŋ]/g/
[ʃiŋgɖũ]	'horn'	/i/[ŋ]/g/
[dʰoŋgi]	'hypocrite'	/o/[ŋ]/g/
[saɲdʒʱ]	'evening'	/a/[ɲ]/dʒʱ/
[piɲdʒaro]	'willower'	/i/[ɲ]/dʒ/
[puɲdʒi]	'wealth'	/u/[ɲ]/dʒ/

So also his contexts for the third allophone [ə̃] are incredibly confused. The speakers of standard Gujarati can be divided into two groups. One group retains Sanskritic pronunciation; such as [kə̃us] 'name of the demon', [və̃uʃ] 'lineage'. It should be noted that it is the complete sequence 'əu' which gets nasalized. The other group

brings homorganic sequence in these words, e.g. [kəns] and [vəɲʃ]. All his examples for [ə̃] are tatsama words. Only when followed by [s/ʃ], speakers show these two variations. When [ə̃] is followed by glides or liquids both the groups have [ə̃u] and not [ə̃] , e.g.

[sə̃uhar]	'destruction'
[sə̃urəkʃə ɳ]	'protection'
[sə̃iɟog]	'opportunity'
[sə̃uwənən]	'courting' etc.,

We have noted earlier that independently [ə] is never nasalized.

Pandit is trapped in a distributional fallacy when he says that "if the preceding vowel is other than /ə/, /əh/ then the first two allophones [ŋ,ɲ] vary freely with the fourth allophone [~] ."[60] This is implausible because when speakers have [~] which is obviously after 'N-loss/reduction', how can there be any free variation with the lost nasal? Pandit has avoided noting that [~] can also substitute other nasal phonemes /m, n, ɳ/. If we define this substitution 'Pandit way' then these three phonemes will also be in free variation with [~] . This will be sheer absurdity and it is very obvious that to avoid this absurdity Pandit has not given homorganic nasal + consonant sequences which are so natural to Gujarati'. He feels that such sequences are localized in a very limited set of environments and "the contrast between different types of nasal phonemes is not neutralized before consonants."[61] To prove this statement

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60. Pandit, 1957, p. 166.

61. ibid, p. 168.

and to refute Firth and Allen[62] he gives another set of examples asserting that "before stops there is only one homorganic nasal". His examples:

[tʃimki] 'pinch'

[maɳki] 'swift mare'

[dʒaɳki] 'Sita's name'

He gives Marathi examples too:

[tsəmki] 'nose ring'

[dəɳka] 'stroke'

Such heterorganic 'N + consonant' sequences of his examples can be questioned if we give serious consideration to the proper phonology of the language.

The present study has all along excluded the heterorganic 'N + C' sequences' from the data for two theoretical reasons - one is that they are phonetically unnatural and second is that every linear sequence is not to be treated as

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62. Firth: "Nasals and nasalization in Sanskritic languages raise fundamental questions of phonetic and phonological theory, and also problem for Roman transcription. Let us take Marathi for instance; In initial position only two nasal consonants can be used, **n** and **m**. In final position there is three-term nasal alternance but immediately preceding another consonant, especially stops, only one is possible, the nasal homorganic with the following consonant." ('Phonological features of some Indian Languages' from 'Papers in Linguistics'.1957,p. 51).
Allen: The homorganic nasals form a single phonological unit and a phonological transcription will recognize the fact." 1953, p. 45.

'cluster'. The phonology discards or challenges any phonetically impermissible sequence/combination of sounds. No doubt that phonotactics of speech sounds includes language specific morphophonemic changes. But their operation will basically depend on natural phonological processes and rules. As Vennemann says when speech sounds combine they do so according "to stringent laws and they can alter contextually if they enter phonetically impermissible combinations. A natural phonological rule finds application in numerous languages; there is no language with a contrary process and the process can be explained phonetically."[63] The topic of nasal assimilation is so well-discussed and accepted that Pandit's remarks surprise us. The homorganicity of nasal and the following consonant, independent of the structure of any language can be explained on grounds of physical constitution of humans. It is more natural to articulate a nasal at the same point of articulation as the following consonant than to take in two different points of articulation in rapid and precise succession. Pandit did not think of the subtle issue involved in such heterorganic 'N + voiced consonant' sequences. All consonants coming in a linear order do not go to make phonological 'clusters' of the language. Syllabic extensions due to derivational or inflectional formations may bring any two or more consonants in juxtaposition, e.g. Gujarati verb

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63. Vennemann, 1975, p. 21.

stem [rəɭ -] 'earn' when, is followed by [-to] suffix of present continuous, we get [rəɭto] 'earning' and as a result we get -ɭt- as a sequence. Same stem followed by the future marker will give [rəɭʃe] 'will earn', i.e. -ɭʃ- in a sequence. Many more such juxtaposed consonant sequences can be cited. Are we to include -ɭt- and -ɭʃ- amongst the clusters of Gujarati? Pandit's data can be classified as below:

I	[rəm|to]	'playing'
	[man|to]	'believing'
	[tʃəɳ|to]	'building'

Here there is a clear morphemic and syllabic break.

II	[bʰam|ʈo]	'brahmin'
	[tʃan|ki]	'piece of bread'
	[tʃim|ki]	'pinch'
	[kəɳ|ki]	'husked rice'

Here, in the first word there is a derisive ending [-ʈo]. A parallel example with [-ʈo] is [tʃorʈo] 'thief'. The other words have dimunitive ending [-ki]. Gujarati has large number of onomatopoetic, dimunitive, derisive and derogatory endings. These endings indicate a potential syllable break before them. Parallel examples to this are plenty: [parki] 'not own', [savki] 'step', [bəʈki] 'short' etc.,

III	[dʒan|ki]	'Sita's name'
	[vəɳ|si]	'destroyed'

Here we have a clear break as [dʒanki] is from [dʒənək] 'Sita's father' and [vəɳsi] is from [vəɳəswũ] 'to get destroyed'. The short vowel [ə] is dropped with syllabic

extensions. Other IA languages too have such examples.

Marathi:	[narəɭ]	'coconut'	[narɭi]	'of coconut'
	[wadəɭ]	'cloud'	[wadɭi]	'of cloud'
Hindi:	[pəkəɖ]	'catch'	[pəkəɖta]	'catching'
	[mətʃəl]	'crush'	[mətʃəlta]	'crushing'

Morphological syllabic extensions, stress change, syllabic break, potential juncture, etc., are highly complex matters and very little is known about such sequential aspects. Precisely for this reason we cannot include all such sequences along with the phonological phenomena. All NIA languages have such issues (homorganic 'N + C' sequences) and they should be resolved by keeping in mind these considerations.

Even to this day when there is more light thrown on natural phonetic processes some generative phonologists include all juxtaposed consonants along with other natural clusters. It is clear that consonant sequences in the language are of two types. The first type of sequences are naturally bound clusters; the bond between the components of these clusters is very strong. This bond may affect these components and may bring assimilative changes. The second type of sequences are the linear order of consonants, very often juxtaposed cross-juncturally. The first type of sequences are part of the segmental level of phonology but the second type of sequences which apparently involve segments are the part of the rhythmic structure or of asegmental phonology. Theoretically as well as methodologically the question is: is it possible to have a common set of rules for both these types? One cannot neglect

these differences. Those who neglect them are neglecting a very fundamental issue of phonology.[63a]

3.6. Answers to the question:

This section tries to answer the questions posed in 3.4.5. These are the main questions, although one may add some more to the list.

The first two questions cover the most interesting area of nasalization in Gujarati and a thoughtful consideration of these questions may throw light on nasalization in general.

63a. Dey (1979, IL. 40:2.2) tries to give a general rule by including the second type of sequences along with the first type. But with this rule he is not able to explain the behaviour of 'native' sequences in Bengali. In fact the differences between indigenous and tatsama-tadbhava sequences indicate that there are 'co-existing phonemic systems' in the language. But Singh (1980 IL 41:12. 2) tries to solve the issue by positing '-g' after 'ŋ' in the words like [lɛŋʈa] 'nude', [bʰaŋtʃi] 'slander' [maŋ-na] 'free of cost', [ciŋ-ɣi] 'prawn' etc. His posited '-g' will automatically give natural homorganic sequences but his reason for doing so is to get Dey's rule predict rightly. However, Singh has to have g-deletion rule later in order to get correct words! Dey has noted optional forms like [ʃOŋbit] /[ʃOmbit] and posited [ʃOŋwit] as an underlying form. But 'w' is not explainable either phonologically (as no where in the language-use or in linguistic description it is called for) or phonetically. One should ask why 'ŋ' appears where assimilatively 'm' seems to be the correct nasal before 'b'. It can be suggested that

Gujarati and Marathi show diverse streams in the development of nasal elements. Where Gujarati favours N-loss nasalization Marathi retains 'V + N + C' sequence, if the 'V' is 'i' or 'u'; or shows denasalization if the vowel is 'e, o', or 'a'. Gujarati nasalization favours its expression before voiceless consonants and as can be seen Gujarati phonological frame is appropriate for nasalization in general. This expression of nasality can be explained as one of the natural phonetic possibilities. Nasal consonant spills nasality regressively as well as progressively. When the progressive nasality is hindered by voiceless consonants immediately following the nasal consonant then the regressive nasality gets stronger and brings the change in the preceding vowel. When voiced sound follows the nasal consonant the phonetics of nasality changes.

60a (contd.)

there is a natural assimilation process taking place; either 'N' is assimilated to the back vowel 'o' or is assimilated to the following 'b'. There is one phonetic quality [+grave] common between 'm' and 'ŋ'. Dey and Singh want to have rules with the stamp of 'maximal generality' which forces them to include any linear occurrence of consonants with naturally bound consonant clusters. The question we face is how does one exclude the unnatural clusters from the natural ones? It is very likely that 'juncture' of every type plays an important role in such decisions and that automatically leads us to an inevitable issue of syllabication.

Gujarati nasalization is best manifested before voiceless consonant and it is tautosyllabic in the context 'V + N + C'. This is true of both the sets of data: tatsama/tadbhava or indigenous. We can illustrate comparable difference between the way Marathi and Gujarati express their nasal elements:

[ĩ] Gujarati

[kʰĩʈi]	'hook'	[tʃʰĩk]	'sneeze'
[tʃĩtʰrũ]	'rag'	[tʃʰĩʈ]	'small print'(cloth)
[lĩʈi]	'line'	[dʒʱĩkwũ]	'to thrust'
[vĩkʰwũ]	'to rummage'		

Marathi does not efface the nasal as can be seen from the following words:

[ʃiŋkə]	'sneeze'	[ɖiŋkə]	'gum'
[tʃiɳtʂə]	'tamarind'	[pimpə]	'drum'

Marathi stretches the sequence 'V + N +VL.C' even in the borrowed vocabulary, e.g. English word 'minute' is spoken as [miɳʈə].

[ũ] Gujarati

[kʰũpwũ]	'to get stuck'	[ʈũpəɳ]	'kneading'
[kʰũtʃəvwũ]	'to snatch'	[ʈũkũ]	'short'
[gũtʃ]	'entangled hair'	[tʰũk]	'spit'
[gʱũʈəɳ]	'knee'	[ɖũkʰ]	'sprout'
[tʃũk]	'shooting pain'	[ɖũʈi]	'navel'
[tʃũtʰwũ]	'to rummage'	[dʱũsri]	'yoke'
[dʒʱũʈəwwũ]	'to snatch'	[dʱũso]	'blanket'
[fũk]	'blowing'	[sũʈʰ]	'ginger' (dry)
[fũfaɖo]	'hissing'	[hũf]	'warmth'
[dʒʱũpɖi]	'hut'		

Marathi words have V + N + VL.C. sequence.

[guntə]	'entangled hair'	[tʰuŋki]	'spit'
[pʰuŋkə]	'blowing'	[sunʈʰə]	'ginger' (dry)

[ẽ] Gujarati

[kʰẽtʃwũ]	'to pull'	[rẽ̬kɖi]	'hawker's cart'
[gɦẽ̬s]	'a food preparation'	[ɸẽ̬slo]	'verdict'
[rẽ̬ʈijo]	'spinning wheel'	[ɸẽ̬kwũ]	'to throw'
[vɦẽ̬tʃwũ]	'to distribute'	[ɸẽʈo]	'turban'

Marathi does not retain 'N' after [e].

[pʰekɳe]	'to throw'	[pʰeʈa]	'turban'

[õ] Gujarati

[kʰõ̬tʃwũ]	'to push in'	[ɦõ̬ʃijar]	'clever'
[gɦõ̬tʃwũ]	'to push in'	[tʃõ̬kwũ]	'to get startled'
[ʈʰõ̬swũ]	'to eat much'	[tʃõ̬ʈwũ]	'to stick to'
[lõ̬kɖi]	'(she) fox'	[põk]	'parched grain'
[bɦõ̬kwũ]	'to stab'	[rõ̬tʃo]	'duffer'
		[ɦõ̬ʃ]	'zeal'

Marathi does not retain 'N' after [o].

[kʰotsɳe]	'to push in'	[bɦokɳe]	'to pierce'
[bɦok]	'hole'	[ʈʰosɳe]	'to eat much'

[ẽ] and [õ] are not found in tatsama/tadbhava/vocabulary.

(except in a word or two)

[ã] Gujarati

[kʰãtʃo]	'corner'	[tʃãplu]	'overwise'
[gɦãʈo]	'shout'	[tʃʰãʈwũ]	'to spray'
[gɦãtʃi]	'oil-seller'	[dʒɦãkʰrũ]	'dry twig'
[gãsɖi]	'bundle'	[ʈãki]	'tank'
[tʃãʈʃijo]	'pirate'	[ʈãʈijo]	'leg' (derisive)

[tʃ̃ap]	'clip'
[tʃ̃apwũ]	'to press'
[dʰ̃akɳũ]	'lid'
[dʰ̃atʃo]	'mould'
[pãsrũ]	'straightened'
[ʃ̃akɖũ]	'smart'
[ʃ̃ako]	'pride'
[lãtʃ]	'bribe'

[ʈ̃ãtʃ wũ]	'to shorten'
[ʈʰ̃ãs]	'boasting'
[dãkʰɭi]	'stem'
[ṽakɖo]	'dowry'
[sãsa]	'dirth'
[ʃ̃akwũ]	'to drive'
[tãs ɭi]	'shallow plate'
[bãkɖo]	'bench'
[sãtəɭwũ]	'to fry'
[sãkʰwũ]	'to tolerate'

Marathi has totally denasalized the sequence 'N + C' when the vowel is [a].

[tsap]	'clip'
[tsapɳe]	'to press'
[dzʰakəɳ]	'lid'

[ʈaki]	'tank'
[ʈatsɳe]	'to shorten'
[bak]	'bench'
[hakɳe]	'to drive'

3.6.1. Phonetics of voiced consonants:

Many researchers have found that the pressure in pharynx differs for voiced and voiceless stops. Lubker et al[63b] have found greater EMG activity for voiceless consonants than for voiced consonants. They have also found that the nasal air flow noted occasionally during non-nasal voiced consonants is not sufficient to provide voicing. In order that voicing should continue during the production of voiced consonants, the supraglottal and subglottal pressures should not be equal. The pharyngeal structure is capable of seeing that voicing does not stop. Dixit and Mackneilage[64] found greater velic leakage for voiced consonants and they felt that this leakage is necessary for preserving voice. It is suggested here that this leakage may also preserve the preceding nasality, i.e. prevent it from getting completely effaced. The leakage brings intrinsic nasality in voiced consonants. The progressive nasality is carried over easily because of the leaky velum and as a result regressive nasality cannot become strong enough. This retains the nasal element atleast in reduced form even after the process of N-loss is activated. Rothenberg suggests that one mechanism for voiced stops requires velopharyngeal opening. Without a transglottal pressure differential there can be no voicing.[65] A slight opening of the velum is one possible way of getting

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63b. Lubker et al, 1970. p. 9-20.

64. Dixit and Mackneilage, 1978.

65. Rothenberg, 1968.

pressure differential. When a voiced stop comes after a nasalized vowel the velum must go from a fairly open position of vowel to a fairly closed position for the consonant, i.e. after N-reduction which takes place when the following consonant is voiced. Now if the oral closure occurs before the velum is fairly close, the reduced nasal consonant gets fully manifested. This manifestation can be prevented if the velum is closed before the oral closure. But such co-ordination between these two gestures is difficult. Brito[66] conducted a test with literate Portuguese speakers making them read the list of nonsense words. The words were written CVCV. It was noticed that in the four words γĩbo, sĩda, rẽba, sẽge the first syllable was read as 'CVN'. When the words were fũto, ãpo, tõco, the first syllable was read as 'CṼ'. Brito's experiment gives a good support to our observations in Gujarati. Rothenberg's observations thus seem highly plausible. Malecot's[67] remarks regarding the English dialect also help in confirming this difference between voiced and voiceless consonants. He refers to the situation where /t/ and /d/ become flaps. The word 'auntie' is pronounced [æ̃ti] and 'Andi' is pronounced [ændi]. Ohala's[68] conclusions are rather contrary to this because she has not thought of the phonetics of voiced consonants in context of nasal consonants. She feels that in Hindi N-loss occurs before voiceless stops and not before voiced ones. Bloch[69] has referred to similar situation in

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66. Brito, 1975.

67. Malecot, 1960.

68. Ohala, 1972.

69. Bloch, 1965.

Marathi. And if one does not look into various differences in the manifestation of 'V + N + voiced consonant' sequences, one would conclude similarly about Gujarati too. Ohala posits underlying forms for the word for 'moon' as [tʃ and] and for the word for 'tooth' as [dat]. She rejects [dant] as an underlying representation because it will mean "positing an abstract form and to posit such abstract form we would need evidence of the psychological reality of such an underlying nasal". The validity of this approach has been already questioned by Entenman. Standard Hindi in its vocabulary certainly has a compound such as [dəntə məŋɳdʒən] 'tooth powder' or related pairs such as [sɑ̃kəl] 'chain' - [səŋkələn] 'collection, [ɑ̃kna] 'to draw' -[əŋkit] 'drawn',[kɑ̃pna] 'to shiver' - [kəmp] 'shiver'. No doubt, there is a possibility that the sequences such as 'N + VL.C' are the results of late borrowings from Sanskrit; but the factor of co-existing phonemic systems has to be accepted. Ohala's criterion of psychological reality is not correct. In fact Rothenberg's experiments conform to and help to explain the actual positions in Gujarati. The positions differ depending upon the dialect and phonation differences as shown on p. 512.

Tight phonation dialects throw important light on the behaviour of nasality. In dialects 2,3 there is a glidal element which disappearing nasal leaves behind. Gujarati provides interesting evidence for this theory of N-reduction where vowels get nasalized after N-loss before voiceless consonants but as there is no complete N-loss due to voicedness of consonants, the nasalization of the vowels before such reduced 'N' is not strong; it is the regressive velic adjustment.

Murmur dialects$_1$: V + N + voiced consonant;

[gand^{ɦ}i]	'grocer'	[saɲɖʒ^{ɦ}]	'evening'
[mandi]	'ill, sick'	[gaɳɖo]	'mad'
		[aŋgɳũ]	'front of the house'

Murmur dialect$_2$: $\tilde{V}$ + voiced consonant;

[gãd^{ɦ}i]		[sãdʒ^{ɦ}]
[mãdi]		[gãɖo]
		[ãgɳũ]

Murmur dialect$_3$: a + N + voiced consonant → $\tilde{ɔ}$ + voiced consonant;

[gɔ̃d^{ɦ}i]		[sɔ̃dʒ^{ɦ}]
[mɔ̃di]		[gɔ̃ɖo]
		[ɔ̃gɳũ]

Tight phonation dialect$_1$: V + N + voiced consonants;

(same as murmur dialect$_1$)

Tight phonation dialect$_2$: a + N + voiced consonant →

$\tilde{a}$ + $\tilde{j}$ + $^{-N}$ + voiced consonant

[bãj̃^{ɲ}d^{ɦ}]	'tie'	[sãj̃^{ɲ}dʒ^{ɦ}]	'evening'
[vãj̃^{ɲ}dʒ^{ɦ}ɳi]	'childless woman'	[g^{ɦ}ãj̃^{ɲ}dʒo]	'barber'

Tight phonation dialect$_3$: a + N + voiced consonant →

$\tilde{a}$ + $\tilde{J}$ + voiced consonant

[bãj̃d^{ɦ}]	[sãj̃dʒ^{ɦ}]
[vãj̃dʒ^{ɦ}ɳi]	[g^{ɦ}ãj̃dʒo]

3.6.2 Nasality in Marathi:

Marathi shows very different development of its nasality. Kelkar[70] notes that in Marathi all voiced stops are prenasalized after V^n (his symbol for nasal vowels). We have shown that Marathi vowels get denasalized before voiceless consonants (i.e. after N-loss), but retain the sequence 'V + N' before voiced consonants. Sardesai[71] gives the evolution of the word for 'onion' as [kā:^{n}da]>[ka:nda] and feels that phonetically the transitional nasal element '-n' might have also helped to regain the nasal consonant fully. In Marathi there is complete N-loss and after that complete denasalization (before voiceless stops) or there is N-reduction (theoretically the result of N-loss) i.e. N-retention, reacquisition of nasal and denasalization of mildly nasalized vowels (before voiced stops). See the flow diagram p. 514, for comparing the behaviour of nasality process in Gujarati and Marathi.

3.6.3. Nasalization as a process occurs uniformly:

The fourth stage in Gujarati as shown in the flow diagram (on p. 514) throws light on the question as to why denasalization has taken place before voiceless stops, i.e. the nasalized vowels after N-loss have started loosing their nasalization gradually. The process of denasalization has begun in my dialect. The situation of this dialect speakers is in some ways parallel to Marathi. But Gujarati shows the process of denasalization to be gradual;

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70. Kelkar, 1968.

71. Sardesai, 1930 p. 537 - 565

NASALITY PROCESS

MARATHI

51

V+N+C. co-articulatory regressive nasalization (I)

- * dãnt
- * kãnda

II N-loss

- complete → * dãt before voiceless stop
- partial (Phonetically N-reduction) → * kã -n da before voiced stop the transitional nasal remains

III Vowel Denasalization

- complete → dat
- partial → * ka -n da

IV Reacquisition of the 'N' from the transitional nasal → kanda

GUJARATI

~ = Coarticulatory mild nasalization

• = coarticulatory milder nasalization

V+N+C co-articulatory regressive nasalization (I)

- * dãnt
- * bãnd^{h}

II N-loss

- Complete, resulting into stronger nasalization. Dialectally → i) b$\tilde{\tilde{a}}$ d^{h} before voiced stop
- Partial (Phonetically N-reduction) → ii) * ba -n d^{h} before voiced stop the transitional nasal remains.

III Reacquisition of the 'N' from the transitional nasal

- Dialectally → ii) band^{h}
- impossible

IV Vowel denasalization begins

- Dialectally → dat
- impossible

Complete, resulting into stronger nasalization. Dialectally → d$\tilde{\tilde{a}}$ t before voiceless stop

$\tilde{\tilde{}}$ = Resulted stronger nasalization

* = non-synchronic forms.

eg:-

(i) nasal effacement ⟶ strong nasalization ⟶

(ii) ⟶ strong nasalization ⟶ mild nasalization ⟶

(iii) ⟶ mild nasalization ⟶ denasalization.

The strongly murmured dialects of Baroda-Ahmedabad area don't show such denasalization as yet. It is noted that the strong murmur and nasalization have very close phonetic bond.[72] It is possible that the position of glottis and tenseness caused in the surrounding musculature for tight phonation is favourable to nasalization. The speakers of the three main dialects of tight phonation never denasalize the vowels before voiceless consonants; and theoretically before voiced consonants, complete nasality loss is impossible. Because there is no N-loss and strong nasalization, but the reduced '-n' before voiced consonants. Ultimately this '-n' is reaquired resulting into 'V + N + voiced consonant' sequence. e.g. we may get:

A

1. [kãʈo] ⟶ [kaʈo]
2. [vãk] ⟶ [vak]
3. [bãkɖo] ⟶ [bakɖo]
4. [lĩʈi] ⟶ [liʈi]
5. [bʱũkwũ] ⟶ [bʱũkwu]

but we never get:

B

1. *[bãdʱ] ⟶ [badʱ]
2. *[bʱãg] ⟶ [bʱag]
3. *[rãɖ] ⟶ [raɖ]
4. *[gãɖũ] ⟶ [gaɖu]
5. *[bãɖo] ⟶ [baɖo]
6. *[vãɖʱo] ⟶ [vadʱo]

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72. Ohala (see foot note 42, Chapter I.)

In fact the words on the right of the arrow are meaningful lexical items and except no. 3 (which is not a lexical item in the strongly murmured dialect) all the words are in contrastive relationship with the words on the left of the arrow. i.e. the nasalized vowels are in contrast with the non-nasalized ones. The very fact that the language provides with such words which can be in contrast with the words having nasalized vowels goes to prove that language disallows nasality-loss before voiced stops whereas the words with voiceless stops (in the list A) can be denasalized without creating any phonological difficulty. This observation about Gujarati has enormous theoretical potentialities. The first sequence such as 'V + N + voiced consonant' can have as one of the possibilities, N-loss nasalization and as the other '$\tilde{V}$ + $\tilde{\text{glide}}$ + $^{-n}$ + voiced consonant' but never a complete nasality loss. All this cannot be explained correctly without taking the help of phonetics.

All the phonetic variations which are attributed to dialect differences compel us to ask a question: 'Did nasal-effacement take place earlier, before the voiceless consonants than before the voiced ones?' Lightner[73] believes in the sequential spread of nasalization over the <u>time</u>; i.e. the phonological nasalization can appear gradually in the language. Such hypothesis is called <u>gradualist</u> or <u>quantal</u> assumption. Linguists assume that development of nasalization proceeds through some parameters such as vowel height, syllable shape, consonantal environment etc., The irregularities seen in the synchronic data are attributed to such 'imperfect rules' regarding the development of nasal

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73. Lightner, 1970. p.179-226

vowels. Entenman[74] strongly rejects this gradualist hypothesis. He believes that the regressive nasalization takes place before all nasals, in all vowels at the same time. It is proposed here that the N-loss must have occurred in Gujarati uniformly at the same time. The difference between the behaviour of nasal consonant before voiceless and voiced stop can be attributed to velopharyngeal dynamics. The inherent phonetics of voiced consonant retains the nasality element and ultimately regains the lost nasal. However, N-loss - nasalization - denasalization seem to be in progress; and Entenman's proposal is theoretically convincing.

3.6.4. Relationship between 'ə' and 'a':

Accepting theoretically that this process occurred in all the relevant contexts then 'ə' which is never nasalized poses a question. What intrigues one most is that though maximum examples of N-loss are seen when the sequence is 'ə + N + C', there is never an example of nasalized [ə̃] (because after N-loss the sequence is 'ə̃ + c'). The relationship between 'ə' and 'a' leads to two more questions: Does it mean that when N-loss occurred 'ə' and 'a' were not distinct? Does nasalization bring lowering of the vowels? Answer to the first question involves a complete diachronic data and though crucial it cannot be dealt with here. The answer to the second question will throw light on the relationship between 'ə' and 'a'. Phonetic researches of low vowels have amply shown that low vowels have greater nasality and greater velopharyngeal opening. It is recorded that low vowels have lower fundamental frequencies, greater duration and higher

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74. Entenman, 1976.

average intensity and peak power than high vowels. It is observed that larger duration and higher intensity cause increased nasality. Bell Berti[75] found that low vowels exhibit participatory nasal coarticulation at the EMG level, whether or not coarticulation is evident at the acoustic signal level. Gujarati examples go to support this. Low vowel [a] can carry strong nasalization. In one of the murmured dialects where there is N-loss nasalization before voiced consonant the vowel is always [a] e.g.

[diɳɖi]	'meter' (poetry)
[dãɖi]	'stick'
[limbu]	'lemon'
[lãbu]	'long'
[kundən]	'girl's name'
[kãda]	'onions'
[guɳɖo]	'ruffian'
[gãɖo]	'mad'
[gəɳɖo]	'rhinoceros'
[gãɖo]	'mad'

Most of the work on universal tendencies of nasalization say that low vowels nasalize readily. But Entenman's[76] view seems to be more plausible that languages tend to lower nasal vowels not that they tend to nasalize low vowels. To make it more general it can be said that vowels change their quality when nasalized and some show lowering of the vowel when nasalized. Ofcourse vowel quality change can be due to variety of other factors too. (This has been discussed while showing mid-vowel lowering

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75. Bell Berti, 1973.

76. Entenman, 1976.

in chapter II). Syllabic extensions also can lower the vowels. Actually the final judgement on behaviour of certain vowels will ultimately depend upon an understanding of all the processes at work in each language. In Gujarati nasal sounds or nasalization is one of the reasons for such phonetic lowering, vowels 'ə' and 'a' are lowered in such contexts as compared to their oral counterparts.

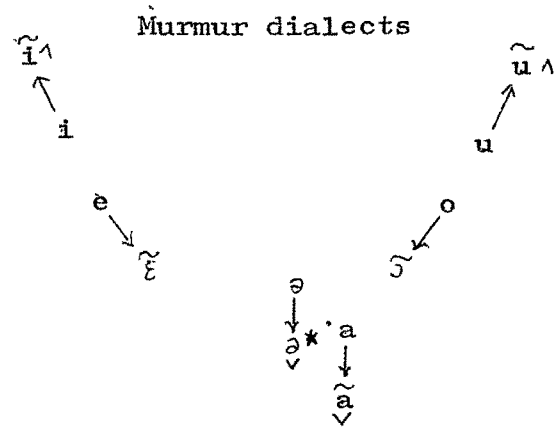
[kəp]	'cup'	[kə̰n̰]	'grain'
[gət]	'plight'	[gə̰n̰]	'count'
[gəp]	'bluff'	[gə̰m]	'understanding'
[vas]	'small'	[vã̰s]	'bamboo'
[kap]	'cut'	[ka̰n̰]	'mourning'
[daɦ]	'burning'	[da̰m]	'money'
[radʒi]	'pleased'	[ra̰ni]	'queen'

However, such environmental lowering depends upon total phonological framework of the language. Marathi does not show such lowering. Marathi refrains from such process and shows fortition process which may raise the vowels, e.g.

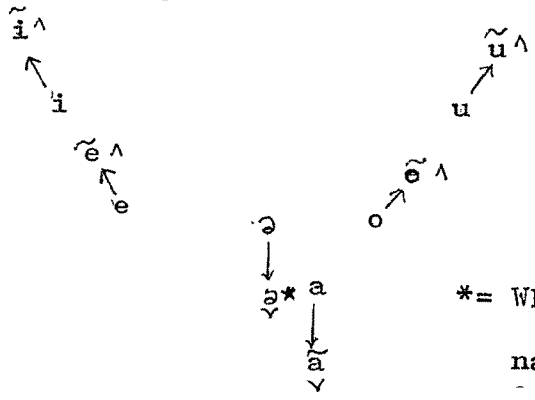
Marathi	: [veɳi]	'flower-garland'	
	[sena]	'army'	
Gujarati	: [veɳi]		
	[sena]		

The phonation differences act as a decisive factor in bringing changes in the vowel quality. In some murmur dialects when nasalized, the high vowels go higher, and mid and low go lower. In some tight phonation dialects high and mid both go higher when nasalized.

Murmur dialects



Tight phonation dialects



*= When followed by a nasal consonant.

Tight phonation brings (Jamnagar area, Rajkot area and Junagadh area dialects) a strong tensing effect and it is like an all pervading fortition prosody.

In short nasality brings quality change in vowels. Divetia and Pandit have gone in a reverse direction as they believe that mid-open 'ɛ' and 'ɔ' are nasalized and mid-close 'e' and 'o' are not. In fact from the data it was noticed that the quality change has not become phonological. It is only a contextual result. Moreover, it is proposed that nasality allows fewer vowel distinctions than orality. In Gujarati nasality has become a controlling force and has played a role of a guard to mid-vowel distinctions - i.e. it prohibits 'e - ɛ' and 'o - ɔ' from becoming distinct. It merges them phonologically.

Returning to the issue of vowel 'ə' it can be said that lowering of 'ə' to 'a' cannot be exclusively due to nasalization. 'ə' has a very specific behaviour as compared to the other vowels:

1) 'ə' never occurs word finally except after the Sanskritic clusters:

[ənnə̀]	'food'	[spəʂ̺ə]	'clear'
[kəʂ̺ə]	'pains'	[tuʂ̺ə]	'satisfied'
[puʂ̺ə]	'healthy'	[vjəstə]	'engaged'
[amrə]	'mango'	[nrutjə]	'dance'
[vidjə]	'existing'		

However, when there is '-N + C +ə#' in Sanskritic clusters Gujarati does not retain the final 'ə'

[rəŋg]	'colour'	[pəɲtʃ]	'five'
[səŋg]	'together'	[bʰəŋg]	'broken'

It is interesting to note that in Marathi Sanskritic as well as indigenous words can end in 'ə'.

2) 'ə' has a highly restricted occurrence as 'ə' is the only vowel which does not occur as any of the inflectional endings in Gujarati.

Feminine marker	:	'-i'
Masculine marker	:	'-o'
Neuter marker	:	'-ũ'
Plural marker	:	'-a'
Present tense 2nd and 3rd person marker	:	'-e'
Instrumental case marker	:	'-e'.

This shows that Gujarati has diachronically avoided the final occurrence of 'ə'.

3) Hence 'ə' cannot take closed second syllable stress.

4) As a single vocalic element it can never be nasalized.

As 'ə' cannot occur in the final position and cannot take nasalization it remains an <u>inadequate</u> vowel phoneme. It transfers all its such functions to 'a' - it smoothly shifts the load on 'a' - without being disturbed as a segmental phoneme. It has an unusual bond with 'a' which is manifested and spread over the whole syllabic network. Segmentally 'ə' and 'a' are distinct phonemes. But in syllabic prosody or in syllabic rhythm they most naturally show an agreement of mutual substitution. (See p. 525 [523]).

This shows that the vowel of the first syllable shortens as the stress is shifted on the vowel 'a' of '-av'; and it is 'a' vowel that always carries stress/length.

Such relationship between 'ə-a' is also seen in Marathi and Hindi to some extent, e.g;

Marathi

Intransitive		Transitive
[mər]	'die/kill'	[mar]
[dʒəḷ]	'burn'	[dʒaḷ]
[gəḷ]	'drip/sieve'	[gaḷ]
[pəḍ]	'fall'	[paḍ]

Hindi

[mər]	'die/kill'	[mar]
[ṭəl]	'avoid'	[ṭal]
[pəḷ]	'year'	[paḷ]

The position of 'ə-a' in IA is interesting. Ancient treatises don't indicate great divergence of quality between

I. Segmental contrasts

[kʰəɾ]	'shed'	[kʰar]	'salt'
[kʰəs]	'move'	[kʰas]	'special'
[nəɭ]	'tap'	[naɭ]	'umbilical cord'
[mən]	'mind'	[man]	'honour'
[tən]	'body'	[tan]	'musical notes'
[vəd]	'speak'	[vad]	'controversy'
[vən]	'jungle'	[van]	'complexion'
[vəɾ]	'husband'	[vaɾ]	'day of the week'
[vəʈ]	'prestige'	[vaʈ]	'road'
[vəɖʱ]	'scold'	[vaɖʱ]	'to cut'

II. There is a set of verbs where 'ə' from intransitive stems change to 'a' in transitive stems, e.g.

[pəɖ]	'fall'	[paɖ]
[təɾ]	'swim'	[taɾ]
[bəɭ]	'burn'	[baɭ]
[məɾ]	'die/kill'	[maɾ]
[gəɭ]	'melt/drip'	[gaɭ]
[tʃəɾ]	'graze'	[tʃaɾ]
[təp]	'warm'	[tap]
[ɖəɾ]	'fear'	[ɖaɾ]
[ʈəɭ]	'avoid'	[ʈaɭ]
[ɖʱəɭ]	'bend'	[ɖʱaɭ]
[ʈʰəɾ]	'settle'	[ʈʰaɾ]

III. All the transitive verbs with CaC form, become CəC when causative '- av 'suffix is added:

Verb stem		Causative
[kaɖʰ]	'remove'	[kəɖʰav]
[kap]	'cut'	[kəpav]
[gá]	'sing'	[gəvɖav]
[gaɭ]	'sieve'	[gəɭav]
[kʰa]	'eat'	[kʰəvɖav]
[gʰal]	'push'	[gʰəlav]
[tʃav]	'chew'	[tʃəvɖav]
[tʃakʰ]	'taste'	[tʃəkʰav]
[tʃaʈ]	'lick'	[tʃəʈav]
[ʈʃaɭ]	'sieve'	[tʃəɭav]
[tʃal]	'walk'	[tʃəlav]
[tʃʰa]	'spread'	[tʃʰəvɖav]
[tʃʰap]	'print'	[tʃʰəpav]
[dʒag]	'wake'	[dʒəgaɖ/-av]
[dʒaɳ]	'know'	[dʒəɳav]
[dʒʰaɖ]	'sweep'	[dʒʰəɖav]
[dʒʰal]	'hold'	[dʒʰəlav]
[ʈaɭ]	'avoid'	[ʈəɭav]
[ʈʰas]	'stuff'	[ʈʰəsav]
[ʈʰar]	'settle'	[ʈʰərav]
[ɖʰaɭ]	'spread'	[ɖʰəlav]
[tak]	'aim'	[təkav]
[taɳ]	'pull'	[təɳav]
[dadʒʰ]	'burn'	[dədʒʰaɖ/-av]
[dab]	'press'	[dəbav]
[nakʰ]	'throw'	[nəkʰav]
[natʃ]	'dance'	[nətʃav]

[nɦá]	'bathe'	[nɦəvɖáv]
[pák]	'ripen'	[pəkáv]
[páɖ]	'draw'	[pəɖáv]
[pám]	'attain'	[pəmáv]
[páɭ]	'protect'	[pəɭáv]
[ʃáɖ]	'tear'	[ʃəɖáv]
[bádʒʱ]	'embrace'	[bədʒʱáv]
[báf]	'boil'	[bəfáv]
[báɭ]	'burn'	[bəɭáv]
[bʱáɭ]	'see'	[bʱəɭáv]
[bʱág]	'run away'	[bʱəgáv]
[bʱáv]	'like'	[bʱəvɖ-áv]
[máɳ]	'enjoy'	[məɳáv]
[rák ʰ]	'keep'	[rək ʰáv]
[lág]	'feel'	[ləgáɖ]
[láɖʒ]	'feel ashamed'	[ləɖʒáv]
[vaɭ]	'pound'	[vəɭáv]
[váɖʱ]	'cut'	[vəɖʱáv]
[váɭ]	'bend'	[vəɭáv]
[sár]	'smear'	[səráv]
[ɦár]	'get defeated'	[ɦəráv]
[ɦál]	'shake'	[ɦəláv]

IV. No doubt the causative suffix '-av' takes the stress and reduces the stress/length of the previous syllables irrespective of which vowel precedes, e.g.

[pí]	'drink'	[pivɖáv]
[bʱí]	'fear'	[bʱivɖáv]
[sív]	'sew'	[sivɖáv]

[kʰíil]	'bloom'	[kʰilə́v]
[tʃír]	'tear'	[tʃirə́v]
[tʃʰín]	'shred'	[tʃʰinə́v]
[kúd]	'jump'	[kudə́v]
[gṹtʰ]	'weave'	[gũtʰə́v]
[túɳ]	'darn'	[tuɳə́v]
[tʃúm]	'kiss'	[tʃumə́v]
[tʃús]	'suck'	[tʃusə́v]
[tʃʰúnd]	'mash'	[tʃʰundə́v]
[púr]	'lock'	[purə́v]
[púdʒ]	'worship'	[pudʒə́v]
[pútʃʰ]	'ask'	[putʃʰə́v
[bʱúl]	'forget'	[bʱulə́v]
[múk]	'keep'	[mukə́v]
[súɳ]	'listen'	[suɳə́v]
[kɦé]	'say'	[kɦevɖə́v]
[tʃét]	'beware'	[tʃetə́v]
[tʃʰéɖ]	'instigate'	[tʃʰedə́v]
[ʈék]	'lean'	[ʈekə́v]
[ʈɦél]	'loiter'	[ʈɦelə́v]
[téɖ]	'lift'	[teɖə́v]
[dékʰ]	'see'	[dekʰə́ɖ]
[pɦér]	'wear'	[pɦerə́v]
[pés]	'enter'	[pesə́ɖ]
[bés]	'sit'	[besə́ɖ]
[mél]	'put'	[melə́v]
[lé]	'take'	[levɖə́v]
[kór]	'engrave'	[korə́v]
[kótʃ]	'make a hole'	[kotʃə́v]
[kʰós]	'push in'	[kʰoʃə́v]

[kʰóɭ]	'search'	[kʰoɭáv]
[gót]	'search'	[gotáv]
[gʱʰóɭ]	'churn'	[gʱʰoɭáv]
[tʃáɭ]	'sieve'	[tʃəɭáv]
[tʃór]	'steal'	[tʃoráv]
[tʃʰóɭ]	'peel'	[tʃʰoláv]
[dʒókʰ]	'weigh'	[dʒokʰáv]
[ɖól]	'sway'	[ɖoláv]
[ʈʰók]	'bang'	[ʈʰokáv]
[tól]	'weigh'	[toláv]
[dór]	'draw'	[doráv]
[notər]	'invite'	[notráv]
[pʱʰõtʃ]	'reach'	[pʱʰõtʃáɖ]
[póʃ]	'support'	[póʃav]
[fól]	'peel'	[folav]
[foɖ]	'break'	[foɖáv]
[boɖ]	'remove hair'	[boɖáv]
[ból]	'speak'	[bolav]
[bʱʰõk]	'pierce'	[bʱʰõkáv]
[rok]	'stop'	[rokáv]

V. This same type of relationship between 'ə' and 'a' is seen when there is 'a + N + c' sequence:

[taŋg]	'hang'	[təŋgáv]
[maŋg]	'ask for'	[məŋgáv]
[maɲdʒ]	'scrub'	[məɲdʒáv]
[sãkʰ]	'bear'	[səŋkʰáv]
[nãkʰ]	'throw'	[nəŋkʰáv] etc.

i/ii and u/uu i.e. between short and long vowels. Phonologically parallel to these pairs was the pair 'a/aa'. From the ancient descriptions we can say that the members of this pair differed not only in length (kāla-bhinna) but also in their quality or degree of openness (vivāra-bhinna). Allen's observation is that in modern languages (i.e. NIA) the distinction is more generally maintained by the qualitative than by quantitative difference. As seen from the data above, Gujarati 'ə' does not take the quantitative load. It is 'a' that takes this load. This way original phonetic relationship between 'ə' and 'a' is maintained. Original 'ə' was referred to as saṃvṛta and 'a' was referred to as vivṛta. Pāṇini was aware that he had based his phonological statement on the fiction of identical quality between the pair and he cancelled his error by the phonetic admission of his famous last aphorism 'aa' i.e. "The short 'a' which has for phonological purposes been treated as of identical quality with the long one is phonetically closer (saṃvṛta)".[77] Despite this quality difference 'ə' and 'a' were lumped together by Pāṇini because they both have karaṇābhāva, both are pure glottal 'voice' and both can have vocalic neutrality. But still it must be noted that if he did so on analogy of i/ii and u/uu pairs it was at the expense of phonetic precision. What linguists feel right as a phonological statement may not necessarily characterize the behaviour of the sounds in future. The phonetic difference between 'ə' and 'a' created perceptive distinctness and in NIA languages they are different phonemes. But on the other hand they yet function together in syllabic relationship:

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77. Allen, 1953, p. 58.

Phonetic difference	Phonetic similarity (vocalic quality of 'neutrality')
/a/ ≠ /aa/	ə ⟿ a
or /ə̀/ ≠ /a/	ə ⟿ a
distinct segmental phonemes	exchangeable functioning in non-segmental behaviour.

3.6.5. Different manifestations of 'ə + N' in Gujarati.

IA 'anusvāra' which had consonantal tendency had a phonetic body which was tantamount to "half g".[78] This 'g' developed into typical nasal 'ङ'. Mahulkar points at two divergent tendencies of strengthening and weakening which must have been working over the Sanskrit 'ङ'. This 'ङ' can be considered as a canonical form N, which can be interpreted as below:[79]

vaṁsa [və̃ũʃə]
|
vaⁿsa

vãs ⟵ /vaNsa/ ⟶ vans

(Gujarati) sĩh ⟵ /siNha/ ⟶ sinha (Hindi)
|
s̃iwha

(Marathi)

Gujarati 'ə + N' has all the three manifestations:

1) wakening process - lenition - can bring N-loss and we get, ə + N + c ⟿ ã + c (ə ⟿ a)

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78. Mahulkar, 1981, p. 74.

79. ibid.

2) There may not be any N-loss but an epenthetic glide raises the 'ə' vowel e.g.

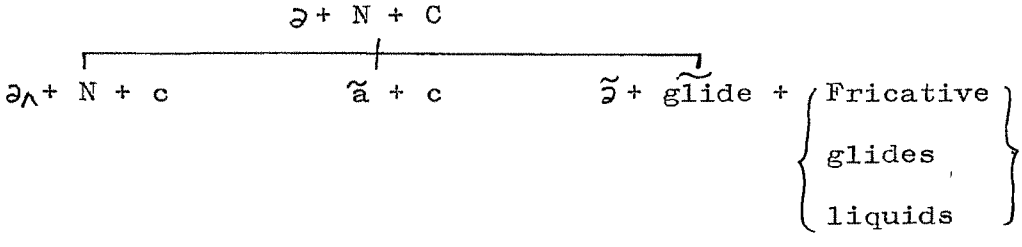
[rəŋg]

[rəŋ^{y}g]

[rə$_{\wedge}$ŋg] ('ə' raised as compared to 'ə' in the word [rəg] 'vein')

3) Effaced nasal may leave the glide and nasalize the preceding vowel along with the glide. This process takes place when the nasal is followed by continuants. This nasalized vocalic sequence has a diphthongal quality and is longer in duration than other nasalized vowels.

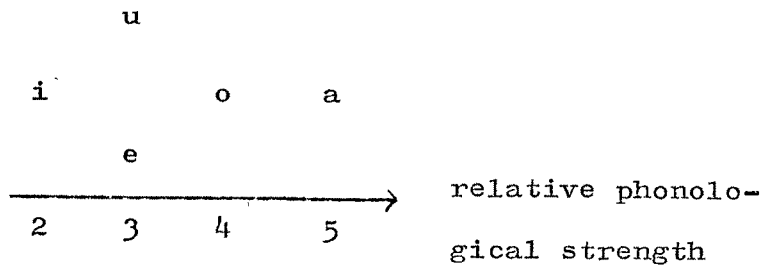
These three variants can be shown like this:



3.6.6. Nasalization and lowering:

It is clear that 'a' is maintained as the lowered and lengthened manifestation of 'ə'. Lengthening of the vowel means increase in duration. Intrinsic duration of low vowels can be favourable to extra lengthening. In other words all intrinsic characters are not always phonologically significant but they may be easily receptive to phonological processes. 'a' in Gujarati is susceptible to nasalization and to the lengthening. Other vowels also lengthen after nasalization. This lengthening is to fill the time left open

by the loss of the nasal consonant. The extra suitability of 'a' to these fortition processes is the main reason for the large number of 'ə + N + c ⟶ ã + c' cases. The lengthening of other vowels does not function as a mark of phonological distinction. But in case of 'ə - a' the conditioned lengthening operates on already distinct phonemes. Moreover 'ə' being achromatic vowel has no colour to lose and when lowering is called for as a result of nasalization it is shifted on the nearest suitable vowel 'a'. Donegan[80] explains this suitability by the law, 'rich gets richer and poor gets poorer' i.e. a vowel is susceptible to increase a particular property because it already possesses that property. This law in some ways is similar to Foley's inertial development principle[81] which says that weak becomes weaker in weak environments and strong becomes stronger in strong environments. According to strength parameter 'a' is the strongest vowel:



The processes working on 'ə - a' can be explained as below:

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80. Donegan, 1978, p. 60.

81. Foley, 1977, p. 107.

Intrinsic qualities	Intrinsic qualities
ə	a
achromatic	chromatic
less sonorant	most sonorant
by process of Leniti-	by process of Fortition
on	
(1) assimilation to nasal consonant: [ɔ̃ə̃ŋk]*	(1) inherently long becomes longer due to nasalization: [rã:k]
(2) [rə̃k]** ⟶ [rãk]	(2) (a) longer vowels are susceptible to tensing because their greater duration allows time for the articulatory organs to reach extreme position. (b) tense vowels get stress: [r̃ã:k]

The fortition process which turn 'a' into the strongest vowel still abides by the phonological frame of the language; in the sense that though there is a phonetically substitutable relationship between 'ə' and 'a' they don't lose their distinctiveness. As Donegan puts it if the fortition process is non-obligatory the phonetic substitution won't apply in all occurrences; and by natural selection principle there is no decrease in the inventory of phonological distinctions.[82] The substitutable relationship of 'ə - a' is an example of changeability of human speech habits. But Jesperson felt that simultaneously there is a 'curbing power' in the mere fact that language exists not for the individual alone but for the whole community and the history of any language is like a

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82. Donegan, 1978, p. 130.

* : coarticulatorily nasalized

** : not possible.

tug of war between the changeability and this curb. This curb will reject the merger of 'ə' and 'a' in spite of the fact that they very agreeabily exchange positions amongst themselves.

The revertible relationship between 'ə + N' and 'ə̃' provides a very crucial evidence to consider all nasalized vowels as the result of N-loss. /ə/ and /a/ being the distinct phonemes of the language the N-loss nasalization becomes very evident. In other vowels the lowered nasalized variants are allophonic and hence such revertible relationship cannot be directly suggestive of the presence of 'v + N + c' sequence; nonetheless nasalization would be the result of N-loss.

One more question regarding the phonemic status of [ɲ] and [ŋ] remains to be answered. /m, n, ɳ/ are independent segmental phonemes. But [ɲ] and [ŋ] occur only as assimilative nasal elements i.e. the shape of the nasal is dependent on the following consonants. All the assimilative nasals occuring in 'VNC' sequences can be included within a complex phonological unit /N̰/ as suggested by our ancient treatises.

3.6.7. Strengthening and weakening processes:

The Gujarati speaker intuitively knows when to nasalize the vowel and when to keep 'V + N + C' sequence. These processes are like mental operations. They are the natural and automatic responses of the speakers to the articulatory and perceptual difficulties which the speech sounds or sound sequences present to the users. Donegan[83] compares it with

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82-83. Donegan, 1979.

the old dichotomy of clarity versus ease (Passy called it 'principe déconomic' and 'principe démphase'). This can explain the working of these processes better. For the sake of clarity the phonetic property has to be increased i.e. fortition process takes place; when for the sake of ease the flowing pronunceability increases and lention process takes place. Our ancient phoneticians also distinguished between pada pāṭha and saṃhitā pāṭha, indicating that speech sounds are transmitted from their 'isophonic stage to the rhythmic continuity in the saṃhitā text: This involves combinatorial phonetic changes which are the result of 'speech organ adjustments'. These adjustments occuring in central nervous system are manifested through some physical motivations. Nasalization in Gujarati is a process in progress. This is highly significant for studies in diachronic sound change, in sociolinguistic dialect variations, in phonation types and prosódies.

3.7. Summary

The nasalization (and its development) in Gujarati can be summed up as below:

1) The natural coarticulatory nasality spills regressively and/or progressively.

2) If the progressive nasality is hindered due to voiceless consonant after 'N', the regressive nasality becomes stronger.

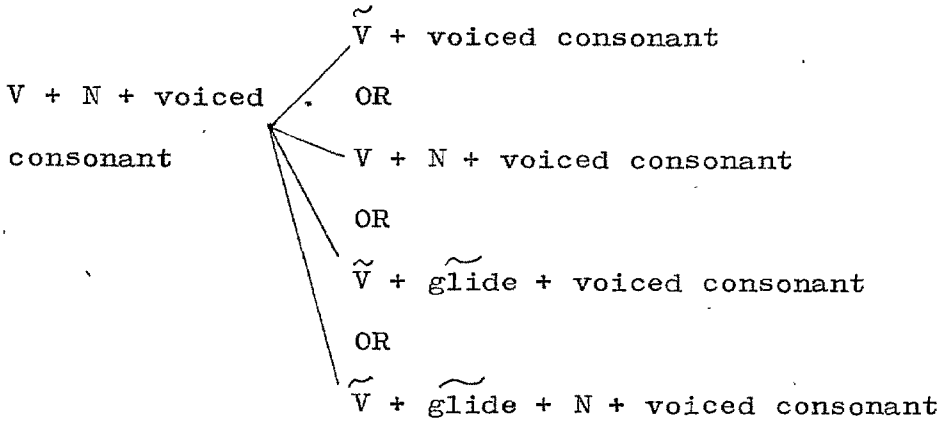
3) The 'N + voiceless consonant' clusters are simplified by N-loss, thus bringing strong nasality to already nasalized vowels.

4) These vowels automatically take (i) length (ii) tenseness (iii) stress.

5) In the 'N + voiced consonant' clusters progressive nasality is not hindered. Hence N-loss is not uniformly found. This situation shows sound change in progress.

6) Some dialects have begun denasalization before voiceless consonants. This is another sound change in progress.

The first three of the above observations show the action of lenition process. Coarticulatory assimilation and cluster simplification bring easy pronunciation. Regarding the fifth observation, one can say that though the natural lenition process is not uniformly overt in the dialects it might have been latently uniform and the manifestation of which shows up differently in various contexts, e.g.,



Unless the process applies uniformly (as it does before voiceless consonant) it cannot become a rule. Most rules originate as processes.[84] N + loss nasalization becomes a rule before voiceless consonants, but not before voiced consonants.)

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84. Donegan, 1978, p. 7.

It is proposed that variations in nasality in Gujarati hint at two points in the history of the said sound change. (1) The N-loss nasalization must have taken place at one time but we may at this point suggest that Entenmman's proposal 'all or nothing' should be revised as thus: 'N-loss nasalization as a process begins in all the relevant contexts but its end-results may vary depending on the phonetics of different language specific sequences. Hence it may not end up as a rule.' (2) The various phonetic manifestations and continuation of the processes defy the staticity of the 'change point' as a stage in history.

The last observation shows that the lenition process of denasalization begins after the fortition process of nasalization. Once again this process is present before voiceless consonants only. Denasalization is phonetically not possible before voiced consonants. The tight phonation dialects inhibit this process because the fortition process of nasalization is very strongly manifested in them due to two fold tensing: one due to intrinsic tension of the muscles in this phonation type and the second due to raised glottis for voiceless consonants. The chart on p. 537 shows the processes and how the sound change continues to progress.

Homorganic nasal + consonant sequences, N-loss-nasalization and denasalization (of already nasalized vowels) provide a panoramic view of the unbroken continuum of sound change. This phenomenon of sound change in progress is a fact of the live language and such fact opens new vistas in

SOUND CHANGE 'N PROGRESS.

	Murmur dialects: D_{1M}	D_{2M}	D_{3M} - - - - -	Tight Phonation dialects: D_{1T}	D_{2T}	D_{3T} - - - -
Stage I V + N + Voiceless consonant	$\tilde{V}$ + V.L cons. (N-loss nasalization)	Same as D_{1M}	Same as D_{1M}	Same as D_{1M}	Same as D_{1M}	Same as D_{1M}
Stage II V + V.L. Cons →	V + V.L Cons. Denasalization has begun	Stage I persists	Stage I persists	Stage I persists	Stage I persists	Stage I persists.
Stage I V + N + Voiced consonants	* $\tilde{V}$ + Vd cons. nasalization and phonetically N-reduction.	* $\tilde{V}$ + ^{n}vd. cons.	* $\tilde{V}$ + ^{n}vd. cons.	Same as MURMURED DIALECTS		
Stage II $\tilde{V}$ + ^{n}vd. cons.	V + N + Vd. Cons. Regaining of reduced 'N' and the nasalization of the vowel is lost	$\tilde{V}$ + vd cons. Reduced 'N' is getting lost	Same as D_{2M}	V + N + Vd. cons. Regaining of reduced 'N' and the nasalization of the vowel is lost.	$\tilde{V}$ + $\tilde{J}$ + N + Vd. cons. A glidal element appears and there is a flowing spill of nasality covering the vowel, glide both. Also regaining of reduced 'N'.	$\tilde{V}$ + $\tilde{J}$ + Vd. con. Reduced 'N' is lost but the glidal element remains and the flowing spill of nasality covers the vowel, glide, both.

Vd. consonants disallow Denasalization. — — — — — — — — — — — — —

D_{1M}, D_{2M}, ---; D_{1T} D_{2T} ---- = Murmured dialects and Tight Phonation dialects resp.

the field of phonology. It is realized since long that any descriptive work which expects homogenous linguistic material is a paradox 'not quite unlike that which is proposed by Zeno about motion.' A moving arrow is located at some point at every moment of time; at intermediate moments it is at intermediate positions; therefore it never moves.[85] In this paradoxical sense every diachronic study has to duly take into consideration synchronic material and every synchronic study has to be a part of spatio-temporal situation.

Looking from this perspective the synchronistic material presented here has enough justification for diachronic work. Lass particularly stresses that for historical argumentations to have any epistemic force it must be essentially synchronic, for both psychological and logical reasons. Explicity relating the present with the past he says that 'no reconstructed entity, configuration of entities, process of change or reason for change can have been the case only in the past.[86]

The synchronic data here, are highly kaleidoscopic and bewitchingly challenging. See the chart on p. 537 One can explain this situation phonetically but to hope to deduce from the data might be futile. What we can do is to bring order in the descriptive statement. As Jørgensen[87] puts it 'there are many different' kinds of explanations: for instance, when a phenomenon or process can be described not as an

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85. Weinreich, 1972, p. 307.

86. Lass, 1980, p. 56.

87. Jørgensen, 1975, p. 387.

isolated case, but as an example of more general phenomena, it is considered as better understood.

Lass[88] concludes that language change is just not explanable deductively because if language is many things other than a communication system, then change can occur presumably for reasons totally unconnected.

Perhaps as it is, a diachronic linguist should be satisfied if he renders intelligible approach and develops a mode of explanation "without being either empirical or predictive".[89] Lass agrees with Popper[90] who feels that historicist should stop clinging to the belief that change can always be forseen because it is ruled by an unchanging law.

3.7.1. Nasalization and asegmentality:

We can now say that in Gujarati nasalization is not merely a segmental issue. The rhythmic balancing of the syllables after N-loss brings this nasalization of vowels. 'VNC' on the one side and N-loss nasalization prosody on the other, clearly necessitates an approach which accomodates non-segmental issues. At times segmental phonemes which are sonorant have potentiality to become non-segmental in the sense that their sonority helps them to spread over the vowels/syllables.

As can be seen from the figure 4 below segmental-non-segmental relationship is quite complicated.

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88. Lass, 1980, p. 136.

89. Lass, 1976, p. 109.

90. Popper, 1957, p. 161.

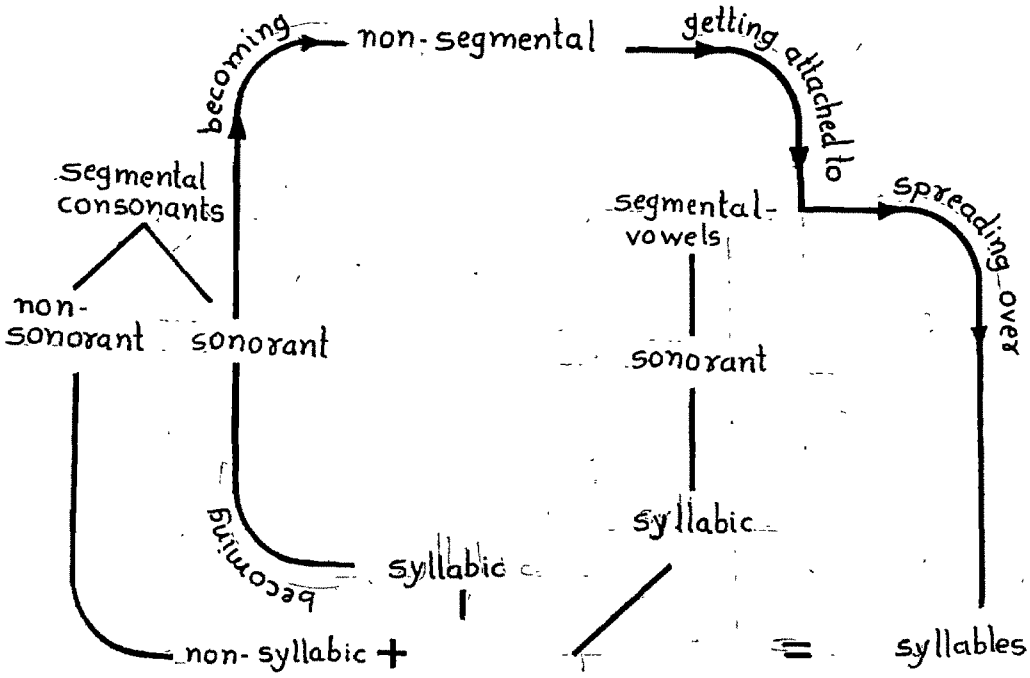

FIGURE: 4 - Segmental and non-Segmental relationship.