CHAPTER II

MID-VOWELS

eṅo vivṛtataratvāt aicām
vivṛtatamatvāditi bodhavyam.

(Mahābhāsya)

Mid-vowels

2.0 Introduction

Here is an attempt to study another crucial issue of Gujarati phonology, namely, the degree of openness and the mid-vowels. Vowels are the most deceptive part of phonology. In the continuum of speech a layman tends to believe that he has perceived only consonantal peaks : given a word and asked to remember he remembers it with the aid of such 'consonantal peaks'. (Though actually he remembers it by syllablic units). The truth is that the vowels are the 'voice' carriers but the greater truth is that the consonants' structural spread (or better way to put it would be 'the consonantal skeleton')[1] is the speech carrier. Between this consonantal spread, vowels are bound to have the environmental variations and these in turn give 'vowels the 'relative values'. In general one can say that vowels have a slippery character. No doubt even the consonants have environmental modifications but as they have definite points of articulations they cannot be slipping away so easily from the hearer's perceptual ability. The vowels, having to be defined by the tongue height, the degree of the opening of jaw, and the arbitrary horizontal division of the tongue, have inherent relativity. This relativity gets multiplied within the consonantal skeleton specific to each language.

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1. Bloch, 1965, p. 47.

In general the mid-vowels once again have the most uncatchable and modifiable character. The higher vowels however higher they become are still the 'high' vowels and the low-vowels however lower they become are still the 'low' vowels but the mid-vowels change the quality and are likely to cause even the 'phonemic change'. Our phonetic descriptions have tried to describe them by the terms, half open, half-close or high-mid, low-mid etc. But none of these can be definite enough because the mid-vowels, are produced at such a position in the mouth that there is a plenty of scope for them to 'change'. In between 'the high' and 'the low' vowel position in the mouth there lies a large area from where a large series of different mid-vowels can be produced. See figure 1 on page 116. The jaw accordingly is lowered or raised for these vowels.

This phonetic character of mid-vowels should certainly be taken into consideration for phonemic study. No phonological statement can afford to ignore the importance of phonetics. Having missed this importance, all the studies of the mid-vowels of Gujarati beginning from 1916 and continuing upto 1978, have failed to give reasonably convincing phonemic statements. We will try to summarize them all.

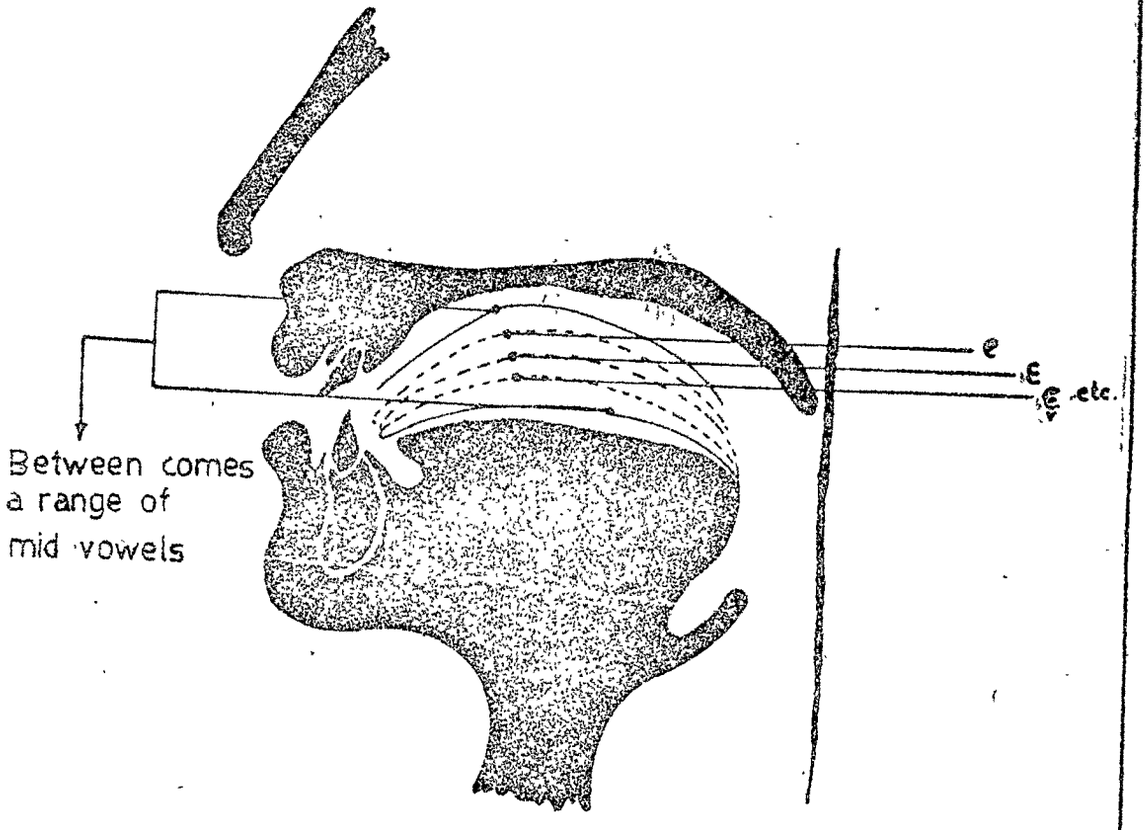

Figure 1 The tongue curves for mid-front vowels.

2.1 Earlier studies of mid-vowels: Narmad's views

The earliest reference to 'the wide sound' in Gujarati is made by Kavi Narmad in his famous Kośa (called Narmakośa). In the introduction of this book he has attributed wide sounds to the presence of 'h' in the words. Divetia has totally rejected this suggestion thus showing his indifference to phonetic facts.[2] Infact Narmad's observation about the Persian loan-word [kəhər] becoming [kɛr] in Gujarati was on the right track.

2.1.1 Dhruva's views

The next important discussion of these vowels is done by Dhruva in the section called vivṛta vidhān,[3] of his book. He gives a few reasons to explain the occurrence of these vivṛta (open) vowels: one of it is that when one member of the consonant conjunct is lost, the 'loss of quantity is compensated for by widening of the vowel'. Divetia disposes this by saying that "the widening of ए[e] or ओ[o] would furnish no real compensation for quantity loss".[4] Actually Dhruva was arriving at an important observation though his statement is rather vague. Unfortunately, he did not analyse the situation fully. Divetia's objection is

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2. Jørgenson has supported her observation regarding the lowering of [e] and [o] when murmured, by formant frequency studies (I.L.), 1967, p. 105.

3. Dhruva, vāg vyāpār, p. 840.

4. Divetia, 1915-16, p. 159.

wrong because widening of the vowel can automatically affect the quantity too. Bloch correctly says that the quantities of all vowels (We would add 'the quality of allophonic extensions too) cannot be wholly accounted for by etymology even when syllabic structure is taken into consideration and consequently the vowels of monosyllables are always long.[5] This quantity and opening of the jaws for the mid and low vowels are dependent on the consonants. Dhruva had noticed that the quantity balance had some role to play in the quality change. He was also correct in considering "the infusion of weak anusvāra" responsible for widening of the vowels. Surprisingly enough Divetia rejects this reason too. Divetia cancels Dhruva's phonetic sense. Divetia admits the co-existence of nasalization and wide vowels but does not want to accept that due to this co-existence the vocal tract configuration can change. In the production of any nasal sound (nasal or nasalized vowels) the lowering of the velum and articulatory movements in the vocal tract are simultaneously in action. When the air stream has an outlet through the nasal cavity the vocal tract opening has to be enhanced more than otherwise. See figure2on page 119.

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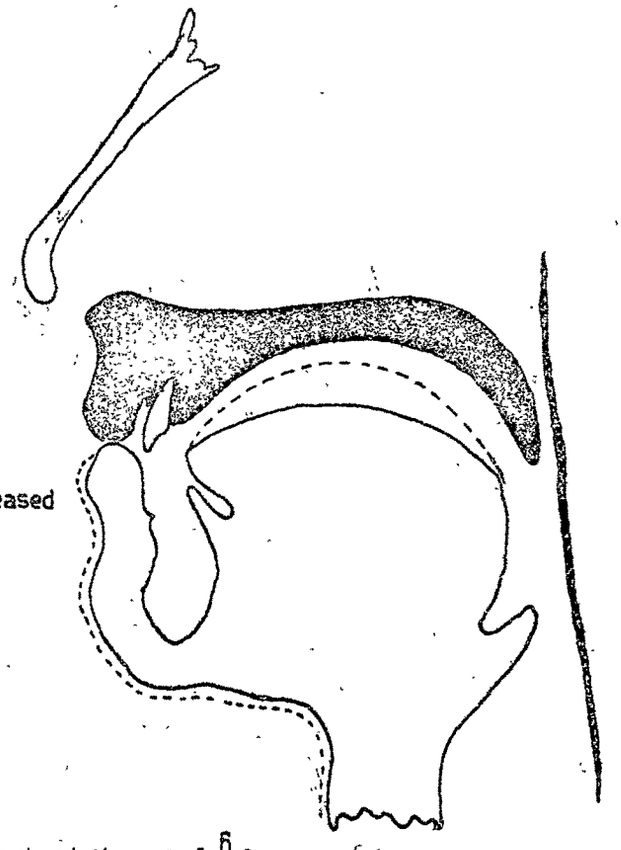
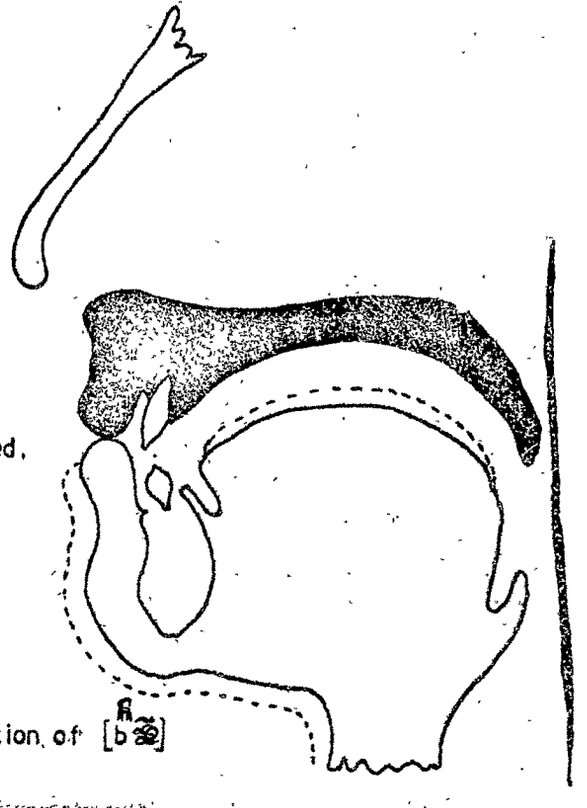
5. Bloch, 1965, p. 47.



When the stop is released

For the articulation of [$\overset{n}{b}e$]



When the stop is released, there is lowering

For the articulation of [$\overset{n}{b}\tilde{\text{ɔ}}$]

Figure 2

2·1·2 Tessitori's views

A mention of Tessitori's work won't be out of the place. Tessitori said that ે-ો derived from અ+ઇ - અ+ઉ were originally pronounced as diphthongs and only afterwards reduced to long wide vowels i.e. according to him [ɛ-ɔ] were derived as under:

અઇ - અઉ
અઍ - અઑ } ે - ો > ɛ-ɔ *

Tessitori has not given any thought to the phonetic possibility. He goes by written spellings and hence he is misled.

2·1·3 Divetia's views

The first interesting treatment of the vowels [e] and [o] comes from Divetia.[6] After this in 1915-1916 he gave a fuller account of this topic.[7] He in the real sense remains the pioneer of this study. As we have mentioned in the previous chapter Divetia and Turner approach the subject depending on the historical material. Automatically two major short-comings of their approach are that they have

(1) to depend on the written material; this material displays variety of spellings;

(2) to reconstruct the missing stage of the development of their sounds in order to reach modern Gujarati open [ɛ] and [ɔ].

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* We are retaining the devanāgari script as in the original writings.

6. Divetia, 1915, p. 17-19.

7. Divetia, 1915-1916.

Divetia defines these sounds like this: "vivrta [ɛ, ɔ] are the sounds "which are sounded wide i.e. with an expanding of glottis". He considers these sounds as peculiar to Gujarati. In a way he is right as Gujarati alone out of all the NIA languages develops open ɛ and ɔ from MIA ai, au, ay, av (but Divetia has considered his own dialect and generalized the features peculiar to his dialect[7a] as common to all standard colloquials.[8] However, Bengali [ɔ] is in a comparable position as it is the result of MIA ‹ĕ, ē›. Bengali commonly represents OIA short [a], through MIA, OB, eMB [ɒ].[9] (eMB = early middle Bengali). Hence Gujarati [ɔ] is not comparable to Bengali [ɔ]. Chatterji has clearly pointed at the fact that MIA ‹e› tended to open up in certain environments. "From early middle Bengali times, it would seem that ‹ē› in initial syllables, with a low position, became the open ‹e› = [ɛ], this occurs in new Bengali as [ɛ] or as [æ]."[10] The origin of MIA ‹ĕ, ē› obviously remains same: ‹ĕ, ē› ‹OIA, ē, ai, ay›. This is definitely similar to Gujarati situation. Another

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7a. Divetia, 1915-1916.

8. I am myself a speaker of one such standard dialect and I have no open [ɛ] and [ɒ]. I have not found these sounds in the speech of Suresh Joshi who hails from South of Surat.

9. Chatterji, (Vol. I), 1972, p. 403.

10. ibid, p. 327.

conspicuously similar feature is the place of occurrence of open [ɛ] in both the languages i.e. in the monosyllables and in the first syllable of the disyllables and polysyllables. Attention should also be drawn at an interesting feature. In Gujarati onomatopoetics have open vowels, e.g. [b$^{\tilde{h}}$æ̃ b$^{\tilde{h}}$æ̃](for buffalo's voice), [bæ̃ bæ̃] (for goat's voice) etc. Chatterji has noted [æ] in words like [k^{h}æ̃ɭ k^{h}æ̃ɭ] (regarding 'field'), [p æɭ p æɭ](belly). He says "onomatopoetics have the æ pronunciation, irrespective of the consonant which follows." The most non-negligible common feature between the two languages is that the existence of open vowel [ɛ] is restricted to the dialects only." In East Bengal dialects, [æ] is rare or unknown"... "East Bengali dialects find it difficult to distinguish between English [æ] and [ɛ]...."[11,12]

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11. Chatterji, (Vol. I), 1972, p.410.

12. Gujarati dialects with six vowels go through similar difficulties. Gujarati speakers with six vowels can be divided into two groups: one having 'murmur' and the other without it. The one with 'murmur' does have some amount of relative lowering of the mid-vowels due to [ɦ] but one without murmur has clearly closed [e] and [o]. The speakers of this dialect have been ridiculed by other Indians for their being unable to keep the pronunciation of the English words 'rape' and 'wrap' distinct! Many such pairs can be cited.

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All NIA languages thus have developed by constantly changing and modifying the MIA sounds. Hence each language as it developed acquired a sound system of its own depending upon which MIA dialect it had come from. Hindi and Bengali do display the tendency of open mid vowels. We have already explained the 'relativeness' characteristic of the mid vowels. It is obvious from all this that open mid vowels are not an unknown phenomena to IA languages.

Divetia's thesis about open [ɛ] and [ɔ] can be summarized like this:

The unaccented medial 'ai, ae' and 'au, ao' become 'j' and 'v' respectively. 'aja' and 'ava' become 'aj' and 'av' and then [ɛ] and [ɔ] respectively. The final 'ai' and 'au' are changed into half open [e] and [o] when the accent falls on the first vowel of those vowel groups, the resulting vowel becomes open. His derivational stages then are:

$$\left.\begin{matrix} ai \\ aja \end{matrix}\right\} > \acute{a}ja > \acute{a}j > [ɛ]$$

$$\left.\begin{matrix} au \\ ava \end{matrix}\right\} > \acute{a}va > \acute{a}v > [ɔ]$$

To support his proposal he gives these examples:

Stress on the first vowel			Stress on the second vowel		
SK	Pra/Ap	Guj.	SK	Pra/Ap	Guj.
vairam	váiru, váyar váyr	(revenge) vɛ́r	tʃampaknagari	tʃampānaari tʃampānayari	(name of the city)
				tʃampānairi	tʃ̃apāner
kapardika	kavaddia				
	kávadi kávdi	(cowrie) kɔ́di			
			tʃatturdaśa	tʃauddaha tʃaúdaha	(fourteen) tʃaud

In the example with the stress on the first vowel, 'ai' becomes 'ay' and then [ɛ] but when the stress is on the second vowel 'aya' becomes 'ai' and then [e]. An important point goes amiss here. He has not mentioned that the first 'ay' is the result of the original 'ai' while the second 'aya' is the result of the juxtaposed vowels due to the middle consonant dropping which is going to be replaced by 'laghuprayatnantara yakara'.[13] In fact this example of his for close [e] is highly doubtful, as we found that all our informants showed a slight lowering of [e] in this word. (We have discussed this later in the chapter.) Divetia has rigidly stuck to his thesis of pratisaṃprasaraṇa.[14] Saṃprasaraṇa and pratisaṃprasaraṇa are the names of the processes observed by the scholars. This does not mean that language must develop consistently, according to the rules of these processes suggested by linguists. Actually, what is natural to human vocal tract only can occur in the languages. Hence 'नेर' [neɽ] cannot be an absolutely narrow [e] as the nasal would make an obligatory opening of the cavity. We have already noted that he has missed the correct points of his predecessors regarding the openness of mid-vowels due to [ɦ] or 'nasality'.

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13. Hemchandra, 1928, 8:1:180: avarṇo yaśrutiḥ

14. It is shown later in the chapter that Divetia could have been on the right tract - but he just missed it.

2·1·4 Turner's views

After writing a full fledged description of Gujarati phonology in 1921 Turner had thought of the issue of the vowels 'e' and 'o' as worthy of getting individual attention.[15] Turner does not agree with Divetia's account but says "in pāli we find Sanskrit 'aya' 'ava' represented by 'ē, ō' which in their subsequent history converge completely with MI 'ē, ō' whether representing primitive Indian ē, ō or ai au. It must be noted that there can be little doubt that aya, ava passed through the stages, ai, au, ɛ̄, ɔ̄ before becoming ē ō " i.e. according to him MIA ē, ō must have come through: aya, ava, > ai, au > ɛ̄ , ɔ̄ > ē, ō. Turner feels that Gujarati open vowels must have had the course from aĭ, aŭ to the diphtongs ai, au to the ɛ̄ , ɔ̄ . There are two stages of this 'course' due to which Turner missed the explanation. One is that Turner derives ɛ̄, ɔ̄ from ai, au and the second is that his aya, ava should go through the samprasāraṇa process and become ai and au. Turner insists on this derivation and says "the same tendency which produced close PI (primitive Indian) ē, ō from Aryan ai, au, and MI close ē, ō from PI ai, au, aya, ava, is still to be seen in the tendency in Gujarati to make ɛ̄ , ɔ̄ more close, and in the failure to distinguish between ɛ̄, ɔ̄ and ē ō, particularly in the unaccented syllables."[16]

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15. Turner, 1975.

16. ibid, p. 231.

He has not realized that in the fluent Gujarati speech ai, au, becoming ay, av by pratisamprasārana or ay, av becoming ai, au by samprasārana is a common process; (at times across the morpheme/syntax boundary or at times within the words). See the examples below:

pratisamprasārana

ai ⟶ aj

dʒəi + avja ⟶ dʒəjavja -'went and came back'

oi ⟶ oj

rəsoi ⟶ rəsojjo - 'cooking', 'one who cooks' (masc.)

au ⟶ av

k^ha + $\tilde{u}$ ⟶ $k^hav\tilde{u}$ - 'eat' + 1st per. sing. pres. marker (I)

nʃha + $\tilde{u}$ ⟶ nhav$\tilde{u}$ - 'bathe' + 1st per. sing. pres. marker (I)

samprasārana and pratisamprasārana simultaneously.

aya or ai		ava or au		
bəyri / bəiri	'wife'	nəv / nəu	'nine'	
kəjlas / kəilas	'name of a person' or 'heaven'	bə^{n}v / bə^{n}u	'too many'	this example was noticed in Bhavnagar area dialect.

One comes across plentiful such examples in the colloquial dialects.

In the pages that follow Turner gives historical derivations of ē, e, ɛ̄, ɛ ō, o, ɔ̄, ɔ. It is however not clear whether he wants to consider them 'distinct' (in the phonemic sense) or not; but he does use the criterion of minimal pair contrast. When he refers to o, ɔ he says "nevertheless the difference of sounds does serve to distinguish difference of meanings in pairs like mōr 'peacock' mɔr 'tree blossom'; gol 'round', gɔl 'treacle'".[17] He has described ē as 'a long close vowel' but the examples given by him show a lowered variety of ē (i.e. slightly open in those environments.) for the dialects with six vowels or for the dialects with eight vowels. Turner has himself referred to these environments (though not fully). He says "Both ē and ō, but particularly later, are pronounced more open when followed by n, l, d or r."[18] Inspite of this he did not see that many of his given examples of 'close ē' actually show the lowered variety. Divetia, Turner and Pandit (discussion of Pandit's work follows) have tried to give derivational stages from OIA to modern Gujarati. For them, once the course id decided no phonetic consideration (even if they have noted) should change it.

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17. Turner, 1975, p.232.

18. ibid. p. 232.

Turner's examples according to the environment

Before retroflexed sounds	Due to murmur (i.e. 'ɦ')	preceded/followed by nasal	When adjacent to palatal fricative
[tʃʰe̬:ɖo] 'end'	[de̬:ɦrũ] 'temple'	[ane̬:rũ] 'unique'	[de̬:ʃ] 'country'
[dʒe̬:ʈʰ] 'elder brother-in-law'	[me̬:gʱ] 'cloud'	[gʰəɳe̬:rũ] 'must'	[ʃe̬:ʃ] 'remainder'
[me̬:ɖo] 'floor'	[bʱe̬:kʰ] 'denouncement'		
[he̬:ʈʰo] 'below'			
[ke̬:ɭ] 'banana plant'			
[pe̬:ʈ] 'stomach' **			
[pe̬:ɖʱi] 'office'			
[ne̬:ɖo] 'attachment'			
[me̬:ɭavũ] 'to mix'			

* Turner's examples are given in the phonetic script.

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* Turner's examples are given in the phonetic script.
** Later we have shown with the help of X-ray pictures that 'ʈ' is the least conducive for the lowering of the mid-vowels.

His examples of short 'e' also can be classified under (
as slightly more open).

Before retroflexed sounds		Due to pre-nasal position		In open syllable and in final position
[dʒe̯ʈʰaɳi]	'elder sister-in-law'	[ke̯:m]	'why'	3rd per. sing. pres. -e̯
[pe̯ʈaro]	'big trunk'	[dʒe̯:m]	'whichever way'	2nd per. sing. pres. -e̯
		[te̯:m]	'accordingly'	3rd per. plu. pres. -e̯
		[gopʰe̯ɳ]	'sling'	Instrumental - e̯
		[sape̯ɳ]	'snake' (fem)	Locative -e̯

It will be noticed that in the mono syllable e̯ is long'.

We Grierson classifyed his examples of long open vowel ɛ̄ as below:

Due to murmur (i.e 'ɦ')		When the vowel is nasalized or is adjacent to a nasal		Diachronically due to ai (Turner) but due to ai > ay (Divetia).	
[pɛɦrvũ]	'to wear'	[kʰɛ̃tʃ]	'pull'	[pɛsvũ]	'to enter'
[bɛɦro]	'deaf' (masc)	[gɛ̃ɖo]	'rhinoceros'	[bɛsvũ]	'to sit'
[bɛɦn]	'sister'	[mɛlũ]	'dirty'	[ɛʃ]	'luxury'
[bʰɛ̃s]	'buffalo'	[mɛʃ]	'soot'	[kɛd]	'prison'
[pɛɦlũ]	'first'	[mɛl]	'dirt'	[gɛb]	'disappear'
[gʰɛlũ]	'crazy'	[bʰɛ̃s]	'buffalo'	[fɛ̃slo]	'verdict'
[gʰɛrũ]	'dark'			[ɛb]	'dirt'
[kɛɦvũ]	'to say'			[gɛr]	'wrong'
[sɛɦvũ]	'to bear'				
[rɛɦvũ]	'to live'				
[lɛɦr]	'fun'				
[dʒʰɛr]	'poison'				
[nɛɦr]	'canal'				
[ʃɛɦr]	'city'				
[mɛɦl]	'palace'				

His examples of ɔ̄ can be classified as below:

Due to murmur (i.e. 'ɦ')	When the vowel is nasalized or is adjacent to a nasal	Followed by retroflexed sounds	Due to apa / ava / ama / au } au (Turner)
			or all these becoming av (Divetia)
[bɔ̄ɦl̃ũ] 'wide'	[pɔ̄ɳ̃ũ] 'three quarters'	[dɔ̄ɖwũ] 'to run'	[ɒ̄sarwũ] 'to ebb'
[ɦɔ̄ɳ] 'this year'	[sɔ̄̃gɦ̃ũ] 'cheap'	[ɭɔ̄ɖũ] 'wide'	[ɔ̄gaɭwũ] 'to dilute'
[pɔɦr] 'fear'	[mɔ̄̃gɦ̃ũ] 'expensive'		[ɡɔ̄kʰ] 'a portico'
[ɦɔ̄j] 'may be'	[sɔ̄̃pwũ] 'to entrust'	[dɦɔ̄l̃ũ]	[kɔ̄ʈʰũ] 'a kind of fruit'
[dɦɔ̄l̃ũ] 'white'	[nɔ̄j] 'no' (from nə+hoj)	[nɔ̄ɭijo]	[kɔ̄jəl] 'cuckoo'
[vɔ̄ɦro] 'a caste amongst muslims'	[pɔ̄̃ɦtʃwũ] 'to reach'	[kɔ̄ɳ]	[sɔ̄j] 'needle'
	[nɔ̄ɭijo] 'a mongoose'		[dɔlət] 'wealth'
	[nɔ̄kʰũ] 'distinct'		[pʰɔ̄̃dʒ] 'army'
	[kɔ̄ɳ] 'who'		[mɔ̄lvi] 'muslim'

Turner has been unable to produce enough examples of short ɛ.[19] Any mid vowel which is accented and long is going to be lowered. Hence it would be unnatural to look for the short low vowel (where lowering as seen from the above examples is due to various phonetic factors). His examples of long close o̅ are wrongly presented, because many of them have ɔ in the dialects with eight vowels. See below:*

[kɔ\ijo]	'mouthful'	[sɔbɔt]	'company'	[tɔ\wũ]	'to weigh'
[ɔʃiya\ũ]	'dependent'	[ɖɔ\wũ]	'to shake'		
[sɔnũ]	'gold'	[kɔɖʰ]	'leucoderma'		
[kɔɳi]	'elbow'				

For the same reasons that he could not find the words with short ɛ, he could not find words with short ɔ. We have tried to show that all these efforts of Divetia, Tessitori and Turner are based upon historical linguistic derivations. Any phonetic guess regarding open ɛ-ɔ was ridiculed in those days.

2.1.5. Pandit's views

The first modern linguistic approach appears twenty years after Turner. Pandit's 'E & O' in Gujarati' was published in 1954. In 1961 he wrote 'Historical phonology of Gujarati vowels' and in 1966 his book on 'Gujarati phonology and the sound change in Gujarati' was published.

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19. Turner, 1975, p. 234.

* His examples of 'o̅' are on p. .

Here We will try to summarize his views from all these writings. As only the mid-vowels are relevant to our topic, We will include Pandit's historical view points about the same.

I	OIA	i	>	MIA e
		bilva		bella 'leaves offered in Puja'
		ai	>	e in close syllable
				ē in open syllable
		vaira		vēra 'revenge'
		u	>	o
		puskara		pokkhara 'A precious stone'
		au	>	o in close syllable
				ō in open syllable
		gaurav		gōrav 'A Puja to be performed by the unmarried girls'
		aya, aye	>	ē
		apa, ava	>	ō
II	MIA	long vowels		ī, e, ā, ū, o
		short vowels		i, u, a.

Intervocalic consonants are lost and new vowel sequences appear, this made it possible to borrow Sanskrit words with 'ai' and 'au' even at the later stage. Pandit feels that these 'ai, au' become 'ɛ' and 'ɔ' in Gujarati.

i.e. Sanskrit 'ai au' (New borrowings) prākrt vowel sequences due to intervocalic consonant loss → Gujarati ɛ, ɔ

III. In between MIA and OG (Old Gujarati) a stage has been reconstructed. It has a similar vowel system like MIA,

OG: Long vowels : ī, e, ā, ū, o.
Short vowels : i, u, a.
Sequences : ea, iu, oi, ui, iā, aū, etc.

IV. In MG (Middle Gujarati) stage the following changes are suggested by him,

OG: ai > MG: ɛ
au ɔ
} in initial syllable or in monosyllable only.

MG vowels: i, e, ɛ, a, ā, o, ɔ, u,

Pandit has attributed open vowels of this period to 'ai, au.' According to him it was during this period (i.e. 15th to 18th century) that 'ɛ' and 'ɔ' appear as a result of the contraction of 'ai' and 'au.' It is but obvious that all NIA languages must have developed their peculiarities in the period immediately preceding to NIA. With the tremendous amount of borrowing going on in the MIA period, the old stage of all NIA languages must have been yet getting shaped. Hence, it is only natural to acquire the observable and

steady peculiarities after the middle stage of NIA. Chatterji has noted that [æ] is a comparatively recent sound.. and it originated.. not earlier than towards the very end of the MB (Middle Bengali) period."[20] What Pandit has said is partially true/that 'ɛ-ɔ' are the result of OG ai au and other vowel sequences which are due to new Sanskrit borrowings. He is only partially correct for the following reasons,

(1) If earlier 'ai', 'au' contracted to 'e', 'o', why the later 'ai', 'au' appear as 'ɛ-ɔ' should be explained phonetically. When a linguistic community acquires a separate identity it must be due to certain phonetic process (which of-course is not an idiosyncratic result but is the result of one of the many possible phonetic currents).

(2) If the stage is reconstructed from the material written by the scribes at one end and the NG (new Gujarati) sounds at the other end then such a reconstruction is also answerable to non-open 'e' and 'o'. The scribed material definitely is an insufficient source. The only authentic material is what a Gujarati speaks and perceives. When 'ɛ' and 'ɔ' are the dialect peculiarities, it is but logical to look

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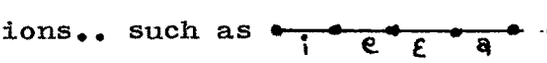
20. Chatterji, vol.I, 1972., P.410.

for the corresponding 'e, o' of the other dialects too.

(3) If Pandit is talking about the dialect with 'ɛ, ɔ' it is not enough that he merely gives reasons for 'ɛ-ɔ' in the words with Sanskrit origin because there is a large data consisting of non-Sanskrit words and yet having 'ɛ, ɔ'.

Pandit's approach in 'E & O in Gujarati' is neither the traditional historical nor it is Bloomfieldian (modern) in nature. (We are inclined to call it Bloomfieldian as he imposes rigidly the phoneme-contrast notion characteristic of Bloomfieldian era). All his writings on phonology were done between the year 1955-1966, the period when already theoretical phonology had gone away from the notion of merely pair-based contrast. He says that in between [i] and [a] there are only four distinct units... A Gujarati speaker is used to have only four divisions.. such as 

.[21] His desire to establish the two new phonemes /ɛ/and/ɔ/ is very strong but the support for this is restricted and limited. He has said that "the nasalized 'e', 'o' of old Gujarati stage were the manifestations of close phoneme /e/, /o/, phonetically their [ẽ] [õ]

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21. Pandit, 1966, p. 159-160.

pronunciation must have been more open than /e,o/, but at that stage openness, closeness (contrast) were not distinct units. .. No sooner in MG stage openness, closeness became distinctive, OG nasalized [ẽ], [õ] became manifestations of open /ɛ,ɔ/ (phonemes). Even if there is no pronunciation change, the systematic change can cause such shifting of phonemes."[22] Pandit has noted in all his writings clearly that the occurrence of open-mid vowels is restricted to only initial position or only in monosyllables. Hence his contrast between /e/ - /ɛ/ and /o/ - /ɔ/ are highly restricted and the pairs given by him to demonstrate these contrasts are highly objectionable as shown earlier.

Also this looks like a strenuous struggle to search for the real contrast between these vowels. In all his writings he mentions that phonetic factors (like nasalization, nasals, retroflex flaps etc.) lower the mid-vowels. He has also observed a tendency of free variation between the close and open mid-vowels. And he has seen the relationship between the close and open vowels as he says "just as /e/ and /ɛ/ are more closely connected to each other same way /o/ and /ɔ/ are also more connected to each other".. (than with /i/ or /u/ respectively).[23] These three points should have been enough to start the re-thinking about the issue. But Pandit like Divetia prefers to ignore any kind of contextual modification.

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22. Pandit, 1966, p. 22.

23. ibid, p. 112.

He vaguely suggests the addition of two more 'symbols' for modern Gujarati orthography and says "Modern Gujarati has some words with open ɛ and ɔ where the openness has resulted primarily due to their being in the closed syllable. We cannot definitely determine the period in which this tendency might have started. In old and middle Gujarati they are usually written with 'e' or with a long 'i' (if it is the case of 'i' in a closed syllable) as the normal graphic and grammatical tradition would demand. During this period upto twentieth century, we should remember that Gujarati never needed two symbols for open and close sounds."[24] Earlier he has noted that the MG vowel system already had openmid vowels. If the scribes then (who were perhaps loyal to their local dialect pronunciations) did not require two symbols for open and close vowels, then what makes Pandit decide that now in twentieth century Gujarati should have two more symbols? The need for extra symbols can only be justified when there is a confusion in perceiving the sounds in the speech. And such a need was not felt earlier nor is it even felt today. The phonemic distinctness between the open and close mid-vowels as asserted by Pandit amounts to the begging of the question. If the phonemic distinctness really existed there would have been some confusion due to the symbols.

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24. Pandit, 1955, p.650.

No linguistic community with the writing system of its own would allow such utter symbolic confusion. His contrast-based phoneme finding approach and half hearted historical approach leads to this ambiguous situation.

2.1.6 Dave's views

Ten years after Pandit's work Dave's dissertation appears.[25] Unfortunately Dave has blindly followed Pandit in this matter.[26] But somewhere he is unsure and says "I have only six vowels in my dialect which is Halari." He ofcourse depends on his informants and often hears free variation between these sounds when in medial position; but his nasalized vowels "however, do not distinguish between the open and close e and o." Again in chapter three he confesses that "varying degree of openness of e-ɛ and o - ɔ have been noticed by me in the speech of my informants"... and the informants do not maintain" the opposition consistently either" and "the same word is spoken with close or open vowel at different times."[27] He also refers to the non-consistent distinction between them, while describing the sounds in terms of distinctive features. He states that "the three degrees of aperture of Gujarati vowels cannot be described satisfactorily but it is possible to find some solution."[28] Why should a linguist compromise and give

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25. Dave, 1978.

26. ibid, p. 7-10.

27. Dave, 1967; p. 11.

28. ibid, 1978, p. 16.

'some' solution in a condescending manner? Throughout both of his writings there is a note of non-commital attitude and hesitation.

2-1.7. Jørgensen's views

Reference to Jørgensen's work has to be made. Jørgensen has in no less assertive terms noted that .. "there is a tendency for [e] and [o] to be somewhat more open when murmured."[29] From Jørgensen's results one can see that

(1) she has not treated open - close 'e' 'o' sounds separately because she noted that except by Pandit and one other informant e-ɛ, o-ɔ were not treated as distinct phonemic pairs. (Pandit being one of the informants it is understandable that the data showing the contrast between these pairs was pre-confirmed and pre-determined).

(2) she has noted a higher F_1 in murmured 'e', 'o', a lower F_2 in murmured 'e' and higher F_2 in murmured 'o'. This leads her to conclude that there is a tendency of more opening (of mouth) for murmured vowels.

(3) she is right when she confirms that the shift of F_1 in murmured 'e' and 'o' should be the result of a larger coupling to the trachea.

(4) she also noticed that open 'e', 'o' mainly appeared in words with murmured vowels.[30]

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29. Jørgensen, 1967, p.105.

30. ibid.

Dave correctly saw that "the words [ve:r] and [ve̲:r] which also have [e] with varying degrees of openness" cannot be "included in the final result" and "consonant with different places of articulation have different 'loci' and they influence the vowel formants in different ways."[31]

It is surprising why Dave inspite of all those observations still insists on following Pandit's phonology. No doubt Jørgensen and Dave both have concentrated on the murmured vowels mainly. Yet both have felt that the distinction between open and close 'e, o' is not absolute. This should have been enough cue for Dave to dissuade him from making a such statement about the phonemic status of e, ɛ , o, ɔ .

2.1.8. Vyas' views

The next work which should be noted is of Vyas.[32] She has not concentrated on this issue. But in her chapter one, she lists eight vowel symbols which "are needed to differentiate the sounds."[32] In a note at the end of the chapter she says "/e/ and /ɛ/ and /o/ and /ɔ/ are always differentiated in monosyllabic words and in the first syllable of disyllabic words. In words of three syllables and over /e/ and /ɛ/ and /o/ and /ɔ/ are in free variation in the first syllable. My own preference is for /ɛ/ and /ɔ/ in this position. In the second syllable of

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31. Dave, 1967, p. 11.

32. Vyas, 1978, p.26.

disyllabic words and in the second and final syllable of polysyllabic words /e/ and /o/ are preferable and the vowels in those positions tend to be the close varieties."[33] It can be inferred from this that,

(1) she considers these pairs as distinct phonemes

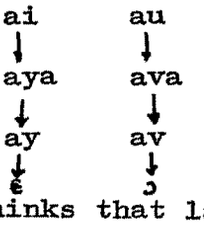
(2) but she does not make any categorical statement about it ,

(3) in some positions there is no definite pronunciation. It also appears that she is not so certain about the status of these pairs except for her 'own preference.'

Putting all the views in short:

(1) Turner derives 'ɛ ,ɔ' directly from the vowel sequences 'ai, au,' respectively

(2) Divetia prefers the stages:



(3) Pandit thinks that late borrowings from Sanskrit give 'ai, au' and these became 'ɛ ,ɔ' respectively; and the vowel sequences due to intervocalic consonant loss result into open vowels. Pandit also tries to establish them as phonemes using contrastive pairs.

(4) Dave and Vyas have half heartedly decided that 'ɛ' , 'ɔ' are phonemes.

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33. Vyas, 1978, p.33.

(5) Jørgensen is clear in her views although her object was to analyse the breathy vowels only. She has left it open for the phonologists to decide about the distinctiveness between 'e - ɛ' and 'o - ɔ'. For her purpose she straight away treats them together as [e] and [o] only.

One can see that there is no definite description of Gujarati mid-vowels inspite of many efforts. While working on murmured vowels, we noticed one interestingly regular phenomenon that the murmured vowels required a little more lowering of the jaw than that required for the clear ones. In this context all the vowels changed their quantity and the mid-vowels changed in quality too. One dialect without murmur and having open mid vowels showed the further lowering whenever there was 'h' in the context. Our inquiry begins from this:

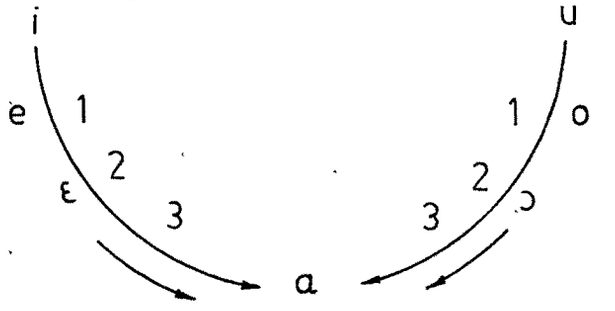
(1) are there dialects in Gujarati with eight vowels phonemes? (The answer to this question would be 'no' and we have fully explained it later).

(2) if 'not', then what is the explanation for the presence of 'ɛ' and 'ɔ' in the so called eight vowel dialects?

(3) in a murmurless dialect when do 'e' and 'o' get lowered? why?

2.2. Ancient Indian phonetics

Before answering these questions, we will first of all examine the mid-vowels phonetically. We have considered these vowels as the movable points between the vowel gradations 'i' and 'a' / 'u' and 'a' such as seen in the figure below:



It would be in all propriety to look for the description of these vowels in ancient treatises too. Allen has accused phoneticians of ignoring these important vowel gradations and considered it as their "failure to discuss one of the outstanding phonological processes of Sanskrit." He feels that "for certain phonological purposes it is convenient to recognize a system of vocalic alternation of the type given below:

Grade			
1	i	u	ṛ
2	e	o	ar
3	ai	au	aar." [34]

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34. Allen, 1965, p. 12.

What makes it obligatory to see the historical development of vowels also makes all the more obligatory to go to the phonetic study of vowels. As one starts from the vrddhi stage and goes upto the guna stage the different manifestations of the guna stage are visible in the NIA languages. Our Sanskrit scholars, having clearly known that 'e' and 'o' are the results of the contractions of two vowels characterized them as having two qualities i.e. they don't have inherently single quality.

RP says that "when a, ā are followed by i, ī, together they become 'e' and in the same way a, ā together, with their following vowels, u, ū become 'o'.[35] In the following two sutras it continues the indication of the further possibilities of contractions. It says "if a, ā are followed by e, ai then together they become 'ai' and if a, ā are followed by o, au together they become 'au'."[36]

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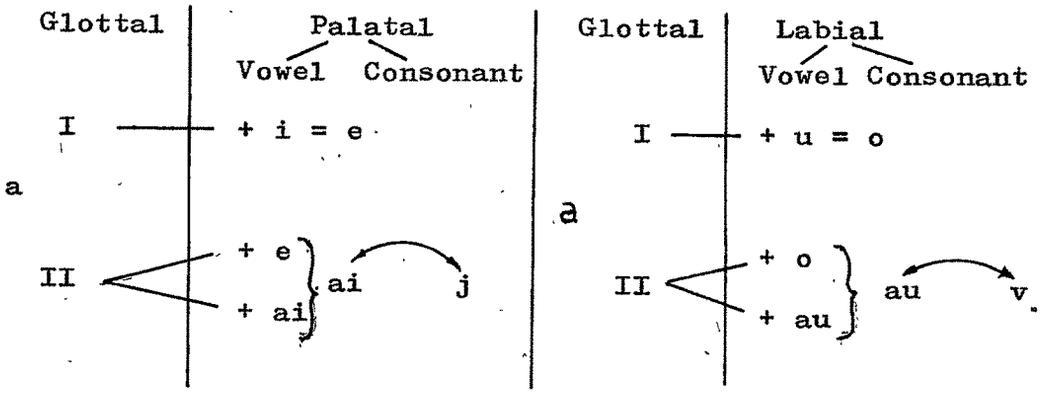
35. II, 16. ikārodaya ekāramakarah sodayah.
II, 17. tathā: ukārodaya okāram.

36. II. 18. paresv aikāram ojayoh.

All these sounds are considered by RP as contractions.[37] The 'i' element and the 'u' element of these sounds (i.e. e, o, ai, au) leaves them in a state from where they can easily move to their 'adjacent' consonantal points too. 'e', 'i', 'ī' and 'ai' along with 'tʃ - varga', 'j' and 'ʃ' are palatals[38] and the treatise has clearly hinted at these two places of articulations. In chapter XIII it is said, that "some teachers regard the diphthongs as the result of combination so that there is found in 'e, o' as well as in 'ai, au' the quality having two places of articulation.[39] These two places are explained by the commentator as 'kaṇṭhatālusthānatā' and 'kaṇṭhoṣṭha sthānatā' for 'e, ai' and 'o, au' respectively. This can be explained as in the table given below:



37. II. 19. aukāram yugmayoḥ.
II. 20. ete praśliṣṭā nāma sandhayaḥ.

Knowing the weak position of these contracted sounds the ancient scholar śākaṭāyana specified that the first half of these diphthongs is 'a' vowel and the second half can be 'i' or 'u'.[40] But RP considers it an incomplete description and in the next sutra says that "the first two (i.e. e, o) by the reason of the fusion of their components - moras - are heard as single sounds.[41] The commentator uvaṭa is more explicit and says that in 'e' and 'o' the components fuse like milk and water and hence the components have aprthak śruti (sounding non-separate). The two (i.e. ai, au) are like interlacing of two vowels and 'i' and 'u' have a larger share of the moras in the sequence.[42] With this unequitable distribution of the two parts of these 'diphthongs' it would be necessary to see how the treatises describe these parts separately as well as in the combination.

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38. I. 42. tālavīyāvekāra cakāra vargā vikāraikārau jakārah śakārah.

39. XIII. 38. sandhyāni sandhyaksarānyāhureke dvisthānatai tesu tathobhayesu.

40. RP. XIII. 39. sandhyesv akāro 'rdhamikara uttaram yujorukāra iti śākaṭāyana.

41. uvaṭao on XIII 40. mātrayoh samayoh ksirodakavat samsargāt na jnāyate kvāvarna mātrā kvāvevarnovarnayoriti.

TP has prescribed 'not too close and not too open lips and jaws for the 'a'varna vowels.[43] This indicates a kind of arbitrariness in the degree of opening of the jaws/lips. The vowel 'a' is crucial for the description of diphthongs and it acts like a point of reference when AP says that "for the vowel 'ā' (ा) the organs of speech are most open, but for 'a' vowel they are rather close. And for 'e' and 'o' the opening is maximum.[44] This description makes it evident that the vowels 'a' and 'ā' are different in their quality by degree of openness, though TP does not describe it so - for the obvious reason that 'a' and 'ā'make a phonologically parallel pair with i - ī and u - ū.

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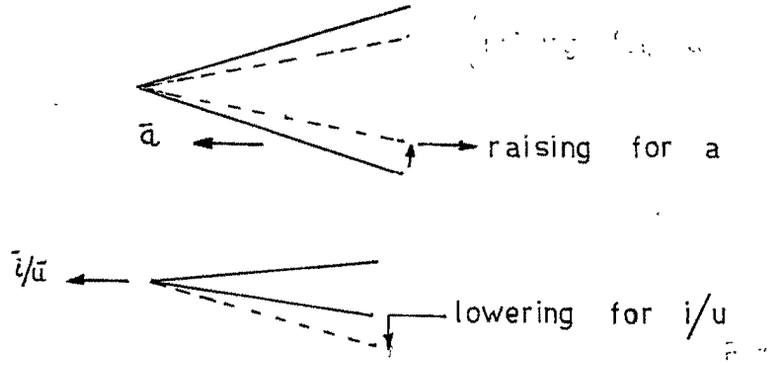
42. uvaṭa on XIII. 41. ivarṇovarṇayorbhūyasī mātrā alpīyasyavarṇasya tasmāttayorvaiṣamyānna kṣīrodakavat samsargo bhavati.

43. II. 12. avarṇe na atyupasamhṛtam ostha hanu na ativyastam.

44. I. 34. ekāraukārasyorvivṛtatamam.
I. 35. tato'pyākārasya
I. 36. samvṛto'kārah

The fact that Pāṇini had to prescribe short 'a' as coincidental in quality with long 'ā' suggests that he did so for the phonological purpose as in actual speech the difference between 'a' and 'ā' might have started increasing. The articulatory difference between the short and long a, ā and the short and long i, ī, / u, ū is, that for the short 'a' the jaw must be raised more than for 'ā' but for the short i/u the jaw opens up slightly more than for the long ī/ū. This can be explained as in the figure below:



This shows that the scope for the change of quality is maximum when the lowering of the jaw takes place (as for i/u). Hence the 'vivṛta', 'saṃvṛta' qualities are vaguely applied to i/u as no definite degree of 'vivṛta-ness, saṃvṛta-ness', can be defined. However, TP is more explicit about describing 'i', 'e', and 'u', 'o'. It says that "for 'o' the jaws are not too

open but lips are closer,[45] and for 'e' the lips are only in slight close position but jaws do come closer."[46] It is specific about the position of 'the tongue for 'ī' varna, that it goes closer to the palate.[47] Whitney has complemented TP for such detailed account saying that "more distinctive description of our 'e' and 'o' could hardly be given.[48] But as we have noted earlier AP suggests the 'vivṛtatama'- maximum open-position for 'e' and 'o'. Allen feels that "e, o, must have been historically diphthongal and continued to function as such for certain phonological purposes. (e.g. vijñaaya + idam = vijñaayedam) and (nagare + iha = nagaraiha).[49] Inspite of the recommended complete fusion of 'a + i/u' in 'e', 'o' they are dissolvable into 'a + i/u' and this

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45. II. 13. okāre ca.
    II. 14. osthau tūpasamhṛtatarau

46. II. 15. īsatprakṛstāvekāre
    II. 16. upasamhṛtatarehanū

47. II. 22. tālau jihvā madhyamivarne

48. Whitney, 1962, p.35.

49. Allen, 1953, p.62.

potentiality of these diphthongs can throw considerable light on the historical development of these diphthongs. Amongst the ancient scholars there is a great deal of disagreement also as to the moras of these sounds. One view (especially Mahābhāsya) wants to have equal moras for 'a' and 'i/u' (samapravibhāga - equal divisions) the other view (vārttika) insists on having only half mora for 'a' and one and half for 'i/u'.[50] TP also gives similar distribution.[51]

Though there are no exactly same values for the vowels in these descriptions some common points could be given:

(1) 'e, o, āi āu,' are 'sandhyaksarāh' - diphthongs.

(2) the first part of these diphthongs is the vowel 'a' and it is (kantya) glottal.

(3) the 'e, āi' have glottal-palatal position for their articulation and 'o, āu' have glottal-labial position for their articulation.

(4) for e, o there is a complete fusion of their components though they are dissolvable at times.

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50. varttika. ecascottara bhūyastvāt

51. TP. II. 26. akārārdhamaikāraukārayorādih.
II. 28. ikāro'dhyardhah pūrvasya śesah
II. 29. ukārastūttarasya.

(5) the difference between 'a, ā,is due to the lowering of the jaw but this can change the quality of high vowels ī/ū and one may get even 'e, o' as the resulting sounds.

(6) e, o have equitable moras between their (a, i/u) components.

(7) but for 'āi, āu' the first part has only half the mora and the second part has one and half moras.

From this it is obvious that the ancient scholars disagree on two main points. First such point is about the degree of opening of the jaw for vowels. Mahābhāsya describes 'a' as having 'vivrta' effort and the excess of it is laid down by the word 'vivrtatara'. The 'a' forming the part of 'sandhyaksarāh'is different from the 'a' elsewhere and i/u of 'sandhyaksarāh' is also are different from i/u elsewhere.When the effort is 'vivrtatara' it results into 'e, o' and when it is 'vivrtatama' it results into 'ai, au'.[52] Tribhāsyaratna states this rather differently. It says "for 'e' the middle of the tongue does not go closer to the palate as much as it does for 'i' because 'e' has as its component 'a' vowel too."[53] This is also an interesting

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52. eño vivrtataratvāt aicām vivrtatamatvāditi bodhavyam (Mahābhāsya)

description which leaves 'e' as an 'openable' vowel. It can lead us to believe that the diphthongs were the sounds, most vulnerable to changes. All this indicates that the degree of openness for these vowels was never a steady well defined feature. Bloch says that "there is nothing, moreover, to show that the pronunciation of 'e' and 'o' was uniform... and "from the point of view of quatity, which is the basic element of the old phonetic system, the distribution of these phonemes is irregular."[54] Of course, the various opinions in the treatises might be due to the changing stages in the development of the language or might be due to the dialectal variations. Allen prefers to consider them as reflections of "actual dialect features".[55]

The second important disagreement is about the moras of the parts of the diphthongs. The controversy is acute between Bhāsyakār and Vārttikkār.[56]

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53. ivarne yathā jihvā madhyopasamhāro na khalu evam ekāre, kintu tato nyūna iti arthah kutah akārmiśritatvād ekārasya (Tribhāsyaratna)

54. Bloch, 1965, p.35-36.

55. Allen, 1953, P.6.

56. Bhatt, 1979, p.366.

TP, RP and vārttika have given similar distribution of the moras for 'ai, au'. But Bhāsyakāra again and again stresses the 'samapravibhāga' - equal distribution of moras for both the vowels, 'Śākatāyana and Bhāsyakāra both believe in this type of equitable distribution, their view can be explained thus:

	a + i/u
moras	1 + 1
by fusion	⟶ e/o vivṛtatara
only by contraction, resulting in one syllable	⟶ ai/au vivṛtatama

Another striking contribution of the ancient scholars, is especially pertinent to our topic i.e. the differentiated description of avyañjana 'e' (vowel 'e' without the consonant) and savyañjana 'e' (vowel 'e' with the consonant). TP has very well distinguished these two types of 'e'. In these Sutras[57] it says that for the 'e' sounds the end of the middle of the tongue goes close to the back part of the palate, but again it says that for 'e' the middle of the tongue goes close to the palate. The commentator has been explicit enough to distinguish these two types of

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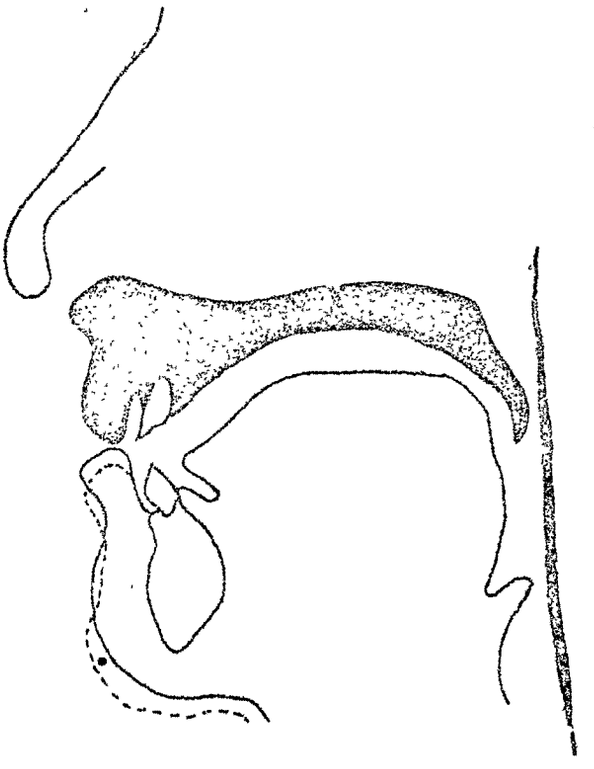
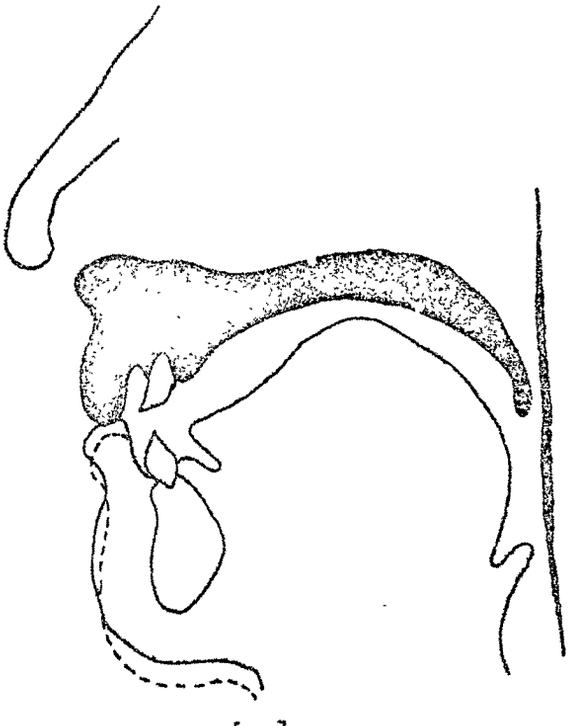
57. Taittiriya: II: 15-17, 22, 23.



'e' without a consonant



'e' with a consonant [ke]

Figure 3: 'e' without and with a consonant

tongue positions for the same vowel 'e'. He has also justified the sutra (II:23) 'ekāreca' saying that though the same features as 'i' given in the sutra II:22 (the middle of the tongue going closer to the palate) are applicable to the vowel 'e', another sutra (II:23) is given in order to show that as 'e' has one of its components the vowel 'a';(this closeness of the tongue to palate is of lesser degree). The commentator rightly feels that when 'e' is articulated without consonants the back portion of the middle of the tongue is involved (I:17) and when it is pronounced with a consonant the middle of the tongue is involved (II:23) see figure no.3 on p.156. That the vowel is modified in the consonantal context is well stated here. Such small but crucial changes in the articulations of the vowel due to consonants are not so easily decipherable articulatorily or perceptually. They become noticeable only when the modification brings qualitative and/or quantitative change in the vowels.

The ancient scholars have not failed to suggest the possible natural changes in the continuous speech, when two sounds come next to each other within the word or across the word boundary. One can easily notice that they start the description of the process of synthesis, first by observing the combinations of

sounds, then of syllables, then of words. AP agrees with others in indicating that the diphthongs 'e', 'o', 'ai' and 'au' result into 'ay', 'av', 'āy', 'āv' when followed by a vowel.[58] But it says that this 'y', 'v' are dropped when in final position.[59] These rules are very interesting from our point of view. The changes indicated are:

e, o, ai, au ⟶ ay, av, āy, āv

y, v ⟶ ∅ (AP).

Whitney has once again praised TP for having discussed this issue in greater details. TP cites all discordent opinions of various scholars, though it has prescribed the 'lopa' (deletion) of 'y' and 'v' when followed by a vowel. The grammarian Ukhya has given the contrary opinion to TP[60a] Sāṅkṛtya denies the loss of 'v'[60b] and Māchākīya restricts the environment to 'u' and 'o' only.[60c] For our purpose the most attractive is vātsapra's opinion. According to him there is no total loss of 'y' and 'v' but these two sounds are imperfectly pronounced.[60d]

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58. AP. III. 40. sandhyakṣarāṇāmayavāyāvaḥ.

59. AP. II. 21. svarādyavayoḥ padāntayoḥ.

60. (a,b,c,d.)
TP X 20-23. nokhyasya! vakārastu sāṅkṛtyasya!
ukāraukāraparau lupyete mācākīyasya!
leśo vātsaprasyaitayoḥ.

Similar opinion of Śākaṭāyana is quoted by AP.[61] The fact that 'y' and 'v' can have attenuated pronunciation as regards contacts perhaps reveals another dialect possibility. This 'leśa' is explained by Vātsapra as 'as good as lost' but not fully lost. This 'weakened' articulation of 'y' and 'v' has been noted by Pāṇinī[62] too. RP needs a special mention here. In a chapter concentrating on the possible faults of pronunciation it refers to the likelihood of 'leśaprayatna' (weakened effort)[63] or 'piḷanam' (extra effort) in articulation. So also the author fears that for the pronunciation of vowels a speaker may commit a fault called 'Śamdaṣṭam' i.e. extra lowering of the jaw.[64] The possibilities of the said 'mistakes' were foreseen by the writer. Though these 'flaws' are not permitted the very fact that the author can define the types of 'flaws' go to indicate that the author was aware of the natural tendency of the speakers to modify the articulation.

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61. AP. II. 24. leśavṛttiradhisparśam śākaṭāyanasya.

62. Pāṇinī aṣṭādhyāyī VIII. 3:19. lopaḥ śākalyasya.
VIII. 3:18. vyor laghuprayatnataraḥ śākaṭāyanaḥ

63. RP XIV. 17, leśena vā vacanaṃ pīḍanam vā

64. RP XIV. 6. śamdaṣṭam tu vrīḍana āha hanvoḥ

The ancient treatises suggest some very important points for our work here:

(1) they provide enough proof for the undefined (or undefinable) position of the mid-vowels,

(2) their suggestions regarding the contextual modifications of the vowels can throw sufficient light on Gujarati mid-vowels ,

(3) the disagreements between them show the dialectal variations,

(4) the question of the distribution of the moras in diphthongs is highly suggestive of possible changes ,

(5) the possibility of weak position of 'y' and 'v' also supports certain derivational course.

The disagreement amongst the ancient scholars though pointing at the existence of the various dialects, is not enough to specify the features of these dialects. The old phonetic system must have started developing in many different directions. As Bloch says it appears to be working in an irregular and ill-matched manner and as he has observed "A is merely a vowel, i, u, ṛ are semivocalic; e and o are diphthongs resolvable into the elements

ay, av, which should normally come from ai, au, but ai, au resolve into āy, āv."[65] As it is apparent from Prātiśākhyas' these vowels must be phonetically resolving into various modifications. It is quite possible that many of such modifications remain unrecorded. Hence inspite of the complicated possibilities we get a simplified picture of Sanskrit phonology but the result is more manifested at MIA stage when we get proliferation of dialects. Bloch has also felt that though the vowel system of Sanskrit is meagre there must have been a great deal of imbalance which caused "extensive remoulding of sounds."[66] The vowels e, o and the diphthongs ai, au of the MIA stage especially continue to show uncertain line of development: in (1) prākrt ai > e/ĕ,[67] kailās > kelās (2) in some words 'ai' is compulsory,[68] ai > ai, daitya > daicca: and in some it is optional,[69] ai > ai/e, vairam > vairam/veram (3) au > o kaumudi > komuī[70] (4) but in some words au > au, paur > paur[71]. (5) in ava, apa, 'o' is optionally recommended.[72]

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65. Bloch, 1965, p.36.

66. ibid, p. 37.

67. Hemachandra, 1928, 18:1:148. aita et.

68. ibid 8:1:151. airdaityādau ca

69. ibid 8:1:152. vairādau vā

70. ibid 8:1:159. auta aot

71. ibid 8:1:162 94. auhpaurādau ca

72. ibid 8:1:172. avāpote

Apart from these changes from OIA to MIA there was a lot of shifting going on due to the changes in consonantal structure. These changes were:

(1) the medial consonant loss and replacement of 'y/v' in their place,

(2) consonant clusters changing to gemination and consequently changing the accent and quality of vowels,

(3) the process of samprasāraṇa changing the vowel sequences,

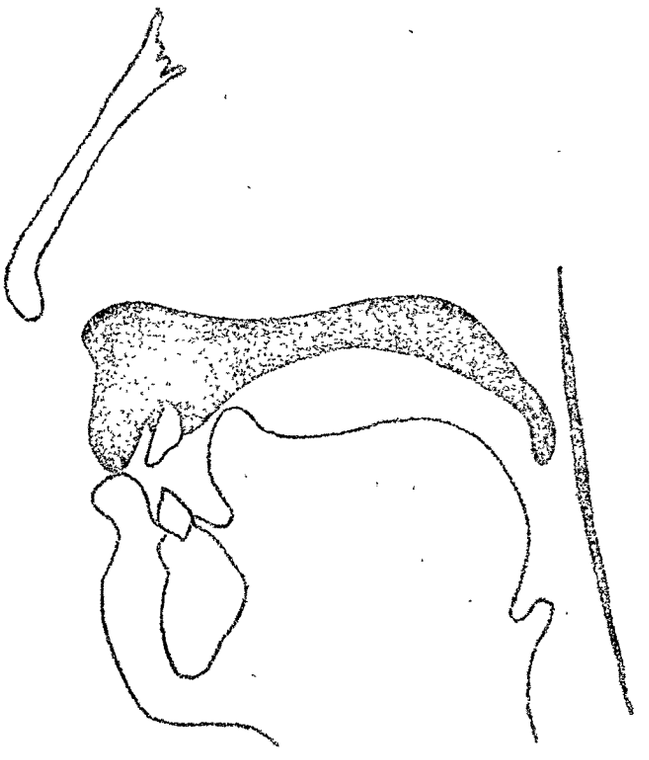
(1) Pischel gives plentiful examples of this type. Hemachandra has prescribed such a consonant loss when 'k, g, c, j, t, d, p, y, v' are dropped in non-initial position, when followed by a vowel and when they are not conjuncts.[73] The 'a' left in place of these consonants is replaced by 'ya śruti' (yod) and this 'ya' is attenuated.

(2) When the consonant conjuncts change into geminates the change in the preceding vowels can be explained like this:

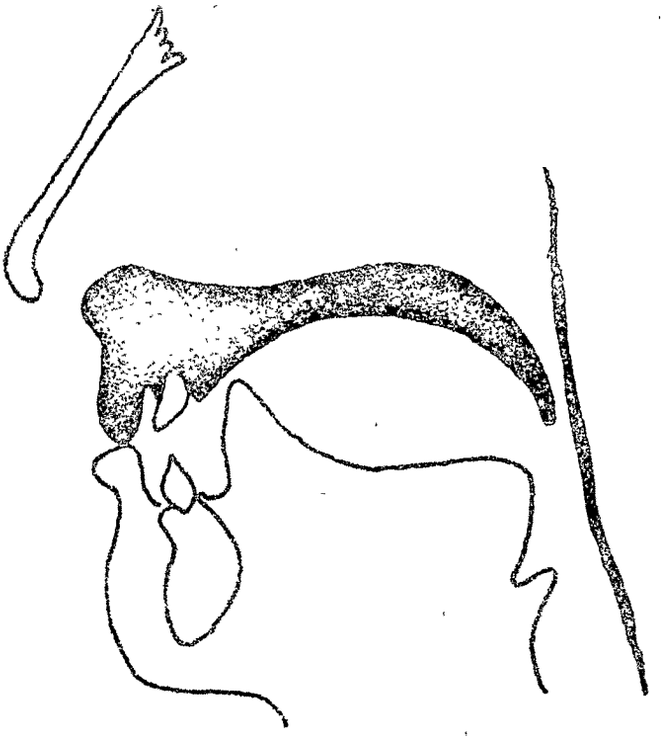
kuṣṭha > *koṭṭha > kodha

---

73. Hemachandra, 8:1:176. svarādasamyuktasyānadeḥ
8:1:177. ka-ga-ca-ja-ta-da-pa-ya-vam prāyo luk.
8:1:180. avarṇo yaśrutiḥ



The tongue posion for s̪h



The tongue position for t̪h

FIGURE:4- The difference in tongue positions for s̪h and t̪h

The lowering of 'u' to 'o' is a natural requirement. In this example the opening of the vowel required for 'st' sequence and 'tth' sequence is different. See the figure no. 4 opp. 163 The hollow created by 'tth' is definitely more because when the two retroflexed stops plus aspiration seek the release the vocal tract opens more for the extra puff of air. In case of 'sth' the first sound being a sibilant the accumulation of air in the vocal tract will be lesser hence the lesser force and lesser opening of the tract. 'tth' makes a way for the lowering of the vowel 'u' to 'o'.

I. kus | tha

II. kut | tha by gemination

kŏt | tha changing the vowel

III. kó:tha gemination replaced by the single consonant and vowel being lengthened and so accented

IV. kŏ:dh/kó:dh final vowel dropped consonant voiced and vowel lowered relatively.

(3) By the process of: sāmprasāraṇa

ya > i or ĕ , aya > e

va > u or ŏ ava > o

ava > au > o

apa > ava > o

These and other changes are a proof for proliferated vowel system at prākṛt stage. Our NIA languages too exhibit the extensive remoulding of MIA vowel system. The diphthongs - vowel sequences - have played an important role in this remoulding. From prātiśākhyas till NIA stage the continuous unsteady character of these vowels is seen. We have tried to show that they are susceptible to changes because of the scope they have in the oral cavity. This makes it a natural process - the diphthongs resolving and dissolving in the contexts of other vowel is inevitably innate to the pronunciation position of the mid-vowels.

2·2·1 Modern phonetics

Having gone through the origin and the development of IA mid-vowels it would be worthwhile now to take the help of the modern phonetics and examine these vowels. It has been realized that 'phonetics' is indispensable. Lehiste has firmly stated that any true work on phonological phonemena has gone through the correct observations of their phonetic manifestations and that "a phonologist ignores phonetics at his own peril."[74] No linguistic study can be made without constantly studying the material on expression level. All modern phonological studies have pronounced their aim to give an explanatory theory.

One agrees with Wang, that without the precise methods of phonetics phonemics is "at best shaky"...[75] Ladefoged,

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74. Lehiste, 1970, p. iv.

75. Wang, 1968, p. v.

Ohala, Lehiste and other phonetists/phonemicists have been insisting on drawing upon 'linguistically relevant phonetic facts' and have been insisting that if phonology has to be 'explanatory' it should aim at explaining the complex of phonetic causes that constitute part of the origin of phonological structure. Lindblom is very categorical and clear when he recommends the use of "phonetic theory in maximally efficient manner".[76]

With enough empirical data at our disposal, we have extended the support to our thesis from various acoustical and physiological researches.

2.2.2 Phonation types, mid-vowels and dialect areas

Going through the data of mid-vowels from four major dialect areas, we can say that,[77]

(1) phonetically open 'ɛ' and 'ɔ' are found in two of the important dialect areas:
   (a) Bhavnagar area (Gohilwad dialect)
   (b) the area that spreads from Ahmedabad to some part of Surat district

(2) In two other important dialect areas

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76. Lindblom, 1971, p. 66.

77. Here it should be noted that the data collection for this work was based upon my earlier knowledge of atleast three dialects. I was exposed to these three dialects from childhood. Infact if required, I can switch over from

(contd.)

only 'e' and 'o' exist. These areas are:

(a) large area of Saurashtra (Sorthi dialect) which includes Rajkot, Junagadh, Jamnagar and surrounding areas.

(b) the area spreading from Songadh (Surat district) to Dahanu (also large number of Bombay speakers, may be included.)

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77. (contd.)

one to the other without any difficulty. Hence this helped me to plan the data collection; but at the same time one can doubt the 'coverage of dialects'. However, we are sure that we have covered the major dialects. The informants were:

(1) Ahmedabad University teacher, age, 33. Born and brought up in Ahmedabad.

(2) Ahmedabad housewife, age, 40. Born and brought up in Ahmedabad. University graduate.

(3) Baroda University teacher, age, 29. Born and brought up in Baroda. Also a literary writer.

(4) Baroda University teacher, age, 39. Born and brought up in Baroda. Also a literary writer.

(5) Baroda housewife, age, 41. Born and brought up in Baroda. A creative artist (painter).

(6) A student from Broach, age, 22. Born and brought up in Bharuch. Studied in Gujarati medium school.

To give a clear picture of these areas, we have given the map. See p. 170. In the last Chapter, we have shown that the murmured vowels are absent in Saurashtra dialect. If we add that fact to the map the map will look as shown on p. 169. A little diversion is here called for. From the above map it is seen that Saurashtra vowels are marked by the absence of murmured vowels. On the contrary they

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77. (contd.)

(7) A student from Navsari district, age, 22. Born in Degam, partly brought up there and partly in Bombay. Studied in Gujarati medium school.

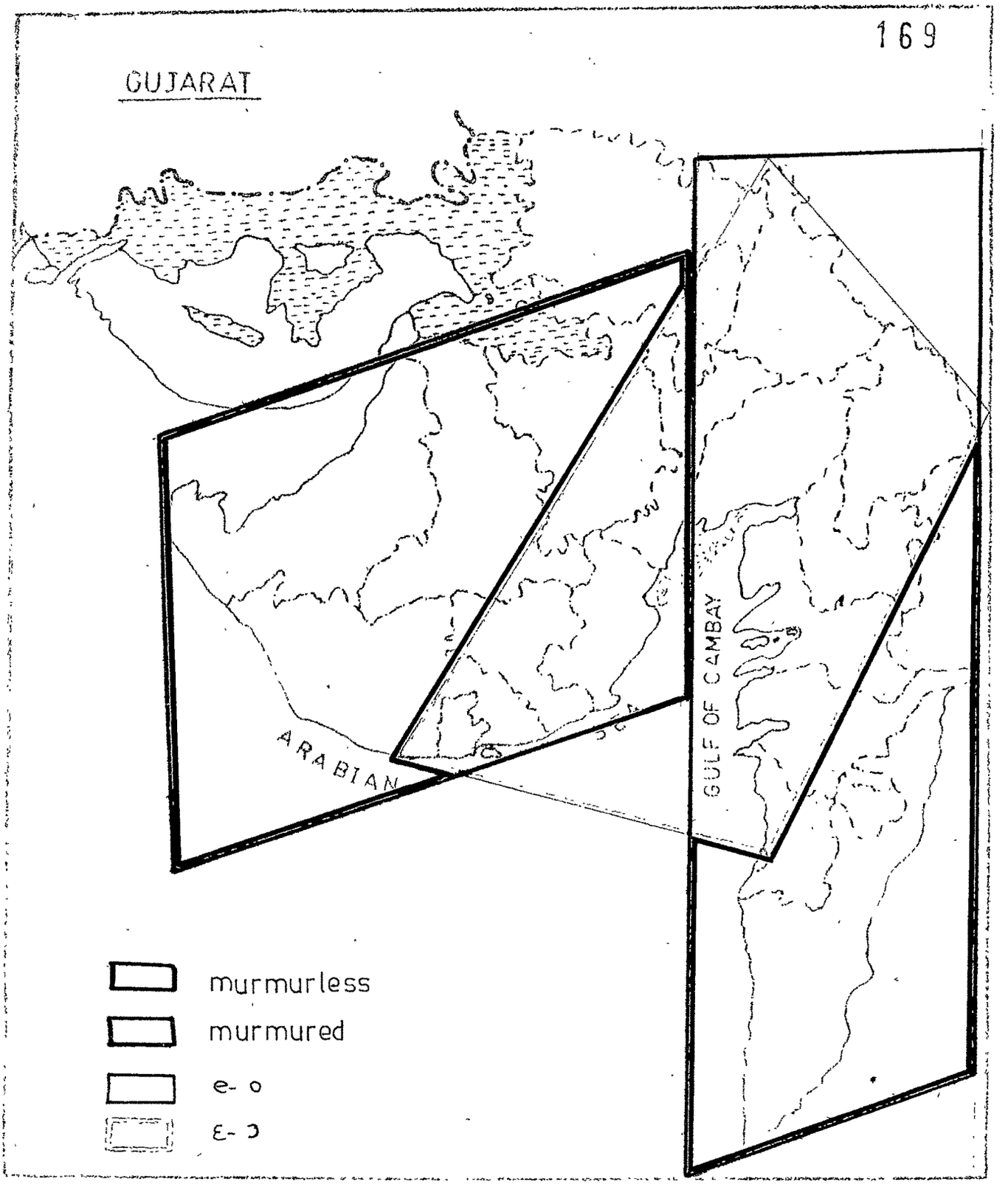
(8) A research student in Science from Rajkot, age, 27. Born and brought up in Rajkot, studied in Gujarati medium school.

(9) An Engineer from Bhavnagar (Gohilvad dialect), age, 30. Born and brought up in Bhavnagar. Studied in Gujarati medium school.

(10) A research student in Science from Bhavnagar, age, 26. Born and brought up in Bhavnagar. Studied in Gujarati medium school.

(11) A bank employee of State Bank of India, at Junagadh, age, 27. Born and brought up in Junagadh. Studied in Gujarati medium school.

GUJARAT



GUJARAT

invariably show a peculiar kind of 'tight' phonation. This significant feature opens up an entirely new area for further studies. Gujarati language displays unusual and distinct voice quality difference in two major dialect areas which are separated from each other in three main ways:

(1) Geographically

(2) Historically

(3) Sociologically.

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77. (contd.)

(12) A housewife from Jamnagar, age 57. Born and brought up at Jamnagar but settled in Bombay from some years. Very little education.

(13) A housewife, age, 58, with similar background as mine; belonging to Surat but educated in Bombay. Highly educated and literary writer in Gujarati. Speaks my dialect.

(14) Self, age, 47. Belonging to Surat, educated in Bombay, now Baroda University teacher in Linguistics.

(15) I was very fortunate to get Prof. Suresh Joshi as one of my informants. He has also exactly similar background as mine and speaks the same dialect as mine.

All along referred to as 'Kathiawadi language' by the laymen this dialect has not only remained murmurless but displays a voice quality which Firth, Fry, Catford and Abercrombie have noted[78] (but they have not discussed it fully). It definitely requires a full treatment and in a way it goes beyond the scope of the present topic hence, here, merely the difference between the said major dialect divisions are shown. By 'voice quality' we mean 'phonation type'. It depends upon specific balance between the kind of tensions in the vocal ligaments and in the vocal muscles. The adjustment of the larynx brought about by the proper nervous activation of the various muscles and the myoelastic properties of the laryngeal components play

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77. (contd.)

(16) Prof. Umashankar Joshi's (a reknowned creative writer) speech which he gave in Baroda University (taped by Gujarati Department of Baroda University) is included in the data here. He would represent the Ahmedabad elite dialect.

78. Firth, 1957, p. 52.
Fry (Ed. Malmberg), 1968, p. 369.
Catford, 1964
Abercrombie, 1967

important role in various phonation types. Catford says that "Laryngeal activity which generates a sound which is common to two or more terms in a system of phonematic units, differentiated by supraglottal modulation is phonatory[79]... and" laryngeal activity is not initiatory in its phonic or sound producing function whatever its phonological function may be". Actually the activity is so complicated that Van den Berg says that "the main adjustment of the larynx depends mainly on the mean adjustment of the laryngeal muscles... and the number of adjustments is infinite."[80] Abercrombie suggests that the larynx may have in some cases, "slightly lowered position giving rise to breathy phonation, in others a slightly raised position in the throat giving rise to tight phonation." "and tight phonation has the cartilage glottis firmly closed, the rest of the glottis in vibration and constriction of the upper parts of the larynx."[81] Vyas in her dissertation mentions the absence of ligamental phonation in her kind of Gujarati.[82]

Looking at the phonation of 'the Kathiawadi Gujarati' perhaps Catford might have felt that Gujarati

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79. Catford, 1964, p. 27.

80. Van den Berg, 1968, p. 296.

81. Abercrombie, 1967, p. 100-101.

82. Vyas, 1978.

has four of his phonation differences: breath, voice, ligamental voice and whispery voice. Catford has discussed ligamental voice as "actively restricted to the anterior ligamental part of the glottis.. Ligamental voice has 'sharp' 'clear' slightly 'harsh' quality, in English often paraphonologically associated with anger or severity."[83] Firth has definitely noted the tight phonation in Gujarati however, he is not right about the area when he says "I have since noticed a similar phonation difference in Gujarati as spoken by Indians in Surat... The vowel qualities thus affected are pronounced

(i) with breathy phonation

(ii) with what I have called 'tight phonation."[84]

With this classification the division of the two major Gujarati dialect areas can be proved to be unavoidable. Any phonemic statement will have to consider these divisions. Both these dialects are

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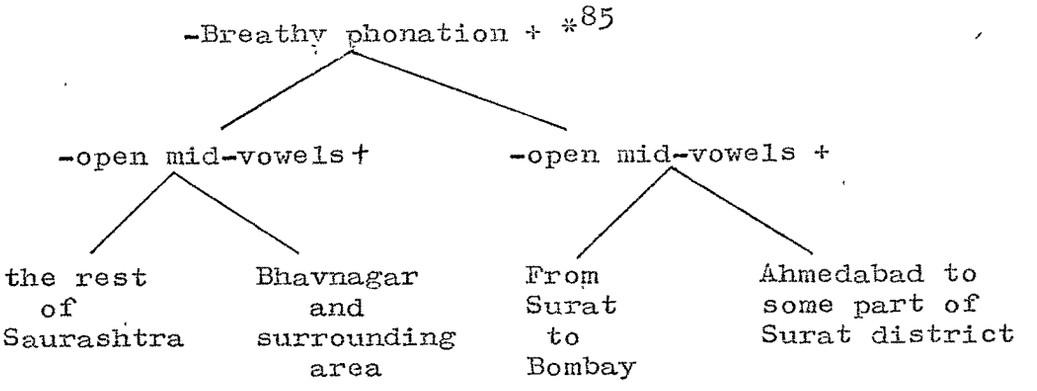
83. Catford, 1964, p. 36.

84. Firth, 1957, p. 52.

further sub-divided depending upon the presence or absence of open-mid vowels. We can chart them as below:



* -Breathy phonation = tight phonation

The dialects having 'ɛ', 'ɔ' displayed tremendous amount of variations in the degree of lowering of the jaw and in the vowel quality. So also the 'e', 'o' dialect did not show any steady quality or the prescribed degree of the jaw opening attached to 'e', 'o' vowels. The dialect with 'ɛ-ɔ', once again vary too much in pronunciation of 'ɛ-ɔ'. Merely giving

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85. Tight phonation requires much detailed study. Murmured dialects have 'murmur' as a prosodic element spreading in the defined environments. In the other environments vowels are clear. But in the 'tight phonation' dialects it appears that larynx is in the raised position through out. The difference is that in breathy dialects there are murmured vowels and clear vowels both. But in the dialects with the 'tight phonation all vowels are pronounced with the same position of larynx.'

a broad label as 'ɛ-ɔdialect' would be misleading. The variations within this area dialects show unbelievably large variety of open-mid vowels. An informant (though a university teacher) from Baroda had the tendency of too much 'lowering' which sounded like a vulgarization of the speech. This informant belongs to the blacksmith community. Another informant from Navsari district also showed such tendency. This informant belonged to the Anavil community. (Their dialect is known for the free use of abusive words and vulgarization of the language at each level). The third such informant was from Bharuch. This informant came from a small place called Jhaghadia. Her non-urban language back ground might be responsible for the extreme opening of the mid-vowels, In between these 'vulgarized' variation of 'ɛ-ɔ' lie the 'ɛ-ɔ' of three other informants whose open-mid vowels come in between the two extremes i.e. the mid-vowels 'e, o' and the open-most 'æ-ɑ' of the above mentioned informants.[86] Out of these three informants one was the Baroda University teacher belonging to the Bania community

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86. Pandit (E and O in Gujarati p. 624) says that "Aristocrats in Ahmedabad and the 'All India Radio, Baroda-Ahmedabad' seem to prefer the close pronunciation to the open, probably endorsing a feeling among the people that open pronunciation is a vulgarization."

and coming from a highly educated family. Though she certainly had open 'ɛ-ɔ', she never showed the tendency of excessive lowering. At the same time there were number of words where she did not speak 'ɛ-ɔ' while as the other Baroda informants had very open 'ɛ-ɔ' in those words, e.g.,

	Baroda speaker with very open 'ɛ-ɔ' (vulgarization)		Baroda speaker with less open 'e-o'
(1)	[kæḍ]	'waist'	[keḍ]
(2)	[ængʱɛn]	'a word in nursery rhyme'	[engʱ en]
(3)	[kæf]	'intoxication'	[kef]
(4)	[tʰæli]	'bag'	[tʰeli]
(5)	[ɔgaḷwũ]	'to melt'	[ogaḷwũ]
(6)	[fɔtrũ]	'peel'	[fotrũ]
(7)	[ɔtʃintũ]	'suddenly'	[otʃintũ]

These differences within the same 'ɛ-ɔ' group can be attributed to caste, education and professional differences. The differences between these variations are conspicuous. However the phonologist has to decide if he should consider them phonemically relevant. Vennemann insists upon taking into account "All of the phonic capabilities of man, linguistic as well as non-linguistic, frequent as well as rare and even

those that have not yet been observed in spontaneous utterances." He fears that by not doing so we would 'deny' the most valuable function of phonetics for linguistics to explain linguistic facts."[87] The phonetic - variations demand more explicit treatment than simple phonemic contrasts or phonetically unexplained stages of the sound changes. Gujarati open-mid vowel study would require 'an extra dimension', and going through the data one can be convinced that "linguistic phonetics has an exceptional value"[88] for phonologist and sociolinguists. We want to show that even in the dialects having 'ɛ-ɔ' (phonetically ranging from the least 'open' to the most 'open' varieties) there are only six vowels phonemes. Labov feels that the linguistic behaviour is an index of social differences but in case of Gujarati 'ɛ-ɔ' we will show that it would be useful to consider phonemic norms as invariants, shared by all the members of the speech community. In the 'ɛ-ɔ' dialect (Baroda area) it was noticed that the upper caste educated person (who would be representing the standard form of the dialect)

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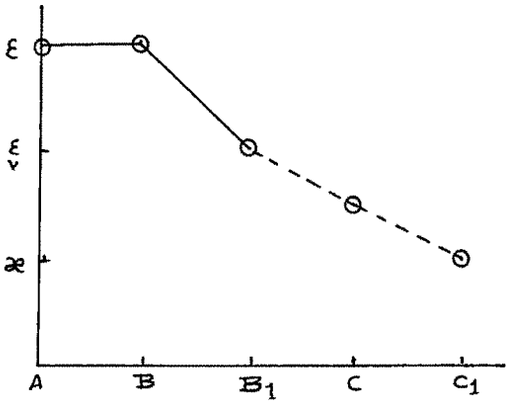
87. Vennemann, 1975, p. 18.

88. Ladefoged, 1967.

would speak 'ɛ-ɔ', the uneducated upper caste would show an extra lowering i.e. 'ɛ̬-ɔ̬', the lower caste educated would also have a lower variety i.e. 'ɛ̝-ɔ̝' and the lower caste uneducated class may have 'æ-ɑ'. We have tried to put this information on a graph taking the words [pɛɳi] 'frying pan', [pɛk] ' cunningly reserved'. See below:



A = standard dialect

B = upper caste educated dialect

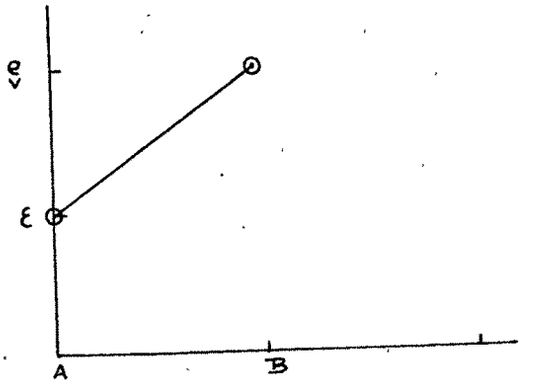
B_1 = upper caste uneducated dialect

C = lower caste educated dialect

C_1 = lower caste uneducated dialect.

Caste stratification of the vowel 'ɛ' in the words [pɛɳi], [pɛk] , The dotted line to show rather unsteady points.

The complexities of variations increase when we take into account the geographical division between the two 'ɛ-ɔ' areas i.e. the Saurashtra dialect with 'ɛ-ɔ' and tight phonation and Gujarati dialect with 'ɛ̬-ɔ̬' and breathy phonation. In some words the differences are distinct, where breathy dialect shows 'ɛ̬-ɔ̬', the other one shows only 'e̝-o̝' e.g. in words [vɛr] 'revenge '[ʃɦɛr] 'city' [vɦɛ̃tijũ] 'dwarf' See the graph,



A = Gujarat dialect with 'ɛ - ɔ'

B = Saurashtra dialect with 'e - o'

Geographical divisions marked by the phonation type and vowel differences.

It would be clear from the figure that the demarcation between the breathy dialect and tight phonation dialect is inevitable. There will be many more caste dialect variations and many more such isoglosses because Saurashtra is full of skilled professional groups such as carpenters, masons, blacksmiths, etc. There are equally large number of settled tribes following their own professions such as boatmaking, fishery, cattle breeding etc. It is impossible for this kind of work to include more than what has been collected through the data; we are hence inclined to delimit the work by only describing the major divisions. The situation can be viewed from the three angles:

(1) the dialectal over-lapping of the mid-vowel pronunciations in some words

(2) the socio-cultural variations displayed in the mid-vowel pronunciations

(3) the phonetic variations: their explanation with the help of linguistic phonetics.

The dialectal differences or the socio-cultural variations ultimately boil down to phonetic facts. If we attribute 'vulgarized' opening of the mid-vowels to a social group and if we notice the geographical division showing distinct dialects and if there are number of isoglosses criss-crossing over the whole area then the number of phonological studies of different dialects have to be given. At the same time there may be some features which might help the phonologist to make generalized statements upto a point. First we will show how the mid-vowels behave in Gujarati. We have collected the single word data. As noticed by the earlier linguists, opening of the mid-vowels in the 'ɛ-ɔ' dialects is restricted to the first syllable/mono-syllables. These words naturally are small in number. From these words again 'ɛ-ɔ' of some words can be attributed to historical developments of diphthongs. The occurrences of 'ɛ-ɔ' in rest of the words are due to different phonetic factors. To put it clearly the opening of the mid-vowels in these words is environmental and even the 'e-o' dialects display such environmental opening. This will make it obligatory to reorganize the data depending upon the kind of opening of these vowels:

The mid-vowels of Gujarati

'e-o' division

'ɛ-ɔ' division

e o ɛ ɔ

In some phonetic environments, (preceding and/or following

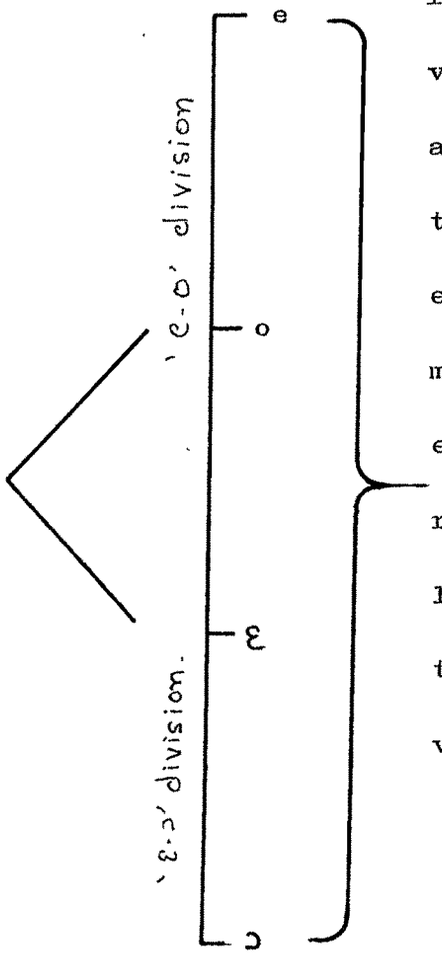
ે The lowering may extend upto 'ɛ'
(depending on the personal-social features)

ો The lowering may extend upto 'ɔ'
(depending on the personal-social features)

ૅ The lowering may extend upto 'æ'
(depending on the personal-social features)

ૉ The lowering may extend upto 'ɒ'
(depending on the personal-social features)

ai,
au,
ahi,
ava
etc.,
of
old
Guj-
ara-
ti



In these vowels also the same environmental effects bring relative lowering of these vowels

e → ɛ The lowering may extend upto 'ɛ' (depending on the personal-social features).

o → ɔ The lowering may extend upto 'ɔ' (depending on the personal-social features).

ɛ → æ The lowering may extend upto 'æ' (depending on the personal-social features).

ɔ → ɑ The lowering may extend upto 'ɑ' (depending on the personal-social features).

We have concentrated on the first set of data where occurrences of 'ɛ-ɔ' are due to historical contractions of diphthongs. Divetia and Pandit mainly considered this data but their data is not systematically arranged as Divetia seems to be thinking of his own dialect only, (i.e. Ahmedabad educated standard dialect with Nagar community features predominating) and Pandit mixes up words from all the dialects. We have reorganized the data. See on page Nos. 185, 186

Divetia and Pandit conclude that the occurrences of 'ɛ-ɔ' in the above words are due to the diphthongs in the earlier stage. Divetia insists on 'pratisamprasārana' with the stress on the first vowel of the diphthongs. Pandit is not particularly keen on giving in between stages of the development.

2.2.3 The diphthongal quality of mid-vowels as studied by the modern researchers.

It is clear that diphthongs are a complex vowel sounds. Our ancient phoneticians noticed it and they did not agree to the duration of the components of the diphthongs. Their dynamic nature has long been "recognized by the practice of transcribing them with double symbols,"[89] in the western phonetic traditions. Even in the prespectrographic days Liddel performed wave by wave Fourier analysis of diphthongs and noted extensive shifting of spectrum.

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89. Holbrook and Fairbanks (Ed. Lehiste), 1967, p. 249.

I 'ɛ' from -aya-, ai		II 'ɛ' from -ahi-, -aha-, eh etc.,	
[pɛɳi]	'frying pan'	[tʃɛɦ]	'funeral pyre'
[bɛsvũ]	'to sit'	[pʰɛ̰ɾəɳ]	'shirt' (made from thin cloth)
[mɛlũ]	'dirt'	[pʰɛ̰lo]	'first'
[vɛɳ]	'promise' 'word'	[vɦɛ̰var]	'communication'
[vɛ̀rag]	'aversion'	[bɦɛ̰ro]	'deaf'
[nɛɳ]	'eyes', 'eyebrows'	[bɦɛ̰n]	'sister'
[bɛʈʰo]	'(he) sat'	[lɦɛ̰ɳũ]	'dues'
[pɛʈʰo]	'(he) entered'		

I 'ɔ' from apa, ava, au		II 'ɔ' from aho, ahu, uha, etc.,	
[ɔtʃʰajo]	'unlucky shadow'	[ɔɳ]	'this year'
[ɔgʱəɖ]	'dunce'	[kɔɳi]	'elbow'
[ɔrto]	'longing'	[pɔ̃k]	'roasted grain'
[ɔrmajũ]	'step brother/ sister'	[mɔ̃gʱũ]	'expensive'
[ɔtʃʰaɖ]	'bed-sheet'	[vʱɔ̃rvũ]	'to accept'
[kɔɭʰũ]	'a kind of fruit'	[sʱɔ̃jlũ]	'easy'
[kɔɭijo]	'mouthful'	[dʱɔ̃jlũ]	'difficult'
[gɔkʰ]	'portico'		
[gɔr]	'brahmin performing religious rituals'		
[tʃɔk]	'courtyard'		
[tʃɔpai]	'stanza of four lines'		
[tʃɔpɖi]	'book'		
[dɔɖvũ]	'to run'		
[dɔɖʱ]	'one and half'		
[nɔɭijo]	'mongoose'		
[pɔɖʰvũ]	'to sleep'		
[mɔɖ]	'forehead decoration used at the time of wedding'		
[mɔr]	'mango blossom'		

He called them 'polyphthongs'.[90] Just like prātiśākhyas the acoustic researches have shown the 'two target position' of these sounds. From the observations of formant movements during diphthong pronunciation a transition between two target points is noted, and is felt that the components of the diphthongs are not phonetically identifiable with the monophthongs. Lehiste and Peterson noted a "visible formant movement in frequency" from one target movement to the other target position and hence they call diphthong "a vocalic nucleus containing two target positions."[91] Holbrook and Fairbanks have seen the longer duration of the formants in the diphthongs 'ai' and 'au'. They noticed that it is the second half of the diphthong that "involves continuous and accelerated changes."[92] This characteristic of diphthongs has been studied and registered by number of phoneticians. Malmberg has called them "a vowel with changing Formant structure,"[93] and Moses called them 'a compound vowel'.[94]

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90. Liddel, Bulletin No. 23, 1927.

91. Lehiste and Peterson (Ed. Lehiste), 1967, p. 237.

92. Holbrook and Fairbanks (Ed. Lehiste), 1967, p. 261.

93. Malmberg, 1966, p.

94. Moses, 1964, p. 49.

Holbrook and Fairbanks found that 'the diphthongs give the impression of heading towards target points"..." 'ai' passes through 'æ' and 'au' passes through 'ɔ' "[95]. See figures on p. 189

It is very interesting to note that the major movement of diphthong tends to occur during the last half of the utterance. Yet perceptually it was difficult to conclude whether a diphthong is one event or two events. Gerber in an experiment observed that the perception and identification of diphthongs as nuclei is done during the second part of the diphthong[96] and the off glide of diphthong is characterized by shift of frequency which may not achieve any specified combination of F_1 and F_2 in the sense of a steady state vowel. All these results of different studies, regarding diphthongs can be summarized as thus:

(1) English diphthong 'ai' goes nearest to single vowel area of /æ/ and 'au' goes near to the single vowel area of /ɔ/.

(2) the second half of the diphthong brings changes in formant frequencies.

(3) so also it is the second half that helps the perception of the diphthong.

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95. Holbrook and Fairbanks, (Ed. Lehiste), 1967, p. 251.

96. Gerber, (PSTC PS), 1971, p. 483.

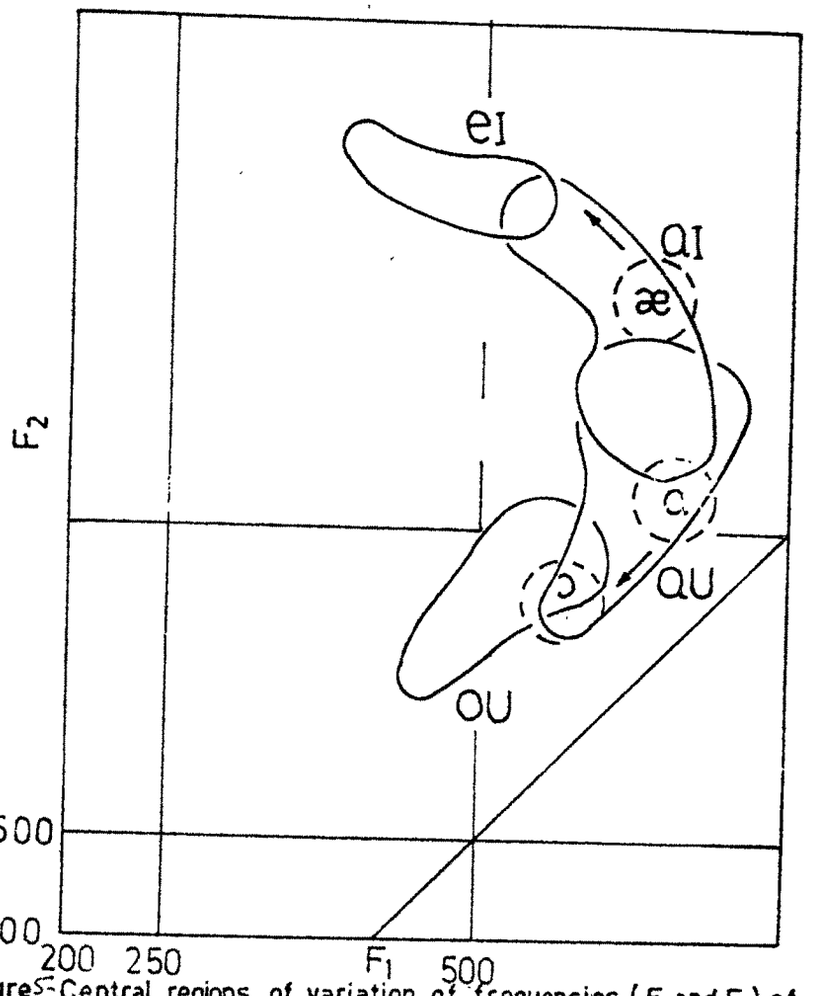

Figure 5- Central regions of variation of frequencies (F_1 and F_2) of Formants One and Two in diphongs.

Now all the examples of Gujarati 'ɛ' and 'ɔ' in the above list have to be understood as the result of the changes that came over the period. Pandit considers Divetia's suggestions regarding intermediary stages of these changes as 'mysterious explanation'. Pandit discards Divetia's proposed answer by calling it "non-linguistic" and thinks it to be so negligible that "hardly a mention be made of it."[97] It is true that Divetia was wrong in rejecting Dhruva. Yet it appears that Divetia's proposal was on the right tract. The issues in question are the diphthongs which appeared at the prākrt stage and 'ai' 'au' of the late borrowings from Sanskrit. While explaining the phenomenon of 'sound-change' in the language Foley uses certain parameters. According to him language continuously displays the strengthening or weakening of sounds depending on strong or weak environment. If 'ai' and 'au' become 'e' and 'o' respectively then it is not merely the case of simple contraction. There is much more to it when understood

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97. Pandit, 1955, p. 631.

with Foley's strength parameter:

γ_1	γ_2	γ_3
ai	a^y	e
au	a^w	o

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 elements.

γ_3 the strongest bond combining the separate elements into a single element which abolishes their separate identity but maintains their characteristics.[98]

A rule may be formulated in this manner.

Universal rule: $[\, ai, \gamma_n \,] \rightarrow$ 'E' / in the first syllable

universal condition: $m \leq n \leq 3$

Parochial condition: for Gujarati $m = 3 (E \rightarrow \{e, \varepsilon\})$

One may not fully agree with Foley about the strength parameter. But the fact remains that in languages there is always a situation which can have strong/weak environments and these environments in turn can bring

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98. Foley, 1977, p. 43.

change in the sound in that situation. Foley has insisted on the favourable environments when the strengthening or weakening can take place. 'ai' becoming 'a^y' and then becoming a mid-vowel 'e'/'ɛ' by abolishment of the separate identity of the two components of 'a^y' is a natural process in many languages. In prākrt the middle consonant loss created variety of vowel sequences. These sequences often resulted into 'yod' formation. Prātiśākhya, Pāṇini and Hemchandra all have discussed the appearance of weak 'y' in certain types of environments. The environments may vary parochially. Pertinent to the thesis here is the possibility of the stage when weak 'y/w' were substituted for 'i/u' of 'ai/au'. Foley's γ_2 (i.e. a^y, a^w) shows stronger bond between the two-vowel components; but i→y and u→w indicate Foley's other strength parameter for vowels where he shows that 'i, u' are weaker than 'e, o'. Historically the diphthong ending in weak vowels 'i' and 'u' may result into 'a^y' 'a^w' however making the bond stronger. This weakness noted by our ancient scholars and used by Foley as the explanatory measure is due to the environments. Acceptance of weak 'y/w' definitely leads us to accept that the first half of the diphthong is a stronger element. At the same time the

view of prātiśākhya and vārttikkār that 'first half of the diphthong is only half mora and the second half is one and half moras becomes an optional solution. Bhāsyakār's opinion of equitable distribution of moras for both the vowels of diphthongs is relevant to the development where contraction is the final result. The two different views are suggestive of the fact that in one line of development the strengthening does not take place. For such development the vārttikkār's suggestion is more logical. For Gujarati the final result being the contraction, we are tempted to consider that the pre-contraction stage logically would be 'a^{y}, a^{w}'. Divetia's insistence that the first vowel must have been accented is rather baseless. The accent, duration (i.e. moras) and strength may sometimes run parallel in a language.

2.2.4 The inherent vulnerability to lowering and the contextual lowering of mid-vowels.

Next, we consider the second set of data where 'ɛ-ɔ' vowels are not the result of 'monophthongization'.

See p. 195-197

This data shows that there are a large number of words having 'ɛ-ɔ' and which are not the results of diphthongal contractions. This opening of mid-vowels is attributed to the following reasons by Pandit:

(1) when followed by retroflexed sounds -ɾ- ɳ -ɭ or tapped -r-

(2) when in a closed syllable

(3) epenthetic e → ɛ

o → ɔ

Pandit's reasons fall short of any precise explanation as he has just scrapingly touched the environmental reasons. Infact this data is the clue to the issue of open-mid vowels. The data from different informants belonging to different dialect groups showed so many minute and noticeable differences in the open-mid vowels that one feels that in every new tongue position a new vowel was produced. Of course it is very true that there cannot be infinite tongue positions within a single language as the possibilities of sequential combinations are limited and as a result the number of varieties "which can be perceptually discriminated is not infinite"[99]. It is equally true that we don't have articulatorily precise labels for these varieties of vowels. The traditional labels such as 'open-mid' are not adequate descriptions, so also it is not possible to find out such label for every tongue-jaw position. The factor of arbitrariness and relativity in the degrees of tongue-height and the jaw-opening is inevitably present in all the languages. From language to language from dialect to dialect and from person to person the vowels will appear in an

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99. Pike, 1943, phonetics, p. 15.

'ɛ'		'ɛ̃'		'ɛ'		'ɛ̃'	
[ɛngʰɛ̃n]	'a word in a nursery rhyme', 'luxury'	[mɛʃ]	soot	[pɛk]	'cunning'	[lɛlũ]	'an instrument'
[ɛle]	'go waste'	[bʰɛ̃s]	'buffalo'	[pɛɳi]	'frying pan'	[vʰɛr]	'saw dust'
[gʰɛ̃s]	'a food preparation'	[ɛ̃ɬʰũ]	Polluted food	[prɛm]	'love'	[vʰɛ̃tʃwũ]	'to distribute'
[tʃɛkvũ]	'to scratch'	[ɛndʰaɳ/ɛ̃dʰaɳ]	'signs'	[mɛdan]	'ground'		
[pɛda]	'produce'	[ɛlan]	'call'	[mɛlũ]	'dirty'	[lɛ̃ŋgʰo]	'pyjama'
[pɛdaʃ]	'production'	[ɛb]	spot	[rɛɳuka]	'name' (female)	[vʰɛvai/vɛvai]	'in-laws'
[ʃɛ̃ɬo]	'turban'	[kʰɛ̃kɖi]	'bony'	[rʰɛ̃ɬijo]	'spinning wheel'	[vɛŋgəɳ]	'brinjal'
[ʃɛ̃dwu]	'to mash'	[kʰɛ̃tʃwũ]	'to pull'	[rʰɛ̃swũ]	'to kill'	[vɛsəɳ]	'gram flour'
[ʃɛ̃slo]	'verdict'	[tʃɛko]	'scratch'	[ʃɛko/lɛko]	'a playful gesture'	[sʰɛlũ/sɛlũ]	'easy'
[mɛte]	'self'	[tʰɛrɬʰɛr]	'everywhere'	[ʃɛdʒət/lɛdʒət]	'taste'	[sɛlũ]	'a sari with gold work'
		[tʰɛ̃]	'exhausted'	[ʃɛr/lɛr]	'fun'	[sɛ̃tʰo]	'hair parting'
		[tʰɛli]	'bag'	[lɛɳũ]	'dues from others'		
		[dɛɳu]	'the dues'				
		[nɛm]	'target/aim'				

'ɔ'		'ɔ'		'ɔ'		'ɔ'	
[ɔdʒar]	'instrument'	[ɖɔɭ]	'hypocracy'	[sɔɳũ]	'dream'	[gʰɔ̃tʃwũ]	'to pierce'
[ɔtʰmir]	'dunce'	[ɖʱɔɭwũ]/ [ɖɔɭvũ]	'to churn'	[shɔrawũ]	'to pine'	[tʃɔɭi]	'beans'
[ɔtʰar]	'prop'	[tʰɔr]	'cactus'	[sɔɭɔ	'marks of the whip'	[tʃɔ̃ʈwũ]	'to stick'
[kʰɔɖo]	'lame or dandruff'	[ʈɔɭ]	'sarcastic'	[sɔ̃pwũ]	'to entrust'	[dʒɔɳũ]	'scene'
[kʰɔrũ]	'rancid'	[ʈɔɳũ]	'taunt'	[hɔwũ]	'to be'	[dɔɖʰi]	
[kʰɔɭ]	'cover'	[tʃʰɔɭ]	'water splashing'	[hɔ̃tʃi]	'braying'	[ʈʰɔr]	'a food preparation'
[kʰɔrak]	'food'	[nɔ̃dʱ]	'to note down'	[kɔɖijũ]	'lamp'	[ʈʰɔ̃swũ]	'to eat too much'
[kʰɔɭwũ]	'to search'	[bʰɔ̃kwũ]	'to pierce'	[kɔɖilũ]	'person with desires'	[tɔr]	'arrogance'
[kʰɔɭo]	'lap'	[mɔɭũ]	'saltless/ chillyless	[kɔda ɭi]	'axe'	[dʱɔɳ]	'washing'
[kʰɔ̃kʰarwũ]	'to cough'	[rhɔ̃tʃũ]	'slow, sluggish'	[kɔʃʈak]	'table' (Arithmetic)	[dʱɔjiũ]	'washed'
[sɔ̃sɔrwũ]	'to hit straight'	[ɭɔ̃kɖi]	'fox' (she)	[gɔɭ]	'jaggery'	[nɔɭijo]	'mongoose'
[dʒʱɔswũ]	'to eat like glutton'	[ɭɔ̃do]	'mashed object'	[gɔndo]	'mashed object'		
		[vɔ̃kɭo]	stream				

'ɔ'						
[nɔdʱarũ]	'supportless'					
[pɔtʃkũ]	'soft'					
[pɔɳũ]	'three quarters or stuffless'					
[bəpɔr]	'noom'					
[bɔɳi]	'bonus'					
[bɔnəs]	'bonus'					
[mɔɳ]	'shortening'					
[mɔɖũ]	'late'					

'over-all' setting of other sounds, adopting themselves to the required adjustments. Inspite of such enormous fluidity in vowels, they never seem to create difficulty in perception. The 'norm' required for the systematic perception of the sounds is invariably caught by the language-users and this abstraction based perception is what has to be explained. The answers to the questions like "due to which phonetic reasons Gujarati speakers have such varieties of mid-vowels?" and "why inspite of such varieties there is no difficulty amongst the various dialect speakers in perceiving them correctly?" should be sought for. In a language, in a particular environment particular likely phonetic change may appear or may not appear. There is no absolute, universal rule for such changes, although often such likely changes do show up. These likely modifications as Brosnahan and Malmberg observed show that "vocoid colouring of contoids as well as transition effects on vocoid formant from neighbouring contoids are consequences of the coarticulation of articules."[100] Fant has concluded from the spectrograms that speech wave is "a mixture of continuous and discrete events. The continuity is mainly an attribute of the F-Pattern, reflecting the

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100. Brosnahan and Malmberg, 1970, p. 129.

continuity of articulatory motions."[101] ... "The phonetic realization of a sound segment is dependent on the immediate phonetic context of preceding and following sounds". Lindblom has noticed the articulatory and acoustic variability of an inter-consonantal vowel.[101a] It has been felt by researchers that the consonants may be identified absolutely or 'categorically' independently of the text context but vowels are identified relatively or 'continuously' with marked contextual effect.[102] The difficulty of segmenting a speech wave which is physically a continuum, lies in the fact that the central portion of the segment is easily located but margins are somewhat indistinct. The borders are the starting point of sound changes. These changes "lead to observable differences in the phonetic substance of a language at points separated in time."[103] For the vowel formant frequencies the position of tongue constriction, the degree of tongue - constriction and the size of the mouth opening, are important.

Stevens and House tried to obtain experimental relations between the articulatory parameters and the

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101. Fant, 1968, p. 223.

101a. Lindblom, (PSICPS), 1971.

102. Liberman et al 1961, Fry et al 1962.

103. Brosnahan and Malmberg, 1970, p. 126.

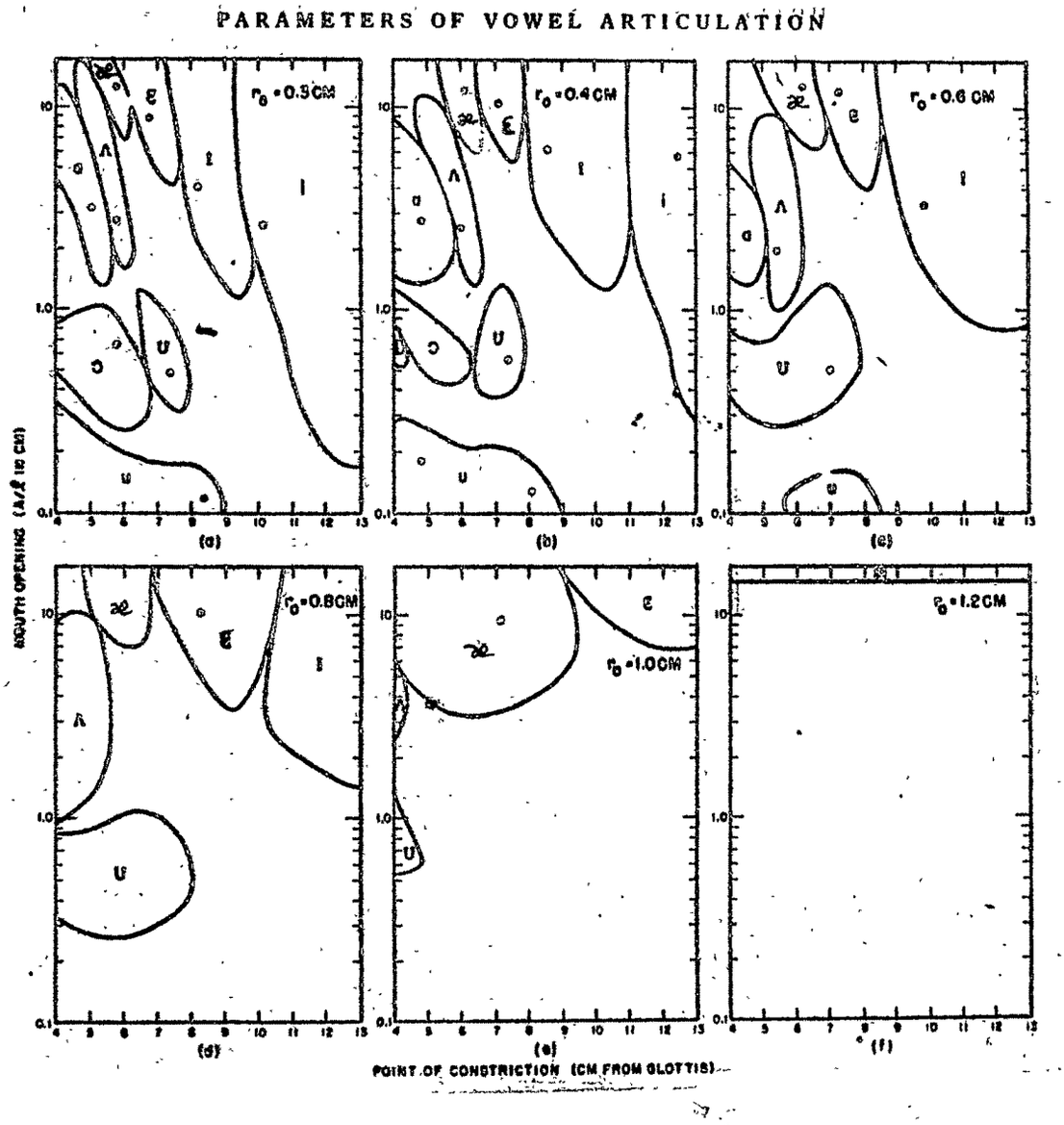

Figure-6

Contours of vowel articulation : The contours delineate the ranges of articulatory positions which produce vowel values. (Adapted from Stevens and House)

formant frequencies and from this data they derived the contours of vowel articulation. Measuring the distance from the glottis to the point of constrictions, the radius at the constriction and the degree of mouth opening they noticed that when the degree of constriction is held constant and when constriction (r_o = radius of the tube) is small then all the nine vowels (given by them) can be produced by proper manipulation of mouth opening and constriction location. They noticed that vowel areas vary considerably in size and "this variation is a measure of the degree of articulatory precision required for the given vowel. That is the size and shape of such vowel area indicates the range of variation of mouth opening and constriction position that can be used to generate that vowel."[104] See the figure no. 6.2.00 on p. 4.

This figure shows that a given vowel can be produced by a variety of articulatory configurations. The various configurations for the vowels in isolation show that variation in lip position with a fixed mandible also can produce considerable variation in the value of A/l[105]. If the value of A/l (A = cross sectional area l = length of the tube) is so susceptible even to the smallest change in the mouth than one can well understand

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104. Stevens and House, 1955, p. 490-491.

105. ibid.

the innumerable variations in the vowel in inter-consonantal position.

The thesis that there are only two mid-vowel phonemes in Gujarati will be supported by three points:

(1) the inherent quality and tendency of mid-vowels make them vulnerable to changes i.e. there is no definite degree of mouth opening for them.

(2) in general, vowels vary a lot inter-consonantally and these variations are obvious, predictable changes which could be recorded and have been recorded by acoustic researchers.

(3) the phonemic status of sounds does not merely depend upon the linguist's contrastive pairs but upon the perception of the speakers of the language. They are the 'just discriminable' differences (if they are there).

Some more support for these points can be extended. It has been sufficiently cited from prātiśākhyas to show that the scholars then, did not agree as to the description of low mid-vowels. Daniel Jones has noted that "the vowel (sc/ɛ) varies a good deal with different speakers."[106]

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106. Daniel Jones, 1956.

Ladefoged has correctly noticed that /ɛ/ vowel in the English word 'hotɛl' does not always have the same phonetic quality because this vowel is certainly known to vary a good deal from speaker to speaker.[107] Ladefoged has clearly pointed at the short comings of the 'listening phoneticians' - (phonologists too). (1) when they are unable to say about the degree of similarity between the vowel sounds of their own and their informants (2) and when they don't differentiate between the personal quality and the phonetic quality of the vowel.

One must not forget that the utterance and identification of a vowel depend upon the language and dialectal background and the vocal and auditory characteristics of the individual concerned. The individual brings along with him the past experience of his language sounds and this experience can also be one of the causes for the confusion. Peterson and Barney conducted a test to see the variations in vowel production and identification. They found that "certain of the vowels are generally better understood than others because they represent "limit" positions of the articulatory mechanisms."[108] They noted that

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107. Ladefoged, 1967, p. 54.

108. Peterson and Barney, 1952, p. 184.

"the [i] and [u] are the terminal or end positions in the mouth... In the formation of [i] the tongue is humped higher and farther forward than any other vowel, in [u] the tongue hump takes the highest posterior position in the mouth... the vowels [u] and [i] are much more difficult to displace, and a greater stability in the organic formation of these sounds would probably be expected, which in turn should mean that these sounds are recognized more consistently by a listener."[109] One can derive from such conclusions that mid-vowels are prone to greater displacement and also are difficult to recognize. They found that there was maximum disagreement as to the recognition of ɪ , ɛ, æ and ɑ , ɔ vowels as shown in the figure and table on p.205

The table and the figure above help us to show that the inconsistency in e-ɛ-æ and o-ɔ-ɑ seen in various Gujarati speakers and dialects is partly due to the inherent fluidity of mid-position of the vowels. The relative nature of vowel quality also adds to this unsteady state of vowels. While studying the vowel intensites Fairbanks, House and Stevens felt that "variations in the vowel may be due (at least partially) to the effects of differing consonantal environments.."[110]

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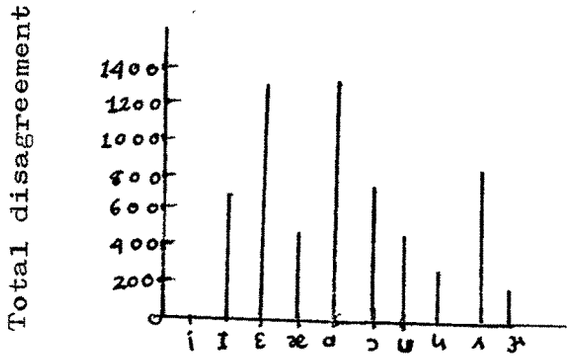
109. Peterson and Barney, 1952, p. 178.

110. Fairbanks, House and Stevens, 1950.



Observer disagreement in listening tests.

For all observers

(from Peterson & Barney)

Vowels classified by listeners

vowels intended by speakers		i	I	ɛ	æ	ɑ	ɔ	
	1	6	9549	694				
	ɛ		257	9014	949			
	æ		1	300	9919			
	ɑ					8936	1013	
	ɔ					590	9539	

(adapted from Peterson and Barney)

The shape and size of vowel cavity changes due to the adjacent consonants and this cavity change can cause the quality change too. In consonant vowel transition we get rapid shifts in the frequency positions of the vowel formants. It is clear that the articulatory positions for consonants and vowels are so different that the rapid movement from one position to the other will produce rapid shift in the acoustic output. These rapid changes may serve as the main cue for the perception of the consonant - vowel combination.

2·2·5 Support from the Gujarati data

To make this point explicit, some observations regarding 'e-o' in different consonantal environments in Gujarati are given. Apart from the occurrences of lower mid-vowels due to diphthong contraction from the old stage in 'ɛ - ɔ' dialects, there are many more occurrences of these vowels. Some of them are given in the data; see p. 207

In 'e-o' dialects also the mid-vowels become lower in the environments of the above data. The difference that one can notice in the degree of lowering is to a certain extent due to the basic difference in two phonation types. See p. 208

[danɻɔ]	'grain'	[k^{h}ɛ̃tʃ]	'pull'
[kənɻ ɔ]	'granule'	[tʃɛ̃ɬi]	'grumbling'
[ɬ ɔ ɻ ɬəppa]	'gossip'	[pɛdaʃ]	'produce'
[t^{h}ɔ r]	'cactus'	[fɛ̃ɬo]	'turban'
[tɔ ɤ]	'arrogance'	[fɛ̃kwũ]	'throw'
[d^{ɦ}ɔ̃knũ]	'a wooden splasher'	[fɛ̃ʃɛ̃]	'to get tired soon'
[d^{ɦ}ɔsri]	'yoke'	[b^{ɦ}ɛ̃b^{ɦ}ɛ̃]	'noise of buffalo'
[b^{ɦ}ɔ ɬ^{ɦ}ũ]	'crest fallen'	[mɛna]	'(she) parrot)
[mɔsəmbi]	'a grape fruit'	[mɛnka]	'name of the girl'
[lɔ̃ndo]	'mashed thing'	[ɛng^{ɦ}ɛn]	'a word in child's nursery rhyme'
[gɔ̃ndo]	'mashed thing'	[ɛ̃ɬ^{h}ũ]	'polluted food'
[b^{ɦ}ɔ̃kvũ]	'to pierce'	[ɛ lfɛl]	'to speak anyhow'
[m ɔ̃ɻũ]	'bland'	[kərɛnɻ]	'name of the flower'

(From the data of a Baroda University teacher belonging to the blacksmith community).

	'ɛ-ɔ' dialects		'e-o' dialects	
	Breathy phonation	Tight phonation	Breathy phonation	Tight phonation
	[ɛ] - [ɔ]	[ɛ] - [ɔ]	[e] - [o]	[e] - [o]
Environments which bring lowering	[ɛ̬] [ɔ̬] (æ) (ɑ)	[ɛ̰] [ɔ̰] (æ) (ɑ)	[e̬] [o̬] (ɛ) (ɔ)	[ḛ] [o̰] -- -- *
Environments where non-open [e] -[o] are found	lax [e] [o]	[e] [o]	Lax [e] [o]	[e] [o]
		Appear slightly higher and non-lax**		Appear slightly higher and non-lax.**

The chief observable differences in the mid-vowel lowering in the dialect divisions.

* The e-o dialect speakers with tight phonation do not lower the vowels beyond [ḛ], [o̰]

** The term 'non-lax' is rather arbitrary. We do not know if we can use the term 'tense' as against the term 'breathy lax.'

It can be noticed that the opening of these vowels depends on two factors. One ofcourse is the consonantal context and the other is the syllabic structure. The opening of vowels due to both these factors is therefore predictable. The data given below should give enough evidence to see these variations. The lowering as a process is uniformly acting for all the dialects; ' ⌊e' and ' ⌊o' signs are used to indicate the process of lowering due to the above mentioned factors. The data here is a general data to show the lowering process. Dialectal differences are not indicated for this particular process.

Here follows the list of ⌊e due to consonantal contexts irrespective of diphthong contraction process:

List I — before r

[k ⌊er]	'havoc'
[k^h ⌊er]	'alas'
[g ⌊er]	'irregular'
[$g^{\hbar}$ ⌊er]	'(to) home'
[t^h ⌊eri dʒwũ]	'to get involved in a quarrel'
[p ⌊er]	'like'
[f ⌊er] *	'feel giddy'
[$b^{\hbar}$ ⌊er] *	'with'
[v ⌊er]	'revenge'
[s ⌊er]	'braid'

* The lowering was not uniformly present.

Before retroflexed sounds

Before [ɳ]		Before [ɭ]	
[d ɭeɳu]	'dues' (to be paid)	[k ɭeɭ]	'banana tree'
[t ɭeɳi]	'she'	[tʃ ɭeɭ]	'itching'
[n ɭeɳ]	'eyes'	[n ɭeɭ]	'a narrow lane'
[p ɭeɳi]	'frying pan'	[bʱ ɭeɭs ɭeɭ]	'mixture; adulteration'
[f ɭeɳ]	'hood'	[m ɭeɭ]	'adjust'
[r ɭeɳ]	'night'	[v ɭeɭa]	'time'
[l ɭeɳũ]	'dues' (to be recovered)	[s ɭeɭbʱ ɭeɭ]	'mixture'
[v ɭeɳ]	'promise/ words'		
[ɭeɳijo]	'dimunitive' of small sized'		

Before or after retroflexed sounds

[k ɭeɖ]	'waist'
[kʰ ɭeɖ]	'plough'
[tʃ ɭeɖa]	'ranks'
[tʃʰ ɭeɖa]	'ends'
[tʰ ɭeʈʰ]	'till end'
[ɖʱ ɭeɖʱ]	'untouchable'
[p ɭeʈʰũ]	'entered'
[b ɭeʈʰũ]	'sat'
[m ɭeɖʱ]	'surname'
[v ɭeɖʱa]	'joint of finger'
[h ɭeʈʰa]	'at low position'

It should be noted that non-aspirated, unvoiced [ʈ] is not inducive to the lowering of the vowel.

In some words opening appeared with duration change. These words have given in the second list.

preceded by [v] in disyllabic and polysyllabic words

[vˌetəɳ]	'non-salaried'
[uvˌekʰwũ]	'to ignore'
[dʒʱ vˌerat]	'jewellery'
[tuvˌer]	'kind of pulse'
[divˌel]	'castor oil'
[nəvˌeli]	'new'
[devˌeʃ]	'God'
[nivˌedəɳ]	'statement'
[nivˌeɖo]	'solution'
[rəvˌeʃ]	'gallery'
[nivˌeʃ]	'house'
[vˌesəɳ]	'gram flour'
[həvˌeli]	'big house'
[gəvˌeʃɳa]	'research'
[prəvˌeʃ]	'entry'
[həvˌe]	'now'
[nəvˌesər]	'start a new'
[dəvˌe]	'a surname'
[vˌegˌũ]	'separate'

preceded by [m]

[m ɭek^{h}la]	'waist-chain'
[m ɭeg^{ɦ}]	'cloud'
[m ɭeɖi]	'floor'
[m ɭeɖ^{ɦ}]	'surname'
[m ɭed]	'fat'
[m ɭenka]	'name of a girl'
[m ɭemsaɦeb]	'madam'
[təm ɭe]	'you'
[ə m ɭe]	'we'
[g^{ɦ}ə m ɭelũ]	'tub'
[dʒ^{ɦ}ə m ɭelo]	'rupus'
[səm ɭeɽwũ]	'to finalize'
[səm ɭesəmũ]	'O.K.'
[gəm ɭet ɭem]	'any how'

followed by [m]

[k ɭem]	'why'
[dʒ ɭem]	'thus'
[ʈ ɭem]	'thus'
[ɳ ɭem]	'vow', 'target'
[ɦ ɭem]	'gold'
[k^{h} ɭem]	'well-being'

preceded by [n]

[kənɭe]	'nearby'
[-nɭe]	'dative marker'
[nəv nɭedʒa]	'great trouble'
[nɭem]	'target'
[nɭevlɭe]	'large streams of water
[nɭeɦ]	'love'
[nɭeɭ]	'a narrow lane'
[nɭefo]	'fold in the petticoat'
[nɭetər]	'cane'
[nɭepaɭ]	'Nepal'
[nɭeɳ]	'eyes'
[panɭetər]	'wedding saree'
[dʰənɭedũ]	'an insect'
[sənɭepat]	'delirium'
[kunɭeɦ]	'skill'

preceded by [l]

[kəl⌊edʒũ]	'liver'	[l⌊elũ]	'an instrument'
[kəl⌊edɻʰi]	'frying pan'	[l⌊ekʰa]	'name of a girl'
[kətl⌊eam]	'slaughtering'	[l⌊enɻũ]	'dues' (to be paid)
[kull⌊e]	'total'	[l⌊epɖũ]	'plaster'
[gəl⌊ef]	'cover'	[vəl⌊e]	'plough'
[gəl⌊efũ]	'cough'	[bʱəl⌊e]	'O.K.'
[dʒəl⌊ebi]	'sweet dish'	[ul⌊etʃwũ]	'to draw out'
[tol⌊ẽ]	'in comparison to'	[upl⌊eʈ]	'a medicine'
[div⌊el]	'castor oil'	[k⌊eli]	'love sport'
[n⌊evl⌊e]	'large streams of water'	[kʰ⌊elaɖi]	'player'
[nal⌊eʃi]	'defamation'	[g⌊el]	'chirpy'
[ful⌊ekũ]	'a marriage procession'	[gʱ⌊elo]	'mad'
[ɻ⌊e]	'take'*	[tʃʰ⌊el]	'gallant'
		[ɖʰ⌊el]	'peahen/peacock'
		[ʈʰ⌊el]	'push'
		[m⌊el]	'dirt'
		[h⌊el]	'water pots on the head'
		[r⌊el]	'floods'
		[s⌊elũ]	'saree'
		[v⌊eləɳ]	'rolling pin'

Some words with these conditions don't show open [e/ɛ] e.g. [lep], [letideti], [leʃ] for [l + e -]; [tel], [b el] for [-e + l].

After and before [ɦ]

[tʃɭeɦ]	'pyre'
[dʒaɦɭer]	'public'
[dʒaɦɭerat]	'advertisement'
[dʒɭeɦad]	'war'
[ʈəɦɭelwũ]	'to wander'
[ʈəɦɭel]	'wander'(N)
[təɾɭeɦ]	'type'
[təɦɭenat]	'in service'
[təɦɭevar]	'festival'
[dɭeɦ]	'body'
[dɭeɦant]	'death'
[nəɦɭer]	'canal'
[nɭeɦ]	'love'
[pəɦɭerwũ]	'to wear'
[pəɦɭerəɳ]	'under shirt'
[pəɦɭero]	'guard'
[pʰəɦɭel]	'to begin'
[pʰəɦɭelvan]	'wrestler'
[kʰəɦɭevət]	'proverb'
[kʰəɦɭewũ]	'to say'
[lɭeɦ]	'burn'
[lʰəɦɭeko]	'mannerism'
[pʰəɦɭervəʃ]	'dressing'
[pʰəɦɭeravwũ]	'to dress'(V.T.)
[mʰəɦɭek]	'fragrance'
[mʰəɦɭekaɭ]	'fragrance'
[mʰəɦɭenɳũ]	'taunt'
[mʰəɦɭetəl]	'period of contract'
[mʰəɦɭeʃil]	'a meeting'
[mʰəɦɭemaɳ]	'guest'
[mʰəɦɭer]	'favour'
[mʰəɦɭeramaɳ]	'ocean'
[məɦɭel]	'palace'
[mʰəɦɭesul]	'tax'
[məɦɭeʃ]	'a name'
[məɦɭendrə]	'a name'
[mɭeɦ]	'rains'
[mɭeɦulo]	'rains'
[mʰəɦɭeʈʰaɳ]	'abode'
[rʰəɦɭewũ]	'to stay'
[rʰəɦɭẽswũ]	'to kill'
[rʰəɦɭẽʈijo]	'spinning wheel'
[vʰəɦɭerwũ]	'to saw'
[vʰəɦɭer]	'saw dust'
[vʰəɦɭelũ]	'early'

After and before [ɦ] (contd.)

[ɪᵊɦɭer]	'enjoyment'	[vᵊɦɭevar]	'communication'
[ɪᵊɦɭedʒət]	'tasteful'	[vɭeɦ]	'a hole'
[ɪᵊɦɭewũ]	'to swing'	[sᵊɦɭetuk]	'intentional'
[vᵊɦɭewũ]	'to flow'	[sᵊɦɭel]	'a trip'
[vᵊɦɭetʃɳi]	'distribution'	[ɦɭeɬʰũ]	'below'
[sᵊɦɭedʒ]	'a little'	[ɦɭetu]	'motive'
[sᵊɦɭewũ]	'to tolerate'	[ɦɭem]	'gold'
[ɦɭedʒ]	'moisture'	[ɦɭer-fɭer]	'shifting'
[ɦɭeɬ]	'affection'	[ɦɭel]	'water pots on the head'
[ɦɭebɔk]	'to take a fright'	[ʃəɦɭer]	'city'
[ɦɭerət]	'surprise'	[ʃᵊɦɭenʃah]	'king'
[ɦɭevajũ]	'used to'		
[ɦɭeval]	'narrative'		
[ɦɭeɭəvwũ]	'to make some one familiar'		
[rɦɭem]	'pity'		

The similar changes due to aspiration and voicing of consonants were noticed. As Kim says if a stop is η degree aspirated it must have η degree glottal opening at the time of release of the oral closure'... 'the turbulance (for 'h' sound) is created not at the glottis but at the point of constriction for the following vowel whose configuration is formed through coarticulation'...[111] The wide opening of glottis and the turbulance cannot let the following vowel go untouched. Kim observed that for aspirated stops glottis may take 100-120 msec to close; stronger the aspiration wider the opening of glottis and longer the period between the release and arrest of voicing. This wider opening of glottis will have chain reaction on the mandible too because the aspiration release requires a larger cavity at the back of the mouth. The cavity cannot be widened without slightly lowering the mandible. The effect of this on the following vowel configuration is obvious in Gujarati. It was observed

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111. Kim, 1970, p. 111.

that, voiced sounds, aspirated sounds (including 'h'), retroflexed sounds, sonants (like liquids, glides and nasals) have noticeable effect on vowels.

It is attempted to show in the data below how 'e' changes the duration with syllabic extensions of the words. List II.

A		B		
[tʟem]	'like that'	[tʟe:mnʟe]	'to them'	[tʟe:mɳʟe] (Inst)
[dʒʟem]	'thus'	[dʒʟe:mnʟe]	'to whom'	[dʒʟe:mɳʟe] (Inst)
[tʟe], [dʒʟe]	'he, she'	[tʟe:nʟe]	'to her'	[tʟe:ɳe] (Inst)
		[dʒʟe:nʟe]	'him'	[dʒʟe:ɳe] (Inst)
[pʟes]	'enter'	[pʟe:saɖ]	'to make someone enter'	
[mʟeɾ]	'dirt'	[mʟe:laʃ]	'dirt'	
[dʰəkʟeɾ]	'push'	[dʰəkʟe:lwũ]	'to push'	
[təgʟeɖ]	'push out'	[təgʟe:ɖwũ]	'to push out'	
[səmʟeɻ]	'finish'	[səmʟe:ɻwũ]	'to finish'	
[lʟeɳ]	'dues'	[lʟe:ɳũ]		
[kʰʟe]	'say'	[kʰʟe:ɳũ]	'call'	
[kʰʟeɾ]	'play'	[kʰʟe:laɖi]	'player'	
[vʟeɻ]	'time'	[vʟe:ɻa]		
[rʟeɖ]	'pour'	[rʟe:ɖav]	'make someone pour'	
[tʃʟetən]	'life'	[vitʃe:tən]*	'lifeless'	

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* The vowel is lengthened and as a result lowered in B; i.e., they are more lowered than in A.

as they cannot be spoken otherwise.

The vowels in B are more lowered than in A. Many more such morphemic derivational extensions could be given. There are also cases of lowered 'e-o' in the second syllable position. See below:

List III.

[mənd^{ɦ}ɭé:rwũ]	'to preserve'
[g^{ɦ}əŋɭe:nũ]	'too much'
[gəŋɭe:ʃ]	'elephant God'
[səɭ ɭe:kɖi]	'bony'
[səɭɭe:k^{h}əm]	'cold'
[b^{ɦ}anɭe:dʒ]	'nephew/niece'
[puŋɭe:ri]	'of Poona'
[b^{ɦ}əmb^{ɦ}ɭe:rnũ]	'instigation'
[d^{ɦ}uɭe:ɭi]	'a festival for playing colours'
[uv ɭe:k^{h}wũ]	'to ignore'
[dʒ^{ɦ}əv ɭe:rat]	'jewels'
[tuvɭe:r]	'a kind of pulse'

The words in the list II show that in the morphemic derivational extensions (B) the stressed vowels become longer. The list III shows some examples of lowered, stressed, and longer 'e' in poly-syllabic words. These two lists are enough to show that contextual lowering is a highly complex process. List IV gives the environments for the lowering of [o] .

List IV.

Preceded by [ɳ] or followed by [ɳ]

[ɔ ɳ losrũ]	'hints'	[ədʒ loɳa]	'unseen'
[ɔɖaɳ lo]	'a raga'	[iɳɖʱ loɳi]	'a round pad to be put on the head while carrying water-pots'
[kəɳ lo]	'grain'		
[kədʱ loɳũ]	'badly washed'	[lo ɳ]	'this year'
[k loɳ]	'who'	[tʃəɳ lo]	'gram'
[k loɳi]	'elbow'	[dʱ loɳ]	'washings'
[ɬ loɳũ]	'taunt'	[paɳ lo]	'stone'
[daɳ lo]	'grain'	[pər loɳ lo]	'guest'
[m loɳ]	'shortening'	[p loɳ lo]	'three quarters'
[vəl loɳũ]	'churning'	[b loɳi]	'the first sale of the day'
[ʃloɳit]	'blood'	[bʱ aɳ lo]	'nephew'
[s loɳũ]	'dream'	[sə maɳ lo]	'similar'
[r loɳũ]	'crying'	[d loɳi]	'a buttermilk pot'
[vaɳ lotər]	'merchant's clerk'		

Preceded/followed by retroflexed stops (aspirated contexts)

[kʰ loɖũ]	'lame'	[ʂʰ loɖwũ]	'to leave'
[g lo ʈʰ ɔɳ]	'knees'	[dʒʱ loɖwũ]	'to beat'
[p lo ʈʰ ijũ]	'a blind follower'	[k lo ʈʰ ũ]	'a kind of fruit'
[kʰ loɖ lo]	'lame'	[k lo ʈʰ imɖũ]	'a kind of fruit'
[k loɖʱ]	'leucoderma'*	[kʰ loɖilũ]	'defective'
[m loɖʱ ũ]	''mouth' or 'face'	[kʰ loɖəŋgawũ]	'to limp'
[bʱ loʈʰ ũ]	'crest fallen'	[tʃʰ loɖũ]	'peel'

The following words are the result of derivational developments such as,

[k ⌊oɖi] : sk. [kəpərdika] : pk: [kəvəɖɖia]

[d ⌊oɖwũ] : sk. [drəvəti] : *pk: [drəvəɖ^{ə}]

[m ⌊oɖ] : sk. [mukuɭə] : pk: [mauɖə]

They seem to be exceptions to the above observation (i.e. lowering in aspirated retroflex contexts). There are many other words where 'o' has similar contexts but no lowering.

[goɖwũ]	'to shuffle'	[roɖũ]	'stone'
[foɖwũ]	'to break'	[toɖwũ]	'to break'
[boɖkũ]	'bald'		

Note that when followed by [ɭ], [o] does not get lowered.

[koɭ]	'coat'	[ɭoɭi]	'small pot'
[k^{h}oɭ]	'loss'	[loɭ]	'flour'

Preceded by n

[ən ⌊ok^{h}ũ]	'unique'	[n ⌊ortũ]	'a day during nine-days festival'
[kən ⌊odʒ]	'Kanoj'		
[kan ⌊o]	'a diacritic mark'	[n ⌊o⌋ijo]	'mongoose'
[dʒən ⌊oi]	'a sacred thread'	[pən ⌊oti]	'bad days'
[n ⌊okər]	'servant'		
[n ⌊ok^{h}ũ]	'separate'		
[n ⌊otrũ]	'invitation'		
[n ⌊od^{h}arũ]	'helpless'		
[n ⌊obət]	'an instrument'		
[n ⌊om]	'9th day of the month'		

Though this 'ɭo' can also be attributed to the diphthongal original in many of the words above, the effect of 'n' cannot be denied.

Preceded by [ɭ]		OR	Followed by [ɭ]	
[agɭɭo]	'bolt'		[kagrɭoɭ]	'racket'
[amɭɭo]	'twist'		[kaɭɭotro]	'deadly'
[ufaɭɭo]	'crooked'		[kãʈʃɭoɭa]	'bowl'
[utʃʰaɭɭo]	'rise'		[kɭoɭwũ]	'to blossom'
[ɭoɭəkʰwũ]	'to know'			
[ɭoɭkʰaɳ]	'acquaintance'		[kɭoɭəɳ]	'a woman belonging to [koɭi] community'
[ɭoɭəŋgwũ]	'to cross'			
[ʰɭoɭwũ]	'to comb'		[kɭoɭijo]	'a mouthful'
[ɭoɭidʒʰɭoɭi]	'a children's game'		[kʰɭoɭ]	'cover'
			[kʰɭoɭwũ]	'to search'
[ɭoɭɭo]	'roasted brinjal'		[kʰɭoɭijũ]	'a hammock'
			[gɭoɭ]	'jaggery'
[kərɭoɭijo]	'spider'		[tʃɭoɭwũ]	'to rub'
[kəʈʰɭoɭ]	'pulse'		[tʃɭoɭa]	'a kind of pulse'
[tʃʰɭoɭ]	'splashing of water'		[dɭoɭi]	'hypocracy'
[dʒʰɭoɭ]	'a hammock'		[dɭoɭi]	'palanquin'
[ɭoɭ]	'airs'		[ɖʰɭoɭwũ]	'to make turbid'
[dʰɭoɭkũ]	'name of the place'		[nɭoɭijo]	'mongoose'

preceded by [s] OR followed by [s]

[sˌotsaɦ]	'with zest'	[sˌopo]	'quiet'
[sˌotkəntʰ]	'eagerly'	[sˌobɔt]	'company'
[sˌodagər]	'businessman'	[sˌomvar]	'monday'
[sˌodo]	'bargain, business'	[sˌorəʈʰ]	'belonging to Sorath'
[sˌonũ]	'gold'	[sˌora wũ]	'to suffer'
[sˌonəl]	'name of a girl'	[sˌosawũ]	'to shrink'
[sˌoneri]	'golden'	[sˌoɦwũ]	'to appear beautiful'
[sˌopan]	'steps'	[sˌoɦiɳi]	'girl's name'

The interesting observation regarding 'o' not lowering when preceded by [p, f, b, bʰ, m] and followed by [s] has to be noted. The labials with lip-closure followed by dental [s] perhaps don't leave enough cavity gap for lowered variety of the vowel, which itself requires slight curving of the lips.

Followed by [r]

[r] in a restricted manner can cause various degrees of lowering depending upon the preceding and the following conditions. [r] can be a supporting factor for the lowering as it can be seen from the following data:

[ˌormɳi]	'sowing'	[ˌormai]	'step'
[ˌorto]	'desire'	[kʰˌorũ]	'rancid'
[ˌorwũ]	'to put in the boiling water for cooking'	[kʰˌoraʃ]	'rancidity'
		[kʰˌorak]	'food'

[tʰlor]	'a food preparation'
[tʰlor]	'cactus'
[plɔro]	'rest'
[plɔrəs]	'enthusiasm'
[plɔrəvwũ]	'to string' (the beads)
[flɔrã]	'water drops'
[flɔrəm]	'forum'
[flɔrwũ]	'to blossom'
[mlɔrəs]	'a vegetable/salt'
[slɔrəbʱ]	'fragrance'
[dʱlɔrəɳ]	'standard'
[dlɔr]	'string'
[dlɔrwũ]	'to guide or to draw'
[dlɔrəvɳi]	'guidance'
[dlɔrijo]	'a kind of thin cloth'
[mlɔrtʃo]	'procession'
[mlɔrəɖ]	'a vegetable'
[mlɔrtʰ utʰu]	'copper sulphate'
[mlɔrijo]	'kind of grain'
[hlɔrwũ]	'to go on accepting'

[r] in final open syllable followed by [o] has a slight lowering effect on[o]

[katrlo]	'a chap'
[kedarlo]	'a raga'
[kutrlo]	'dog'
[tʃarlo]	'grass'
[gʱugʱrlo]	'toy'
[dʒʱarlo]	'a spoon used for frying'
[ɖəʈʃurlo]	'chocking'
[ɖʱəɳɖʱerlo]	'announcing'
[təmburlo]	'tanpura'
[dərlo]	'a skin disease'
[dʱarlo]	'convention'
[parlo]	'mercury'

In the 'ɛ-ɔ' dialect the words [g ˩oraɳi˥] and [g˩or˥] have absolute lowering of [o] but in the word [gori] there is no such lowering. Divetia has explained by attributing these two different [o] s to two different derivational lines. Though it is possible to have two types of developments simultaneously becoming active in the same language (dialects) there are not many such examples. Divetia feels that the lowered [o] of [g ˩orjo] must have developed like this: au > ava > av > ɔ and non-lowered [o] of [gori] must have developed straight from 'au'. One cannot be so sure about such exceptions. Yet one can say that the high vowel [i] of the second syllable might have some effect on restricting the lowering process. The whole process of lowering and raising depends on the immediate syllable and the syllablic frame both.

Followed by [j]

[k ˩o$^{\tilde{h}}$jlo]	'rotten'	[t ˩oj]	'even then'
[k^{h} ˩ojɳũ]	'cover'	[d($\tilde{h}$) ˩ojlũ]	'milked'
[g ˩ojɳi]	'a young married girl'	[d$^{\tilde{h}}$ ˩ojlũ]	'washed'
		[nh ˩oj] (nə + $\tilde{h}$ ˩oj)	'not there'
[tʃ ˩ojɳũ]	'a long piece of cloth'	[p ˩ojɳi]	'lotus bud'
		[m$\tilde{h}$ ˩ojlũ]	'flour with shortening'
[dʒ ˩ojlũ]	'seen'	[s$\tilde{h}$ ˩ojlũ]	'good'
[ɽ ˩ojlu]	'a small pot'		

Followed by [ɦ] or preceded by [ɦ]

[arɭoɦwũ]	'to climb'	[mɭoɦən]	'a name'
[kɭoɦwũ]	'to get rotten'	[rɭoɦən]	'a name'
		[lɭoɦwũ]	'to wipe'
[tʃɭoɦaɳ]	'a surname'	[vɦɭoro]	'a caste in Muslims'
[dʒɭoɦər]	'sacrifice'		
[dɭoɦəd]	'place name'	[vɦɭorwũ]	'to accept'
[dɭoɦwũ]	'to milk	[ʂɦɭoj lũ]	'easy'
[dɭɦro]	'a poem'	[səɦɭodər]	'born of same parents'
[məɦɭorũ]	'mask'		
[bɦɭoɭũ]	'wide'	[sɭoɦaj]	'looks good'
		[sɭoɦamɳũ]	'charming'
		[sɭoɦagi]	'lucky'

In case of [e] it was labial [w] that clearly caused lowering. For [o] it is [j] that causes lowering.

The following set shows the duration change in syllabic extension of the words. (Meanings being not relevant, are not given.)

List V.

A	B
[dɭoɭ]	[dɭo:ɭwũ]
[tʃəgdɭoɭ]	[tʃəgdɭo:ɭwũ]
[ədʱɭoɭ]	[ədʱɭo:ɭijũ]
[kədʱɭoɳũ]	[kədʱɭoːɳɑ]
[kənɭodʒ]	[kənɭo:dʒi]
*[kəsɭoɭ]	[kəsɭo:ɭi]
[kəmbɭodʒ]	[kəmbɭo: dʒi]
[kaɭɭo]	[kaɭɭo:tro]
[tʃəɳɭo]	[tʃəɳɭo:ɭi]
[dʒʱəkdʒʱɭoɭ]	[dʒʱəkdʒʱɭo:ɭwũ]

	A	B
	[ɖʱ ˩o˩]	[ɖʱ ˩o̞: ˩wũ]
		[ɖʱ ˩o̞: ˧˩aɳ]
	[dʱ ˩o˩ũ]	[dʱ ˩o̞: ˩aʃ]
	[k ˩o˩i]	[k ˩o̞:˩əɳ]
	[dʱ ˩obi]	[dʱ ˩o̞:bəɳ]
*	[dʱ ˩or]	[dʱ ˩o̞:rəɳ]
	[n ˩okər]	[n ˩o̞:kri]
	[n ˩ondʱ]	[n ˩o̞:ndʱɳi]
	[n ˩otrũ]	[n ˩o̞:tərwũ]
*	[pən ˩o]	[pən ˩o̞:ti]
*	[ʄ ˩oʄə˩]	[ʄ ˩o:ʄə˩ijũ]
	[ʄ ˩oɖ]	[ʄ ˩o:dai]
	[ʄ ˩ol]	[ʄ ˩o:lai]
	[bəp ˩or]	[bəp ˩o̞:rijũ]
	[bʱ˩o˩]	[bʱ ˩o: ˩ə vwũ]
	[b ˩o˩]	[b ˩o:˩avwũ]
	[bʱ ˩o ˩]	[bʱ ˩o̞: ˩wɑ]
	[mʱ ˩or]	[mʱ ˩o̞:rwũ]
*	[m ˩oko]	[m ˩o:k˩ũ]
	[m˩ogər]	[m ˩o:gro]
*	[s ˩oɖ]	[s ˩o̞:ɖwũ]
*	[s ˩om]	[s ˩o:me ˥vər]

* These words in A and B are not the same morphemes but they are specifically good examples for showing how irrespective of meaning the language syllable-stress system works.

** Words in A have less lowered [o] than those in B. This shows how syllabic extensions can affect the vowels.

Here follows the data where 'e', 'o' are lowered because they are nasalized. This effect of nasalization on the vowels is also common to all the dialects and hence the data is a general list.

List VI -[ɭẽ]

[ɭẽtʰũ]	'polluted food'	[fɭẽʈo]	'turban'
[kʰɭẽʈʃ wũ]	'to pull'	[bʱɭẽʃ]	'buffalo'
[kʰɭẽkɖi]	'bony'	[bʱɭẽbʱɭẽ]	'onomato͡poetic'
[gʱɭẽs]	'food preparation'	[mɦɭẽ]	'I' (Instrumental)
		[rɭẽkɖi]	'vendor's cart'
[tʃ ɭẽtʃ i]	'grumble'	[rʰɭẽʈ ijo]	'spinning wheel'
[tʃɭẽtʃ ɭẽ pɭẽtʃ ɭẽ]	'weakling'	[rɦɭẽswũ]	'to kill'
[tʃʰɭẽtalis]	'fo͡urty six'	[vɭẽtʃ wũ]	'to distribute
[ʈʃẽsi]	'boasting'	[vɦɭẽtʃ wũ]	'to sell'
[ʈʰɭẽ]	'to show off'	[sɭẽkɖo]	'hundred'
[ʃɭẽ]	'onomato͡poetic'	[sɭẽ]	'a short form for hundred'
[f ɭẽkwũ]	'to throw'		
[f ɭẽdwũ]	'to mess'	[ɦ ɭẽ]	'exclamation'
[f ɭẽslo]	'decision'		
[fɭẽ fɭẽ]	'exhausted		

[kʰ⌊õkʰaro]	'coughing'
[kʰ⌊õʈʃ wũ]	'to push'
[tʃ⌊õkwũ]	'to get startled'
[tʃ⌊õʈ adwũ]	'to stick'
[dʒʱ⌊õs⌊o]	'to snub'
[dʱ⌊õkwũ]	'to strike'
[dʱ⌊õsri]	'yoke'
[ʈʰ⌊õs⌊o]	'blow'
[ʈʰ⌊õswũ]	'to eat much'
* [t(ɦ)⌊õter]	'fo(r)rty three'
[dʱ⌊õkɳũ]	'a wooden splasher'
[dʱ⌊õs⌊o]	'blanket'
[n⌊õdʱ]	'to note down'
* [p(ɦ)⌊õk]	'roasted grain'
* [b(ɦ)⌊õʈ er]	'seventy two'
[bʱ⌊õkwũ]	'to pierce
[bʱ⌊õʈʰũ]	'crestfallen'
[bʱõ]	'ground'
[m(ɦ)⌊õ]	'mouth/face'
[m⌊õgʱũ]	'expensive'
[ɤ⌊õtʃũ]	'dunce'
[l⌊õkdi]	'(she) fox'
[v(ɦ)⌊õk⌊lo]	'stream'
[s⌊õgʱũ]	'cheap'
[s⌊õpwũ]	'to entrust'
[s⌊õsərwũ]	'straight'
[ɦ⌊õʃ]	'enthuse'
[ɦ⌊õʃiʃər]	'clever'
[ɦ⌊õʈʃi]	'braying'
[ɦ⌊õkar]	'yes'
[tʃʱ⌊õʈ er]	'seventy six'

* These words in breathy dialects will have [ɦ] before the vowel [o]

2.3: The lowering and the duration of mid-vowels 231

The data in the list II and list V would require a special attention. These lists present an interesting feature of length (duration) in mid-vowels. The intrinsic duration of 'e' and 'o' is not pertinent here because it is very obvious that irrespective of any intrinsic duration, the duration increase takes place in these examples. It should be noted that the extra lowering of the vowels and duration increase are simultaneous. It is known that the greater the extent of articulatory movements the greater the length of vowels i.e. low vowels have longer duration. Intrinsic length of the low vowels is greater than that of the other vowels. Also the intrinsic duration of lowered vowel can be more than the non-lowered vowel depending on the other factors.[112] Jørgensen has observed that "the duration of a vowel depends on the extent of the movement of the speech organs required in order to come from the vowel position to the position of the following consonant."[113] Lehiste has also quoted Maack[114] whose observations are similar to Jørgensen's. The fact is that the duration and height of the vowels change with the syllabic extensions. This takes us into an involved issue of stress and syllabic extensions but that is beyond the immediate topic. At this stage, we have put down two tentative observations:

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112. Lehiste, 1970.

113. ibid, p. 20.

114. ibid, p. 21.

(1) the duration-increase partially depends on the consonantal frame of the syllable;

(2) and the syllabic extensions cause two types of highly complex chain reactions:

(a) the consonantal frame may cause the increase in duration which in turn may cause the lowering of the mid-vowel and these two in turn also affect the placement of stress in the syllabic sequences.

(b) the syllabic consonantal frame itself may change in the process of extension, i.e. the close syllable becomes heavier; e.g.,

[lé] 'take' (open syllable)

[l ⌊e:ʃ] 'a little' (close syllable)

From the articulatory position of the preceding consonant to the articulatory position of the following vowel to the articulatory position of the following consonant, there is a continuum. It means that a kind of cortical control exists for "synergestic actions which are required for the skilled motor movement that occur in speech."[115] Kim believes that all the nerve

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115. Ladefoged, 1980, p.

impulses for speech must be leaving the cortex at the same time. And in anticipation of the following sounds human speech musculature keeps adjusting itself and thus at one particular point in the speech production we get simultaneously more than one position of articulation.[116] The issue of various degrees of lowering of mid-vowels in Gujarati shows such various adjustments in various contexts. That historically in some dialects of Gujarati we get open-mid vowels is not merely a matter of coincidence. All dialect variations of any language have to be explained in terms of natural phonetics. The [ɛ),ɪɔ] of 'ɛ-ɔ' dialects are all not due to diphthongal contractions (and even when they are the result of diphthongal contractions, the cause for the lowering is to a greater extent contextual.) but as shown in the data they are also due to the natural contextual articulatory adjustments. Hence one is forced to look for the consequences in the similar contexts in 'e-o' dialects. As the lowering of mid-vowels is the contextual consequence also in the e-o dialects, the explanation (which we have tried to seek) based on phonetics seems more plausible. The x-ray photographs on p. 238-245 support our observations.

Variations in the secondary characteristics (of the vowels) which may be systematically related to the widely varying consonantal environments have attracted

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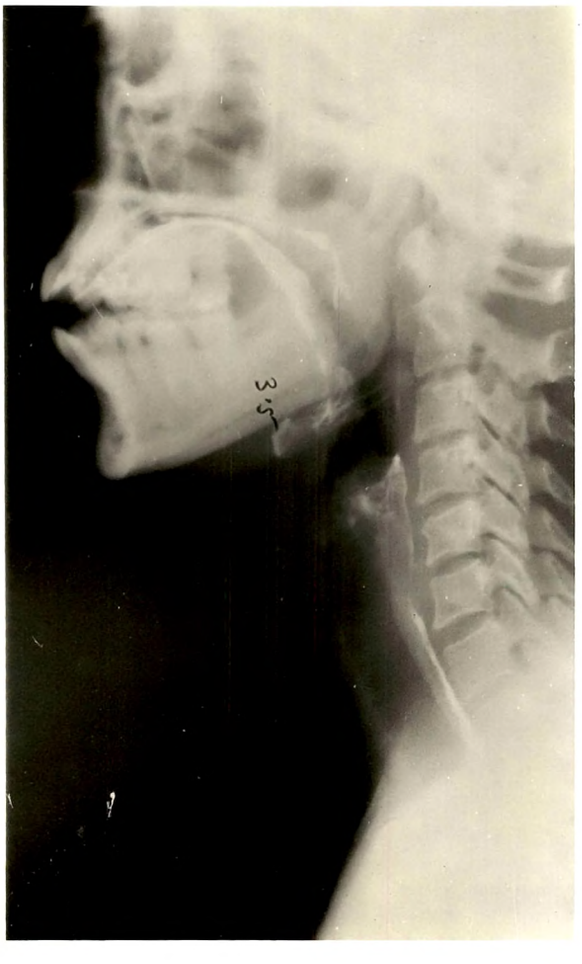
116. Kim, (PSICPS), 1971, p. 339-40.

Photograph I - More lowering of the jaw for murmured vowel [ə] as in [vhər] (Bombay dialect speaker)

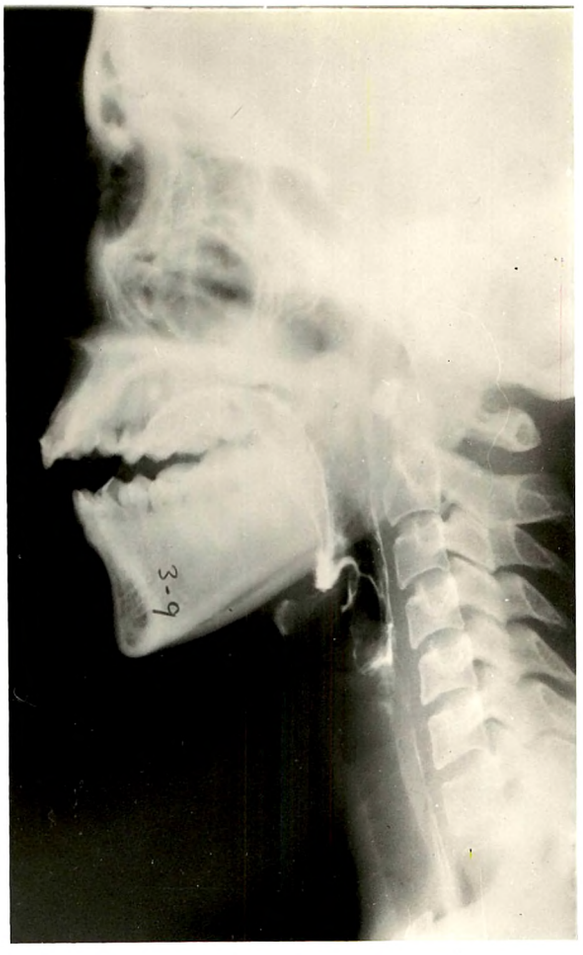
Photograph II - Lesser lowering of the jaw in [vər] as compared with that of the murmured [ə] (Bombay dialect speaker)


3-6


3-5

Photograph III - The jaw is lowered more when followed by the retroflexed consonant [ɖ] e.g.[kɛɖ] (Baroda speaker)

Photograph IV - Lowered jaw when followed by [ɖ] as in [kɔɖi] (Baroda speaker)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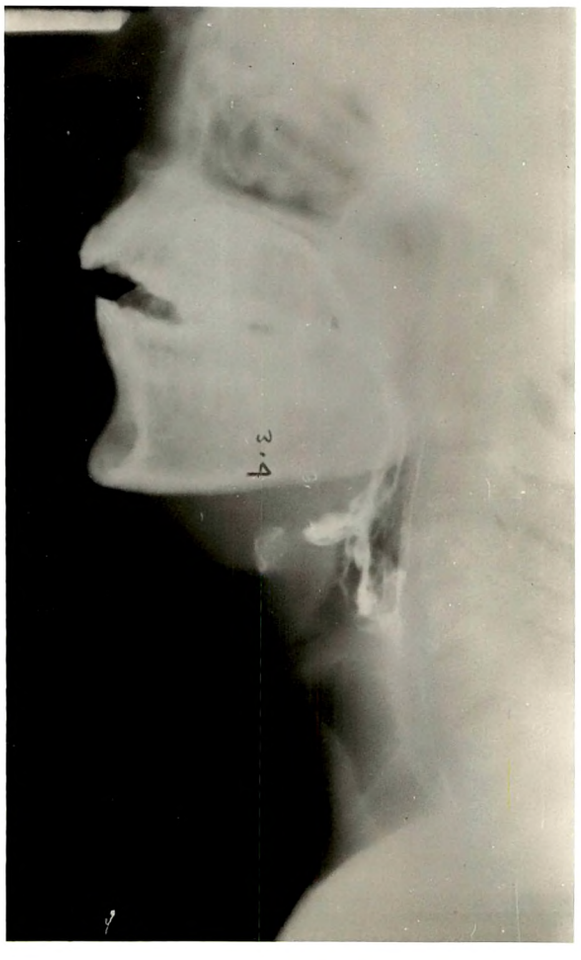
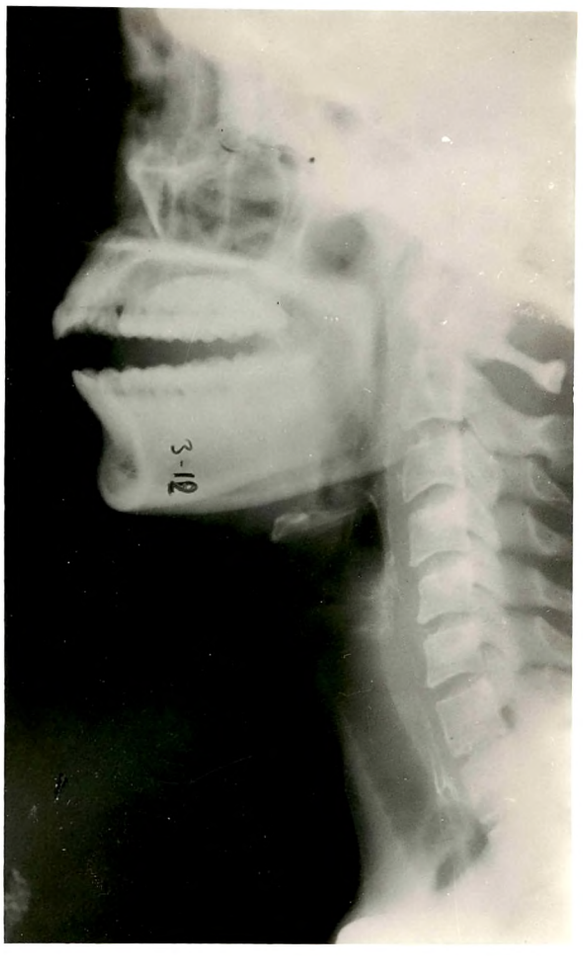
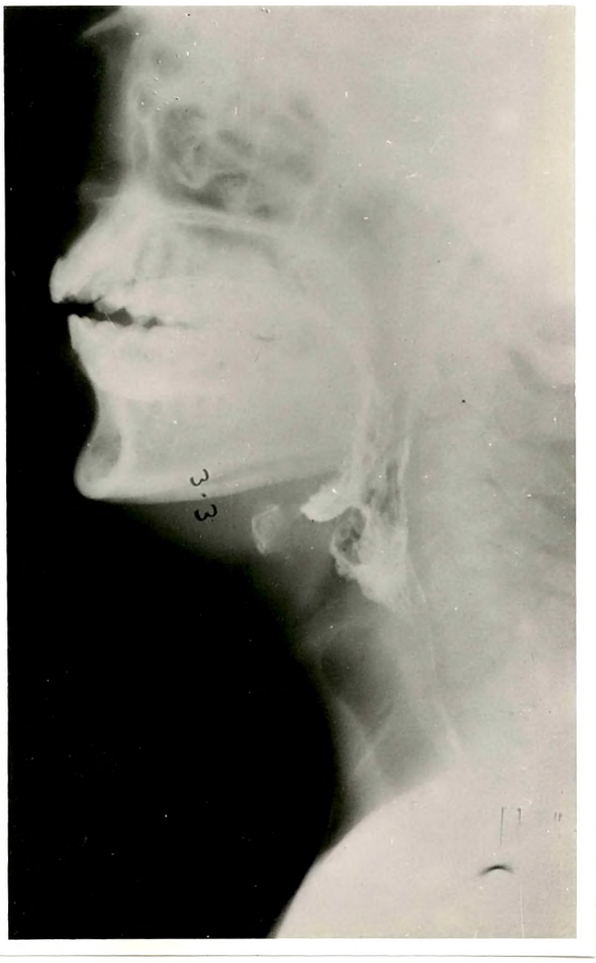

3-4

Photograph V - Lesser lowering of the jaw when followed by [ʈ] as in [peʈi] (Baroda speaker)

Photograph VI - Lesser lowering of the jaw when followed by [ʈ] as in [koʈi] (Baroda speaker)

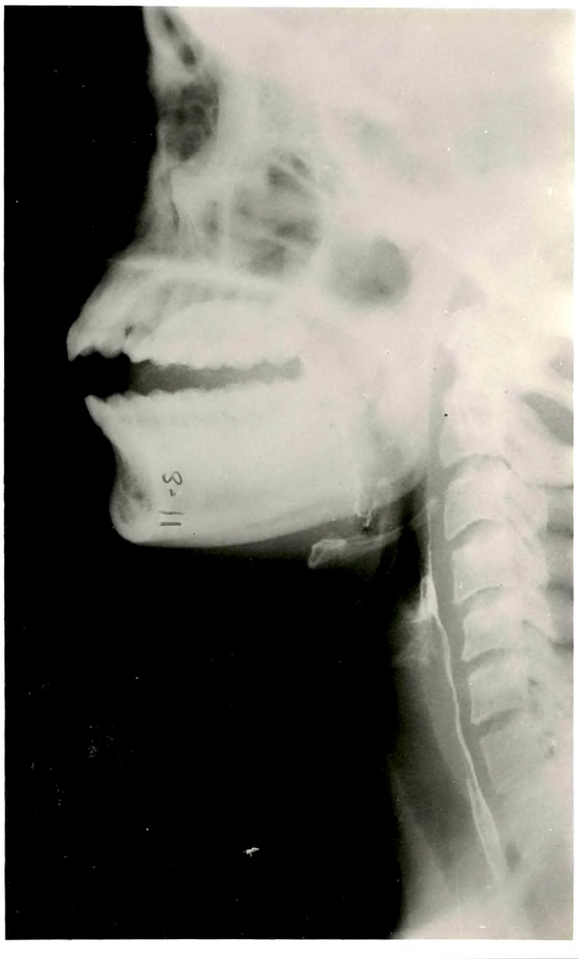

3-12


3-3

Photograph VII - Excessive lowering of the jaw of a Navsari dial speaker when [e] is followed by the retroflexed nasal as in [pẹ̆ɳi]

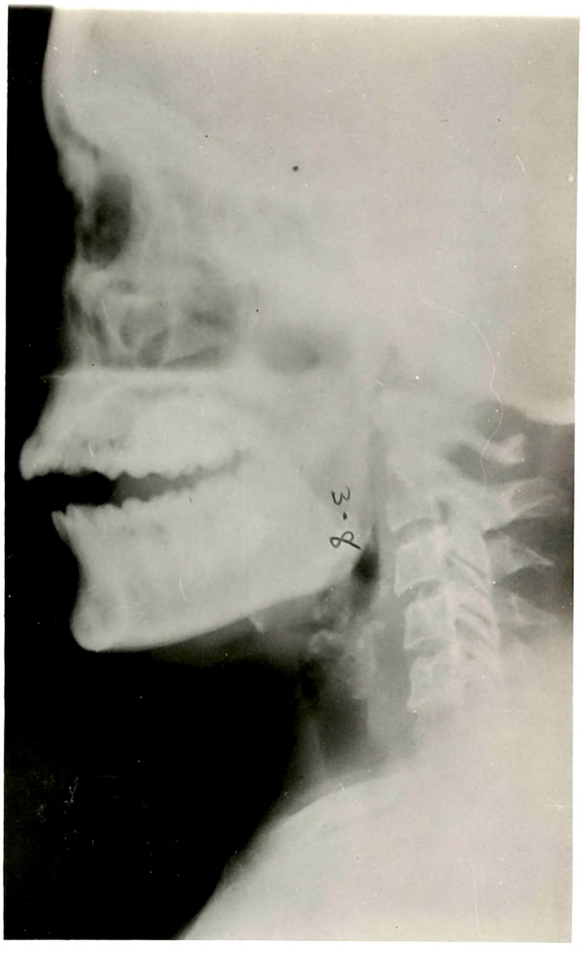
Photograph VIII - For the same word the jaw is not so much lowered by the Bombay speaker, e.g. [pẹ̆ɳi]


3-1


3-11

Photograph IX - This photograph shows the lowered jaw position o
the speaker of tight phonation dialect with 'ɛ-:
in the word [nɛɳ](vowel is followed by the
retroflexed nasal] (Bhavnagar dialect speaker)

Photograph X - Same speaker's lowered jaw in the word [kɔɳi]
(followed by the retroflexed nasal)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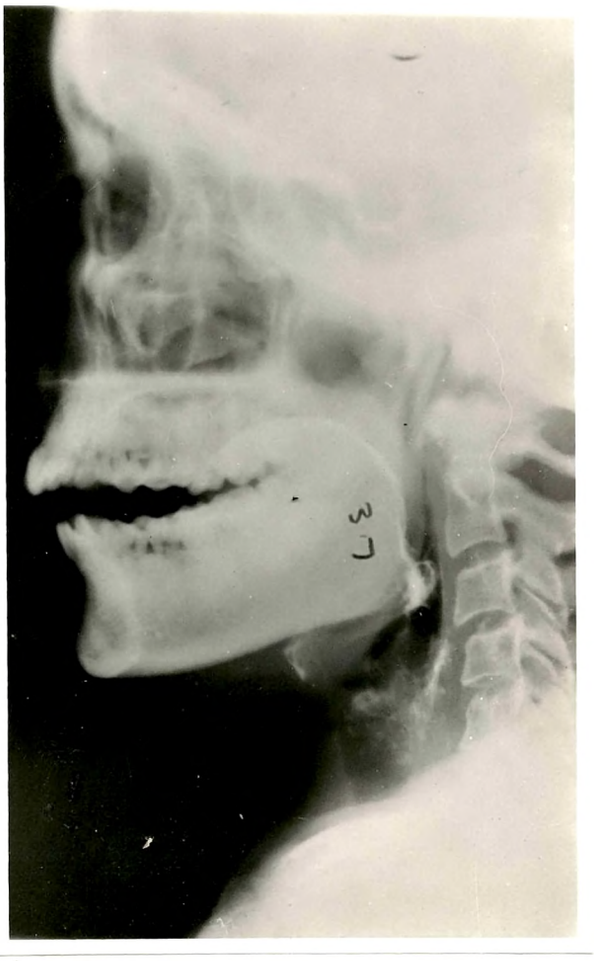
3-7

Photograph XI - Fricative also can cause the lowering of the jaw as in [kɛ̬ʃ] (Ahmedabad speaker)

Photograph XII - The same Navsari speaker who has vulgarised, opening of the vowel 'ɛ' shows lesser lowerin of the jaw when the vowel is followed by [t̬] a in [pɛ̬t̬i]


3-10


3-2

attention of many researchers. The intensity and duration of the vowel can vary from word to word and the researches have shown that this in part atleast, is the effect of differing consonantal environments."[117] House and Fairbanks found out that the duration of vowel increases in the following consonant environments:

Voicing	Time in seconds
voiceless consonants	0.174
voiced consonants	0.253
Manner of production	
stop	0.203
fricative	0.239
nasal	0.232
Place of production	
bilabial	0.205
labio-dental	0.234
post-dental	0.232
velar	0.198*

* (From House and Fairbanks).

The environments noted in our data here have the support from this study. One most interesting observation of House and Fairbanks is regarding vowels 'e' and 'o'. They studied the duration, relative power and fundamental frequency of the vowel [i, e, æ, ɑ, o, u]. The table and the graphs on page 247, 248 will make it clear that [e, o] do behave differently.

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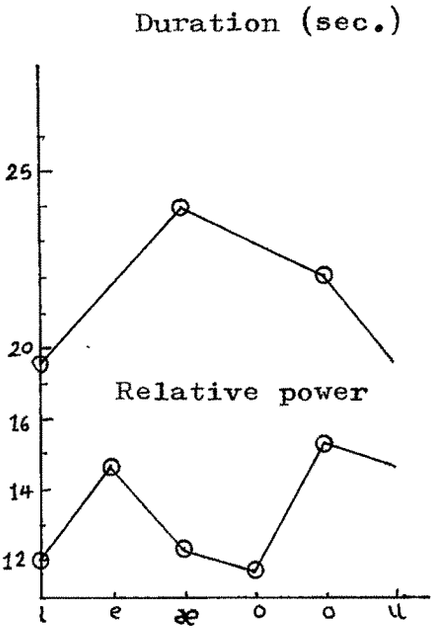
117. House and Fairbanks (Ed. Lehiste), 1967, p. 130.

	Duration (sec.)					
	[i]	[e]	[æ]	[ɑ]	[o]	[u]
All environments	0.199	0.225	0.244	0.236	0.221	0.195
Voiceless stops	0.138	0.171	0.184	0.180	0.157	0.138
Voiceless fricatives	0.177	0.199	0.215	0.218	0.187	0.161
Nasals	0.209	0.238	0.263	0.235	0.241	0.217
Voiced stops	0.215	0.251	0.276	0.267	0.244	0.215
Voiced fricatives	0.277	0.283	0.304	0.295	0.293	0.261
	Relative Power (db was converted to Relative Power*)					
All environments	12.43	14.94	12.35	11.97	15.49	14.94
Voiceless stops	4.16	8.30	5.50	5.78	7.35	4.91
Voiceless fricatives	12.41	12.70	11.39	11.17	12.83	11.48
Nasals	17.05	15.96	17.18	12.14	16.84	17.97
Voiced stops	13.80	16.65	13.66	14.94	18.29	14.78
Voiced Fricatives	18.19	23.58	16.74	17.42	24.82	30.67

Table III

* Relative power was taken as equal to $\text{antilog}_{10} N/10$ where N was expressed in db.



Mean duration and Relative Power of vowels. consonant environments Pooled

(Adapted from Houca and Fairbanks.)

The above observations show that "the duration of vowels is directly related to size of mouth opening and inversely related to tongue height. The conformity of [e] and [o] to the progression is interesting. Since they are commonly diphthongized longer duration would not have been surprising."[118] It will be seen that [e] and [o] have highest relative power. For our purpose two points are important:

(1) [e] and [o] have longer duration indicating the wider mouth opening;

(2) and their display of having high relative power indicates their specific behaviour different from the other vowels.

Jørgensen also connects duration with the lowering. That in Gujarati, retroflexed sounds, sonorants (nasals [m, n, ɳ], glides [w] for [e] and [j] for [o] , [r] for both the vowels) and fricatives (mainly voiced [ɦ] for both and [s] for [o]), bring lowering gets the support from this study. The manner of articulation and voicing are the responsible factors for the changes in duration of the vowels.

2.3.1 Further phonetic support

Diphthong contraction and vowel lowering is not an idiosyncratic sound change of Gujarati. Old High German 'ai' becomes ɛi and au becomes ɔu and then they appear as ei, ou respectively but this ei becomes ē before r, x and w (via ɛ̄), and ou becomes ō before r, x and all dentals. (via ɔ̄)

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118. House and Fairbanks (Ed. Lehiste), 1967, p. 132.

[ɛi] ⟶ [ɛ̄] / ⎯⎯ [r, x, w]

[ɔu] ⟶ [ɔ] / ⎯⎯ [r, x, (dentals)]

Spanish has lowering of i, u, e, o before [r̆, x]

[i, u, e, o] ⟶ [i̯, u̯, e̯, o̯] / ⎯⎯ [r̆, x]

In old Icelandic [e] ⟶ [æ] / [w ⎯ x]

[w] has a lowering effect on [e] .

These all are partial equivalents to Gujarati situations. But Vennemann has very well explained the Old High German situation. His explanation is like this:

ai ⟶ ɛi (by assimilation)

ɛ + i

i ⟶ ɛ / ɛ ⎯ [r, x, w]

so we get ɛɛ ⎯ [r, x, w] i.e. ɛ̄ ⎯ [r, x, w]

similarly au ⟶ ɔu

u ⟶ ɔ / ɔ ⎯ [r, x, (dentals)]

we get ɔɔ ⎯ [r, x, (dentals)] i.e. ɔ̄ ⎯ [r, x, (dentals)] [119,120]

Hence, our explanation regarding the old Gujarati diphthongs ending in i (j) and u(w) respectively and resulting into lowered, accented (due to duration) open mid-vowels before the contexts favourable for lowering has the support elsewhere too.

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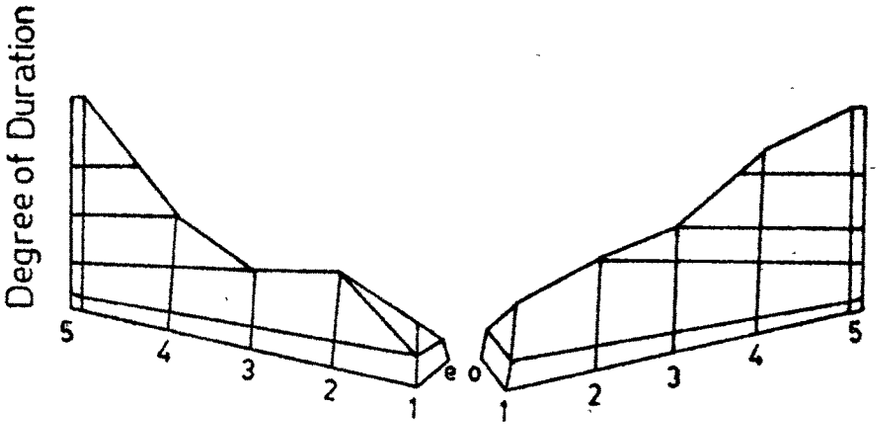
119. Vennemann (Ed. Bartsch and Vennemann), 1975, p. 27 .

120. Similar situation is found in Swiss German dialects where the causes of lowering vary in different dialects. (Robinson, 1976).

Duration, stress and lowering being inter-connected for Gujarati mid-vowels, it would be interesting to see which consonants bring maximum duration to the vowels;

	For [e]	For [o]
I.	Retroflex nasal	Retroflex nasal
II.	Retroflex aspirated voiced stops, [ɭ]	Retroflex aspirated, voiced stops, [ɭ]
III.	Nasals [m, n]	Nasal [n]
IV.	Voiced fricative [ɦ]	Fricative [s], [ʃ]
V.	[r, l, v]	[r, j]

(Retroflex nasals bring the maximum duration to vowels and r, l and glides bring the minimum). This is simply based on perceptional conclusion. Such observations can remain challangeable yet they cannot be called baseless. We have tried to put this data on a three dimensional figure. See p, 252. The figure shows the changes in vowel duration due to the changes in consonant environments with the vowels. Duration increase causes lowering and long vowels takes stress. Lowering of vowels due to the adjacent consonants is a universally found process. Dinnsen in giving a set of atomic rules from which all linguistic variations requiring varied formulations of phonological rules can be predicted, suggests one such rule regarding [o] → [ɔ]. Such rules are independent and are basic rules. The point we want to



1 = [r, l, v] for [e] [r, j] for [o]

2 = [ɦ] for [e] [ɦ, s] for [o]

3 = [m, n] for [e] [n] for [o]

4 = Voiced and/or aspirated Retroflex stop, for both

5 = [ŋ] for both

FIGURE: 7 - Three dimensional figure indicative of the duration differences in vowels.

make is that the lowering of mid-vowels 'before coronals, and 'r' sounds' is considered one such atomic universal rule.[121]

Now the question is 'of what importance is such an explanation for any phonemic conclusion?' Or to put it differently, in a phonological description of language, is there any need of such phonetic details?" It has been realized that phonological features do not suffice for specifying the actual sounds of a language. Ladefoged has suggested a set of articulatory parameters to help the description of varieties of sounds[122] some of these are useful for the variations of [e] and [o] in Gujarati. See figure on pa 254

These new parameters help in asserting the solution given here. The wide variety of potential actions resulting from the complex system of the tongue and mandible are suggested in this figure, 'Front raising' parameter corresponds in great part to the actions of genioglossus and of opposing muscles such as the glossopharyngeus and other pharyngeal constrictors. The 'Back raising' parameter corresponds to the action of styloyglossus and hyoglossus. But Ladefoged feels

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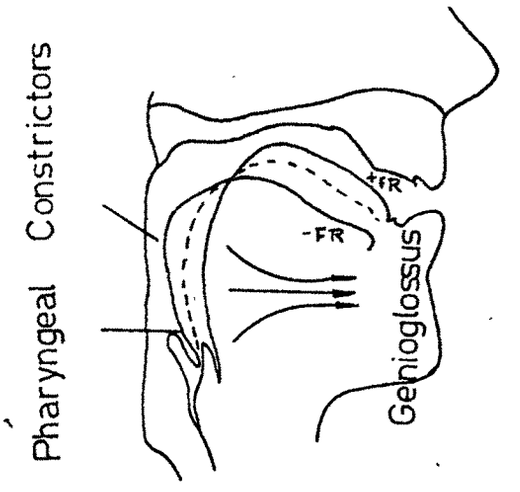
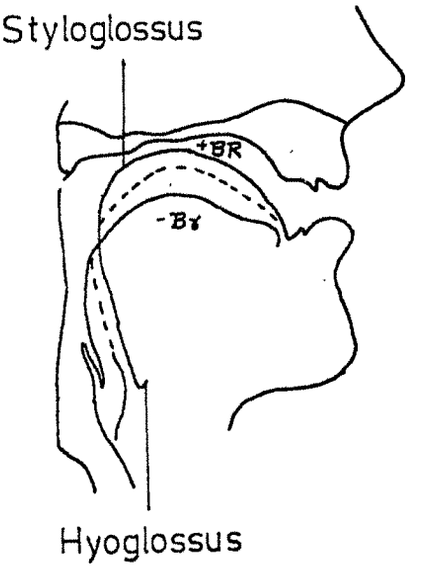
121. Dinnsen, (Ed. Dinnsen), 1979, p. 31.

122. Ladefoged, 1980.



(a) Front raising



(b) Back raising

FIGURE: 8 - Ladefoged's articulatory parameters.

that "these parameters describe higher level cortical control functions."[123] He has rightly considered this as the cortical control function because the tongue front/back and the mandible raising/lowering is not merely a segmental state. The cortical orders for the co-articulatory adjustments of the muscles (involving such raising/lowering) are carried out with such swiftness and fluidity that if such raising/lowering are not noted the crucial point regarding phonemes of the language can be missed. The other two parameters, 'tip raising' and 'tip advancing' show the "two dimensional movement of the tongue." For retroflex sounds the tip of the tongue is raised and is in a slightly retracted position. This can be stated in quantitative terms. In my mouth, I would say that the 'tip raising' for the retroflex sounds was about 2.5 to 3 cms. from a reference point. See the figure on p. 256 This 'tip raising' causes conspicuous interactions as seen in mid-vowels of Gujarati. If Ohala observed that alveolar consonants sometimes seem to cause a lowering of the back of the tongue, we would add that retroflex sounds particularly are capable of causing the lowering of the front of the tongue for the front vowels and of the back of the tongue for the back vowels.[124]

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123. Ladefoged, 1980, p. 488.

124. Ohala, 1974.

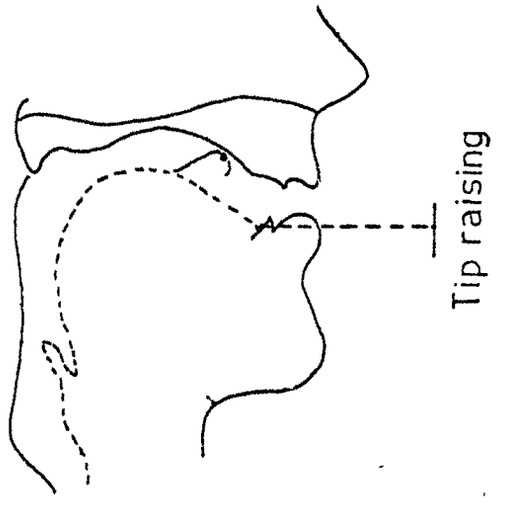

FIGURE: 9 - Tip raising for retroflexed sounds.

If the language displays relative tongue lowering for [e -ɛ] or [o -ɔ] then this 'relative'ness refers to the reference position of the tongue. The phonological feature such as 'high', 'low' 'back' are not at all sufficient to describe the variations of this nature. The Binary features fail in describing the phonological processes where (as in Gujarati) there is a movement along a single parameter (mid-vowels). Lindau has shown that such descriptions can be fruitful if the features are multivalued.[125] If the mid-vowels in Gujarati can range from [e] to [æ] ([e, e̬, ɛ, ɛ̬, æ]) and from [o] to [ɑ] ([o, o̬, ɔ, ɔ̬, ɑ]) then Lindau's suggestion seems to be more 'intuitively satisfying' and a rule with a multivalued feature [mid] can be worked out as below:

$$[n\ mid] \longrightarrow [n + 1\ mid] \ /\ \begin{bmatrix}\text{All noted}\\ \text{environ-}\\ \text{ments}\end{bmatrix} \text{———}$$

$$\text{or} \quad \text{———} \quad \begin{bmatrix}\text{All noted}\\ \text{environ-}\\ \text{ments}\end{bmatrix}$$

$$\text{or} \begin{bmatrix}\text{All noted}\\ \text{environ-}\\ \text{ments}\end{bmatrix} \text{———} \begin{bmatrix}\text{All noted}\\ \text{environ-}\\ \text{ments}\end{bmatrix}$$

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125. Lindau, 1978.

2·4·· Conclusions

The data and the discussion here should be enough to show that lowering of the mid-vowels in Gujarati is a natural process definable and predictable in terms of genetic phonetics, and that there are dialects with open-mid [ɛ, ɔ] . Although, these mid-vowels are partly the results of diphthongal contractions they are lowered in defined environments. Moreover, [ɛ, ɔ] don't form contrasts with [e, o] perceptually. A tentative implicational hierarchy may be inferred from this case of lowering of mid-vowels in Gujarati as follows:

Glides	[v](w) for [e]
	[j] for [o]
Liquids	
Nasals	[m, n] for [o]
	[n] for [o]
Fricatives	[ɦ] for [e]
	[ɦ, s] for [o]
Coronal obstruents	

I. If [e] lowers to [ɛ], and [o] lowers to [ɔ],

a. before liquids then they also lower to glides,

b. before nasals then also before liquids and glides,

c. before fricatives then also before nasals, liquids and glides,

d. before coronal obstruents then also before fricatives, nasals, liquids and glides.

Some rare pairs we get are not enough to prove that [ɛ, ɔ e, o] are four distinct phonemes. Lindau and Ladefoged both have tried to know as to how many contrastive values must be set for vowel features. The parameters that we already have may not be sufficient for showing the contrast, in all the languages (as many are yet unknown) or all the parameters may not necessarily always demonstrate constrastive values. What a language-study may need much depends on the perception of the speakers. If the speakers feel the absolute distinction between the sounds in question, then only the phonemic status be given to them. It is a difficult task to study the speakers' perception of his sounds and as Fant felt "it is a more difficult task to establish a unique code between the measurable parameters of any sample of live speech and its absolute phonetic quality."[126] In fact there is no absolute phonetic quality to a sound because in connected speech several adjacent sounds may carry information on one and the same phoneme. The typical examples of this can be seen from the Gujarati data, here. The perception of a Gujarati speaker does not register these differences in the vowel variations. But there is the probability that the differences observed by the researchers and "which are differentially discriminable in the vowel dimensions are smaller when the sound exists in an isolated quasi - steady

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126. Fant, 1962 p. 5

state than when it exists in the more dynamic state characterizing connected speech."[127] And the fact remains that one never speaks an isolated vowel with quasi-steady stage. Hence it is perceived in the connected speech only. In the dynamic state one gets a continuous succession of gradually varying and overlapping patterns. The speaker also perceives the speech message by noting the discrete sound units and their boundaries while automatically uttering them in the continuously varying and overlapping sequences. The articulation and perception contribute to the shaping of the phonological structure. It is certain that in the dynamic state the differences in vowel dimensions increase. But out of these which are the difference limens has to be determined. Researchers have repeatedly revealed differences in the patterns of identification and discrimination of consonants and vowels. In an identification test the listeners more consistently identified consonants than they did vowels. As Studdert-Kennedy notes "they identify consonants absolutely or categorically independently of the test context, while they identify vowels relatively or continuously with marked contextual effects".[128a]

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127. Flannagan, 1957, p.?.

128a. Studdert-Kennedy, 1975, P. 115.

This indicates that listeners have a longer short-term auditory store for vowels than for consonants. In another experiment it is noted that vowels like non-speech tones are susceptible to psychophysical anchoring effects.[128b] It was also felt by Word that auditory store and phonetic store can exist simultaneously.[128c] Thus many researches have proved that auditory and echoic memory play an important role for vowel perception. Perception is not totally a vague and baseless criterion. As the Gujarati speakers don't see the necessity to discriminate between the said vowels, they don't maximize the perceptual distance between them. Wang has specifically stressed this perceptual distance which he keeps separate from articulatory distance.[129] The principle of maximum perceptual distance or maximum perceptual contrast has been cited by Lindblom, in a very explicit manner. He has tried to quantify this principle. He conducted an experiment to show that the change in jaw positions for the same vowel do not bring any difference in values of formant frequencies and this must be due to 'compensatory'

128.b Sawusch & Pisoni, 1974, p. 436 (A)

128.c Word, 1973, p. 453 (A)

129. Wang, 1968, p. 34.

articulation' of the tongue which maintained the cavity shapes.[130] But here is one point where natural language situation will differ completely, as in Gujarati. The change in jaw positions "has been shown to have a considerable effect on formant frequencies,"[131] and one would expect that if the vowel varies from [e] to [æ] or [o] to [ɑ]. In this situation there is no question of any 'compensatory articulation'. In spite of the fact that 'this range of the mid-vowels is bound to produce difference in values of formant frequencies, as long as they don't strive for distinctness and as long as they don't struggle for independent identity they still will be perceived as phonemes /e/ and /o/ only. The contrasts between [e] and [ɛ] or [o] and [ɔ] are not to be treated as the linguistic methodological gimmicks by the linguists. Linguists have to consider the issue as an existing phenomenon. The very fact that despite the variations there is never a confusion regarding these vowels (irrespective of which dialect the speakers -

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130. Lindblom, (PSICPS) 1971, p. 74.

131. ibid, p. 71.

listeners belong to) is enough to indicate that perceptually there is no contrast between them. It is amazing how the users of the language have perceptually counterbalanced the effects of differences and achieved the intelligibility. See figure 10 on pg. 264

The persons speaking Gujarati may belong to two entirely different dialects - one may speak Halari (e-o dialect) and the other may speak the dialect of a community (near Navsari area) where open 'ɛ-ɔ' are very much existent - their intelligibility will not suffer due to these vowel differences. The varieties of mid-vowels spread over whole of Gujarat are indicative of the different courses that various dialects have taken. The sociolinguists have long since confirmed that the pronunciation a person uses tends to reflect among other things his regional and social origin. It has been already shown that there is more than one articulatory configuration that will produce a perceptual pattern required for 'e-o'. Lehiste and Peterson have observed a kind of a correction factor' working in perceptual process and it stops confusion created due to environmental effects.[132] The environmental effects are common to all the dialect speakers with the relative variations depending upon their point of reference.

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132. Lehiste & Peterson (Ed. Lehiste) 1967, p. 429.

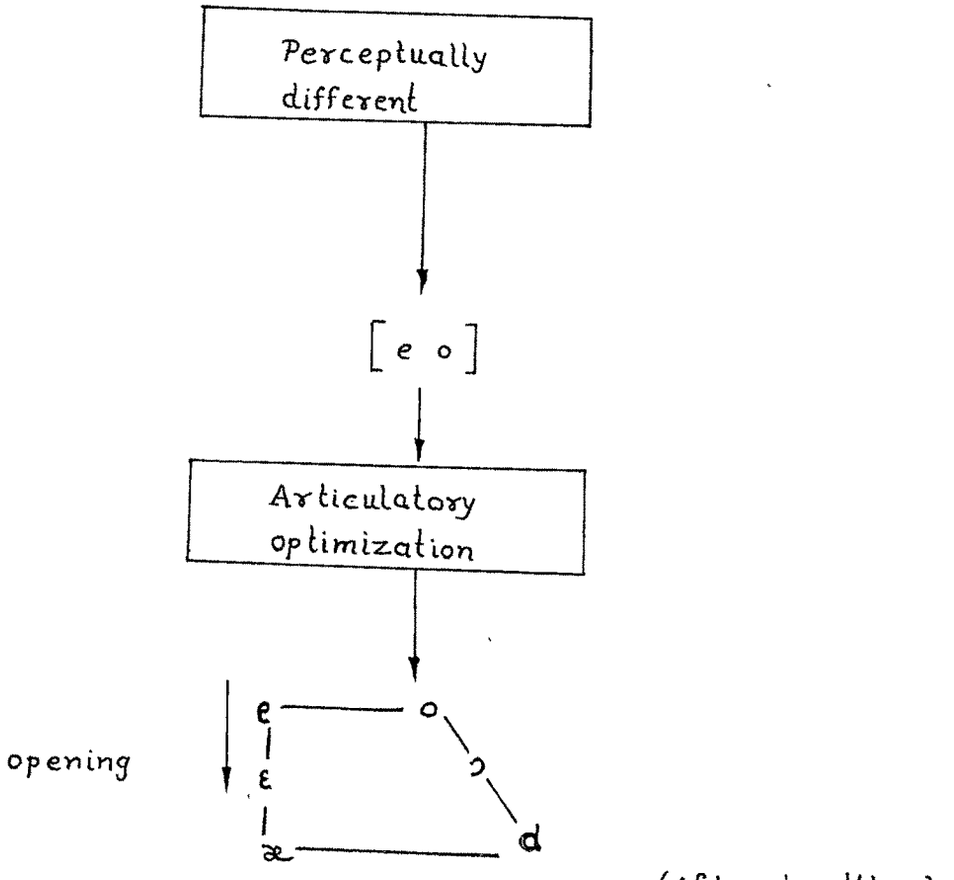

Fig 10

FIGURE: 10- Perception - Actuation.

One must assert that each dialect requires separate phonology. The caste, the profession, the social status, the educational background, the economic class and the geographical area are the factors, causing the variations in sounds of a large number of subdialects. But by and large the educated speakers from the two points farthest from each other have accepted the differences and managed to draw the 'mean' of the mid-vowels. These speakers are aware of the extra-linguistic factors. The way they perceive the vowels without any confusion stands as an evidence showing that when hearers perceive they derive much from multidimensionally complex sociolinguistic information. 'ɛ->' and 'e-o' variables are not a problem to Gujarati speakers. Writing the phonologies is the problem of linguists. But linguists can't ignore these variables of language use. As Weinreich has suggested "phonemic systems of the varieties should be fully established before 'the diasystem' is constructed"[133]. Accordingly the system of Gujarati vowel could be framed as below:

$$1,2 \;//\; i \approx \underset{\underset{\sim}{}}{[e,\ \underset{\sim}{e},\ ɛ]} \approx \underset{[ɛ,\ \underset{\sim}{ɛ},\ æ]}{} \approx u \approx \underset{\underset{\sim}{}}{[o,\ \underset{\sim}{o},\ ɔ]} \approx \underset{[ɔ,\ \underset{\sim}{ɔ},\ ɑ]}{} \approx ə \approx a \;//$$

(1) the diagonals = the formula for diasystem

(2) the double tildes = oppositions in the system

(3) the numbers show the numbers of varieties.

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133. Weinreich (ed. Fishman), 1972, p. 313.

If any attempt be made of writing such a phonology of 'the diasystem' it has to be substance based' and not 'form-based'.[134] The opposition of generative phonology coming from the 'natural generative phonologists' and from the sociolinguists, has condemned the primacy of 'Linguistic form' over the variables of language use. They have along with the phoneticians suggested a productive point of departure from the form based approach and insisted on substance based approach where "the linguistic form is not postulated but derived as a consequence of the structuring that substantive conditions impose on the speech signals."[135] It is certain that one should not take weird pairs to prove the contrast between the sounds, nor can one begin with abstract structures first and then go to phonetic reality. These phonetic and psychologically perceived realities should be the starting points.

After all this discussion, it is felt that we have tried enough to show that:

(1) perceptually 'e - ɛ' and 'o - ɔ' are non-contrastive,

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134. Weinreich, (Ed. Fishman) 1972, p. 310.

135. Lindblom, (PSICPS) 1971, p. 85.

(2) mid-vowel variations are,

(a) the phonetic realities,

(b) predictable in defined contexts,

(c) indicative of dialect differences.

(3) the articulatory space for the production of mid-vowels itself is prone to easy fluctuations.

(4) inspite of such phonetic differences in those vowels the speakers of the various dialects are able to draw the 'mean' out of them and hence the intelligibility is never affected.

Therefore we can say that Gujarati has six vowel phonemes: /i, u, e, o, ə , a/.