

SPIRANTIZATION-STOP states that non-nasal obstruents are realized as fricatives when immediately preceded by voicing and as voiceless stops elsewhere.

Each solution has become progressively more abstract. The first solution, a concrete one, posited three sets of underlying consonants in order to account for the variation. The second solution posited two sets, and the third solution just one set (whose surface manifestations are derived in conjunction with underlying glottal closure). The solution one adopts will be determined by the constraints one accepts on formulating and ordering rules. If Hooper's True Generalization Condition (1976:13) or Vennemann's Strong Naturalness Condition (1974b:346) are accepted as the constraints limiting possible solutions, then the third solution (which is a case of absolute neutralization) is untenable because it sets up an underlying glottal closure which never reaches the surface. This clearly violates Hooper's claim that the rules speakers formulate are based directly on surface forms (1976:13), i.e. there is never absolute neutralization.

If the abstract solution is to be maintained, then there must be some strong arguments to motivate it. There are considerations which speak for this abstract synchronic solution, but for natural phonologists they could never be weighty enough. For them, only surface alternants can justify a solution. My search for factors motivating the abstract set of non-nasal obstruents has extended beyond a consideration of surface manifestations.

Motivation for the abstract solution stems from segmental pattern congruity, alternation in existential and dubitative formatives, psycholinguistic factors, and dialect variation. First, and as already pointed out in 85 (cf. 77-84), setting up the archisegmentals, from which all non-nasal obstruents are derived, enhances segmental pattern congruity. The distribution of glottal stop is curiously limited in surface forms and the proposed non-nasal obstruents would spread its distribution so that it

symmetrically occurs before all underlying segments (except /ŋʷ/, which is most likely an accidental lacuna).

Second, alternation in existential and dubitative formatives forcefully argues that the abstract solution, though a case of absolute neutralization, does reflect native speaker competence, as 88-91 illustrate:

	(a)	(b)	(c)
(88)	['lkaʔaʔ] 'tree'	['lkaʔakʰʌnə] 'it is a tree'	/ʔkʰʌkʰtnt/
(89)	['e] 'there'	['eʔʌnə] 'it is there'	/ʔkʰtnt/
(90)	[ondəʔblʔ] 'pig'	[ondəʔblte] 'it could be a pig'	/odʔPʰte/
(91)	['ʃo] 'this one'	['ʃofe] 'it could be this one'	/ʔToTe/

In column a, 88 and 90 are terminated by glottal stop; 89 and 91 are not. In column b an existential suffix meaning 'is' has been attached to 88 and 89, and a dubitative suffix meaning 'could be' has been attached to 90 and 91. The formatives show a crucial alternation. The glottal stop that ends forms in column a has been lost in column b. And, it is precisely the formatives in which glottal stop has been lost where the existential and dubitative suffixes surface with voiceless stops, cf. [-kʰʌnə] vs. [-ʔʌnə] and [-te] vs. [-fe]. This occurs whenever the forms to which they are attached end in a glottal stop (88,90a). And, the forms that end in a vowel (89,91a) exhibit no alternation between columns a and b. It is evident that stem final glottal stop conditions the first segment of existential and dubitative suffixes so that voiceless stops result on the surface. The glottal stop itself no longer surfaces except that the [ʔ] and [ʃ] absorb its stopness and surface as [kʰ] and [t]. This case of alternation in existential and dubitative suffixes nicely supports the abstract solution,

which sets up a sequence of underlying glottal closure and non-nasal obstruent for all occurrences of word medial voiceless stops. It also demonstrates that SPIRANTIZATION-STOP is motivated independent of earlier considerations. Even if we did not use this rule to account for medial voiced fricatives and voiceless stops, it still must be formulated (similarly to 87) to account for the alternation in existential and dubitative suffixes (even by proponents of Natural Generative Phonology). Furthermore, if it must be formulated to account for the alternation in these suffixes, then it can reasonably be extended by the principle of 'free ride' (Schane, 1974:303) to account for other occurrences of medial voiceless stops as the surface manifestation of an underlying sequence of glottal stop and non-nasal obstruents.

Psycholinguistic considerations also support the abstract solution. New literates in Angave never say voiced fricatives when they are reading a new word. When asked to read or spell a word, they sound it out by syllables, always pronouncing as voiceless stops those segments which surface as voiced fricatives in normal speech. For example, [nʌgo'befə] 'to wrap' is sounded out by new literates as [nə/kʰo/pe/lə]. The voiceless stops are the consequence of strengthening each syllable boundary to an external word boundary within the domain of a single word. This is precisely what the abstract solution predicts: all non-nasal obstruents surface as voiceless stops following the pause associated with an external word boundary. The conditioning factor is preceding voicing and not position in the word, as new literates confirm. Even more convincing is the fact that speakers cannot read a voiced fricative when it is immediately preceded by a syllable terminated with glottal closure. They naturally read voiceless stops in the same environment.

A case of variation between Angai and Winoyit lects of Angave also substantiates the abstract analysis. An inspection of 92-98 reveals that the [k] and [kʰ] which fill the onset slot in the

final syllable of Winoyit forms roughly corresponds to [ʔ] in Angai forms:

	(a)	(b)	
	(Angai)	(Winoyit)	
(92)	['aʔoʔo]	['aʔəkʰo]	'grandfather'
(93)	['ʃoʔoʔ]	['ʃokʰʌʔ]	'knife'
(94)	['eʔeʔ]	['eəkʰʌʔ]	'arrow'
(95)	['lkaʔaʔ]	['lkakʰʌʔ]	'wood'
(96)	['ʔaʔaʔ]	['ʔakʰiʔ]	'fire'
(97)	[om'baʔʌʔ]	[om'baʔʌʔ]	'many'
(98)	['ʃəʔʌʔ]	['ʃəʔʌʔ]	'bamboo'

If it is postulated that historically some *k and *kʰ went to [ʔ] in Angai, a kind of change not uncommon across languages, one must also say that the resulting glottal stop then terminated the penult rather than initiating the ultima as *k and *kʰ must have done historically, because glottal closure in the synchronic language only terminates syllables and never initiates them (and most likely proto-Angave was the same). It can alternatively be argued that the reconstructions *ʔk and *ʔkʰ were realized as [ʔ] in Angai and [k, *kʰ] in Winoyit. Thus the correspondence between [ʔ] and [k, *kʰ] in the two lects can be explained by saying that *k, *kʰ --> Ø/ʔ ___ in Angai, and *ʔ --> Ø/ ___k, kʰ in Winoyit. This historical reconstruction of *ʔk and *ʔkʰ for proto-Angave further confirms the plausibility of representing underlying voiceless stops in the synchronic grammar of Angave as the sequence of glottal closure plus non-nasal obstruents, because it indicates how Angai ended up with a reflex which terminates the preceding syllable, but Winoyit a reflex (i.e. [k, kʰ]) which initiates the following syllable.

The final argument I will make for the abstract solution is a response to those who would disallow it just because it is a case of absolute neutralization. I would like to suggest that not all cases of absolute neutralization are the same, and therefore each must be evaluated for plausibility independently. While some cases

of absolute neutralization may not be well-motivated synchronically, others are, because they account for surface irregularity by natural processes involving a minimal number of features. For example, in Hyman's (1970:58-76) analysis of Nupe, contrast between labialized and palatalized segments preceding the low vowel, though neutralized in the underlying consonants, was maintained by displacing into the underlying representation of the low vowel (/ε,ɔ/). The contrastive features were maintained in the underlying representation though not on the same segments where they are found in surface manifestations.

Another example of absolute neutralization is seen in Saporta's (1965:220-22) analysis of Latin American Spanish, in which he postulates an underlying /θ/ for certain verbs which undergo a rule which inserts a [k], i.e. $\emptyset \rightarrow [k] / \emptyset _ \left\{ \begin{array}{l} a \\ o \end{array} \right\}$, and /s/ for those which do not. There is no contrast in the surface manifestation of /θ/ and /s/, for both result in [s]. The only difference in the verb endings is that the form derived from /θ/ has a [k] in addition to the [s], whereas the one derived from /s/ does not.

Though both Nupe and Latin American Spanish are cases of absolute neutralization, they are clearly different. It is easy to see how the features 'back' and 'round' could appear on different segments in surface representations because of natural phonological processes in Nupe. The case of Latin American Spanish is not the same and cannot be accounted for by a minimal number of features and one or two natural phonological processes. It would require intermediate stages of development to account for the surface forms. Furthermore, it is a morphological process restricted to a small subset of verbs.

It seems strange to me that some proponents of generative phonology, where features and phonological processes are in focus, would disallow cases of absolute neutralization where contrasting features are maintained in underlying representations though not on

the particular segment they surface in. This ties phonological processes too tightly to phonetic units, the very segments they should elucidate. The abstract solution I have proposed for Angave is similar to the Nupe analysis, for here again contrast between word medial voiceless stops and voiced fricatives is maintained, not in the underlying non-nasal obstruents, but in preceding glottal closure. For underlying glottal closure to surface in non-nasal obstruents has been shown to be a well-motivated process in Angave and the solution must not be rejected because it is simply branded a case of absolute neutralization. It is based on synchronic phonological processes (cf. discussion of existential and dubitative suffixes in this section) and a minimal number of features. An abstract segment specified for neither 'continuant' nor 'voice' coalesces with a preceding glottal stop and surfaces as a voiceless stop; when following a vowel not terminated by a glottal stop it surfaces as a voiced fricative assimilating in voicing to the preceding segment. These are natural phonological processes, not ad hoc, and they require no intermediate stages in the derivation of surface forms.

I consider SPIRANTIZATION-STOP (87) to be well-motivated and will now proceed to illustrate its operation on non-nasal obstruents. It has been stated in the most general way without encumbering it with restrictions or blocking features in order to capture the overall symmetry in the way non-nasal obstruents are realized on the surface. There is, however, variation in surface forms not accounted for by it. As was indicated earlier, some variation in surface forms (69c, 71-74d) was ignored during the formulation of SPIRANTIZATION-STOP. By looking at the operation of this rule, first as it applies to the non-nasal bilabial obstruent, second as it applies to the velar and postvelar non-nasal obstruents, and third as it applies to the alveolar non-nasal obstruent, we will be able to see where it does not produce the appropriate surface representations. Then we can make some

refinements in order to account for the otherwise anomalous forms, for it is not enough to establish rules which give a unified description of only selected data. If SPIRANTIZATION-STOP accurately reflects a native speaker's competence, then we should be able to find plausible explanations for anomalies at differing points of articulation.

3.3.1.1 The Bilabial Non-Nasal Obstruent

When SPIRANTIZATION-STOP operates on strings containing /P/ it produces [b], a voiced bilabial fricative, and [p], a voiceless bilabial stop. When immediately preceded by voicing the voiced fricative surfaces, having assimilated to the voicing of its preceding environment. The fact that [b] is continuant can be viewed as the weakening of a stop intervocalically, a process common to many languages (cf. Foley (1977:107) for the process of lenition traced historically in several Indo-European languages). The following examples, including both underlying and surface forms, illustrate SPIRANTIZATION-STOP producing [b] from underlying /P/. It operates across formative boundaries (101, 102) and across internal word boundaries¹⁸ (103, 104), as well as within formatives (99, 100):

- | | | | |
|-------|------------------|-------------------|--------------------|
| (99) | / 'lPʔ / | ['lbəʔ] | 'sago palm' |
| (100) | / Tle'Plá / | [še'byaʔ] | 'long' |
| (101) | / o#Tt+PeaTtnt / | ['o fə'pæʔnə] | 'Is he dying?' |
| (102) | / nt+PleáTtTt / | [nə'byətəfə] | 'to shed' |
| (103) | / 'Tlɣá#Ptɣf / | ['šlʔɣa 'bɣəʔ] | 'stone ledge' |
| (104) | / 'ámá#Ptuatnt / | ['aʔma 'bwaʔnə] | 'a man is passing' |

When SPIRANTIZATION-STOP operates on strings containing /P/ not preceded by voicing, it produces [p], a voiceless bilabial stop. /P/ is not preceded by voicing when it follows an external word boundary or formative medial glottal closure which terminates the voicing of the preceding vowel. The realization [p], when /P/

is preceded by an underlying glottal stop, can be viewed as a coalescence of glottal stop and the following non-nasal obstruent. The feature [-continuant] of glottal stop is absorbed by the following segment so that it surfaces as a stop maintaining its point of articulation. SPIRANTIZATION-STOP also states that the surface manifestation of /P/ will have the same values of 'continuant' and 'voice'. Since the non-continuant nature of [p] has been seen to result from the absorption of the stoppage of glottal closure, which terminates the voicing of the preceding vowel, it is natural that it is also [-voice]. When /P/ is preceded by an external word boundary, the preceding environment is voiceless; so, it is again natural that it would surface as a voiceless segment (and the same explanations may be generalized for all non-nasal obstruents). 105-110 illustrate the operation of SPIRANTIZATION-STOP producing [p] from /P/ when preceded by glottal closure (105-107) and an external word boundary (108-110).

(105) /f'Pánf/	[l'paʔnəʔ]	'co-initiate'
(106) /'KóPfná/	['kʰopəʔnaʔ]	'termite'
(107) /á'Pláwf/	[a'pyaʔwuʔ]	'flame'
(108) /##'Plenɿ##/	['pyenəʔ]-['pyenəʔ]	'round house'
(109) /##'Pɿɣf##/	['pɿɣəʔ]-['pɿɣəʔ]	'cliff'
(110) /##'Pá##/	['paʔ]-['paʔ]	'a bird'

It is evident that SPIRANTIZATION-STOP does not account for the variants with [p] in 108-110. It is not capable of predicting these surface forms. When SPIRANTIZATION-STOP was formulated earlier, we saw that only at the bilabial point of articulation (69c) did voiceless stops vary with voiceless fricatives following an external word boundary. At all other points of articulation for that environment (70-74c) voiceless stops had no variants. Now, why should there be variation at the bilabial point of articulation and not at the others? I think the answer for Angave may lie in the special status the word initial voiceless bilabial stop has in

sound change, as has been noted by some phonologists. Wolfgang Dressler (1974:98) marshalls historical evidence from several sources to substantiate his claim that "p is the least stable unvoiced stop in language change...the functionally weak member of the voiceless stops." He shows that *p (limited to syllable initial position) frequently has a greater variety of reflexes than the other voiceless stops.¹⁹ Among these frequently occurring reflexes is the voiceless bilabial fricative, just the variant we have found in Angave. The weakening of stops to fricatives is the well known process of lenition, and it appears that in Angave a new rule is being added to the grammar of its speakers which optionally weakens voiceless stops to fricatives following an external word boundary. For the present, however, this process of lenition is restricted to the bilabial point of articulation. So, if Dressler's contention, that the voiceless bilabial stop is the stop most likely to undergo sound change, is correct, then it explains why lenition occurs only at the bilabial point of articulation in Angave. Other phonologists like Foley, however, would not agree that [p] is the weakest of the voiceless stops, so we must investigate further to see whether there are other processes in Angave which bear on this matter. One method used for determining the relative phonological strength of consonantals in any language is to compare the consonantals within a natural set to see which ones undergo lenition. Such a comparison, it is claimed, allows one to determine which point of articulation is weaker or stronger than others. Foley (1977:29) states that "lenition applies preferentially to weak elements." Therefore only one (or some) member of a set undergoes lenition, then that member is ranked as phonologically weaker than the other members. In Angave nasal obstruents (prenasalized voiced stops) have no phonetically conditioned variants, and only /b/ varies morphologically. There is one morphological rule (cf. 186) which describes word initial [mb] weakening to [b] when it becomes medial. It operates on compounds with the verb stem /bɬ-/ 'come'.

There is no variation which hints that [nd] or [ŋg] ever weaken. If "lenition applies preferentially to weak elements," then [mb] is 'weaker' than [nd] or [ŋg], and bilabials are weaker than consonantals at other points of articulation. Hooper (1976:186) states that consonantal strength rankings may only be formulated on the basis of 'surface true' phonetic variation. I think she would reject that the morphological variation between [mb] and [b] in Angave has any bearing on the relative strengths of [mb], [nd], and [ŋg] synchronically. But even she argues that diachronic change (1976:202, 213) helps to justify her system of strength rankings, and therefore it seems to me that some valid conclusions may be drawn about the synchronic grammar of Angave on the basis of morphological changes (relics of phonetic conditioning). At the least we can say that historically *mb weakened, and there is no evidence that *nd or *ŋg ever did. It is possible that *nd and *ŋg did not weaken (though it is also possible that all voiced stops weakened historically, and *mb, as the strongest in the set, resisted lenition longer, which is evidenced by its morphological variants today), and that *mb was the weaker member historically. And if *mb was the weaker member historically, its potential to be weaker synchronically can also be inferred. This is the opposite of Foley's (1977:33) conclusions about consonantal strength rankings for he postulates that if a language has a weakening process affecting only one point of articulation, it will not be at the bilabial, but rather at the velar. Foley's position must be answered, but there are other factors involved here like position in the word, position in the utterance, and variation at the velar and postvelar points of articulation. So we will temporarily suspend this discussion on consonantal strength and come back to it again in the discussion of how SPIRANTIZATION-STOP relates to the velars and postvelars (cf. sec. 3.3.1.2), for the variation exhibited by the other non-nasal obstruents will help us determine whether viewing [p] (word initial) as the weakest of the non-nasal

obstruents is coherent within the whole. For now, I assume it is possible that lenition could affect initial [p] alone, and the rule BILABIAL LENITION has been formulated to account for the occurrences of [p̥]. It is an optional rule that operates on the output of SPIRANTIZATION-STOP and produces [p̥]:

$$(111) \quad \text{BILABIAL LENITION} \quad \left[\begin{array}{l} \text{C} \\ +\text{anterior} \\ -\text{coronal} \\ -\text{continuant} \\ -\text{voice} \end{array} \right] \quad \text{----> } [+ \text{continuant}] / \# \# \text{ ____}$$

BILABIAL LENITION states that the voiceless bilabial stop produced by SPIRANTIZATION-STOP weakens to the voiceless bilabial fricative following an external word boundary. It applies optionally, and is intrinsically ordered after SPIRANTIZATION-STOP, as derivations 112a,b illustrate:

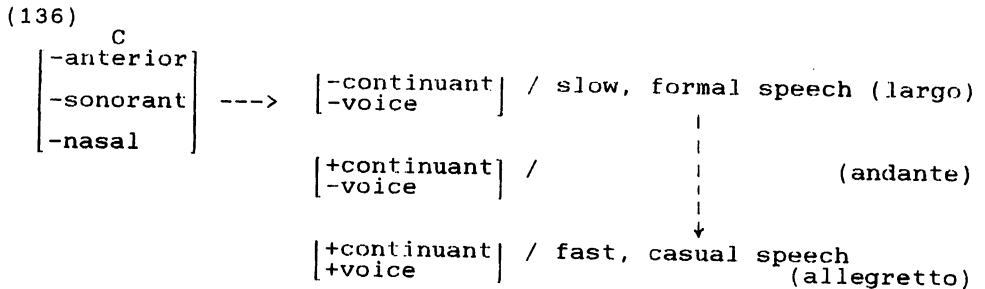
	(a)	(b)
(112) U.F.	/##'Pɬŋf##/	/##Pá##/
SPIRANTIZATION-STOP (87)	'pɬŋf	pá
BILABIAL LENITION	'p̥ɬŋf	p̥á
S.F.	['p̥ɬŋəʔ]	['p̥aʔ]
	'cliff'	'a bird'

3.3.1.2 The Velar and Post Velar Non-Nasal Obstruents

SPIRANTIZATION-STOP operates on strings containing /K/, /Kʷ/, /k̚/, and /k̚ʷ/, and produces the voiced fricatives [g], [gʷ], [g̚], and [g̚ʷ] when the preceding environment is voiced, and the voiceless stops [k], [kʷ], [k̚ʰ], and [k̚ʷ] elsewhere. 113-122 illustrate SPIRANTIZATION-STOP producing voiceless velar and postvelar stops when the preceding environment is voiceless, i.e. following an external word boundary (113-117), and following glottal stop both within formatives and across formative boundaries (118-122):

(113) /##K̚ɪmɪ'wɪ##/	[k̚əmu'wuʔ]	'a tree'
(114) /##'K̚leK̚f##/	['k̚yeəg̚ʌʔ]	'a parrot'

should not expect it to account for this variation. We will see, however, that, just as in the case where [p]~[p̥], there is a plausible explanation for it. The variation being considered here is actually conditioned by environmental factors that are superimposed over the environment specified in SPIRANTIZATION-STOP. I will first schematize the variation indicating the variants with their conditioning factors:



Whereas SPIRANTIZATION-STOP produces voiced fricatives following an internal word boundary, 136 claims that only in fast casual speech do the voiced fricatives actually occur at the back points of articulation. In slow speech voiceless stops surface and in moderate speech voiceless fricatives. The progression from voiceless stops to voiceless fricatives and finally to voiced fricatives follows the progression from largo to andante to allegretto speech styles. But how is this process related to SPIRANTIZATION-STOP? It can be related in one of two ways. One, it could be that a rule operates subsequent to SPIRANTIZATION-STOP and accounts for the variation. Or, it could be that another rule operates in place of SPIRANTIZATION-STOP on velars and postvelars in this one environment. Let us explore both possibilities, beginning with the former.

Since the variation [p]~[p̥] was explained by the operation of a minor rule subsequent to SPIRANTIZATION-STOP, perhaps a minor rule that operates on the output of SPIRANTIZATION-STOP can be formulated to produce the appropriate surface forms of velars and

postvelars following an internal word boundary. Such a rule would permit keeping the major rule intact. This idea actually calls for two rules, one of which triggers the other:

(137) BACK /C/ DEVOICING

$$\begin{array}{|l} \text{C} \\ \hline \text{-anterior} \\ \text{-sonorant} \\ \text{-nasal} \\ \text{+continuant} \\ \text{+voice} \end{array} \text{-----} \rightarrow \text{[-voice] / \# ___]}_{\text{andante}}$$

(138) BACK /C/ STRENGTHENING

$$\begin{array}{|l} \text{C} \\ \hline \text{-anterior} \\ \text{-sonorant} \\ \text{-nasal} \\ \text{+continuant} \\ \text{+voice} \end{array} \text{-----} \rightarrow \text{[-continuant / \# ___]}_{\text{largo}}$$

BACK /C/ DEVOICING will only operate on the output of SPIRANTIZATION-STOP and will produce voiceless fricatives. A string meeting the structural description of BACK /C/ DEVOICING and conditioned by slow speech will first of all be operated on by 137, whose output will then feed BACK /C/ STRENGTHENING. Though these two rules account for the variation, I think they may be weak in explanatory value. They appear to make fast casual speech the standard and slower speech more marked, because it requires more rules to produce its surface manifestation.

Another possible way to account for these variants in 131-135 is to say that SPIRANTIZATION-STOP is still spreading through the language and has overtaken the back points of articulation in all environments except following an internal word boundary. And even here it is gaining ground, for it does apply in the most casual speech style. (cf. Labov, 1972:79f for a discussion of speech styles). Only in the more careful speech styles is its application

blocked. In fast speech more rules are applied (especially across internal word boundaries, as English [dɪd yu] "did you?" in careful speech surface as [dɪ.ju] in casual speech) so SPIRANTIZATION-STOP is applied producing voiced fricatives in an environment where it is blocked from operating in slower speech styles. Support for this idea comes from the converse of what Dressler said regarding the susceptibility of the voiceless bilabial stop to undergo sound change (cf. sec. 3.3.1.1). Conversely, stops at other points of articulation are more stable and resistant to change. Dressler's contention, however, may not be entirely supported by sound changes in Angave for it has been seen earlier than *k and *kʰ have undergone change diachronically. This objection may not be valid, for the only *k and *kʰ which were deleted in Angai lect appear to be part of an old system of noun class endings which have been simplified. It may also be argued that [k]--->[x]--->[g] is a single process of lenition that has two steps conditioned by the two casual speech styles. The first step from [k] to [x] is a weakening (lenition) from voiceless stop to voiceless fricative, and the second is a further weakening to the voiced velar fricative [g] as it assimilates to preceding voicing (Hooper, 1976:206). Such weakening of stops in casual speech styles is quite common. For example, Spanish [syudaó] 'city' in very careful speech is [syuóað] in casual speech. Not only is this idea attractive in view of the correlation between lenition and casual speech in other languages, it also suggests a reason for why there is the more abrupt change from voiceless stops to voiced fricatives (without the intermediate voiceless fricatives) at other points of articulation, and that is because SPIRANTIZATION-STOP has gained access to all these forms across an internal word boundary irrespective of the style of speech. Notice how well this complements the previous discussion (cf. sec. 3.3.1.1) on the phonological strength of [p] in Angave. We concluded that the bilabial point of articulation appears to be phonologically weaker than the other voiceless stops. If that is

true, then we would welcome independent evidence which suggests that some voiceless stop is stronger than [p]. Since back non-nasal obstruents do not weaken following an internal word boundary in precise speech, and since the other non-nasal obstruents do, it appears that in Angave back non-nasal obstruents must have a higher phonological strength ranking. Perhaps I have been too simplistic in my analysis, but we have found consistent evidence from two sources to justify ranking back consonants as the strongest members and the bilabial as the weakest member of the set of non-nasal obstruents. Furthermore, even Foley (1977:126) has recognized that bilabials are not the strongest consonants in every language, for he cites English as a language in which dentals are stronger than bilabials and velars.

We have seen that the variants at the bilabial and back points of articulation, which were unaccounted for by SPIRANTIZATION-STOP alone, have plausible explanations based on natural phonological processes. These variations or seeming irregularities do not in any way challenge the validity of the abstract set of non-nasal obstruents. Rather, they help to support the abstract analysis, for languages (especially unwritten ones) are not static, but are always under pressure to change. A single very general rule blocked from applying in one environment, or followed by a less general rule which further alters the expected surface manifestations from one point of articulation to another, is not unlikely in cases of languages undergoing sound change. Foley (1977:25) has cogently argued that "rules typically apply to partial classes, and to entire classes only as the result of generalization," and his statement is aptly illustrated by Angave's non-nasal obstruents.

There is one more point of articulation to which SPIRANTIZATION-STOP applies, the alveolar. At the alveolar point of articulation also there is variation in surface forms not predicted by SPIRANTIZATION-STOP. Once again we will seek to explain the anomalous forms on the basis of natural processes.

SPIRANTIZATION-STOP does not produce the appropriate surface form. Consider 152-154:

- (152) */nt+TtTt/ ['nətəʔə] 'to put'
 (153) */mt+ToaaTtntnt/ [mətəʔəʔnə] 'he isn't smoking (it)'
 (154) */'ʌmt#+Toat/ ['aʔmə taʔə] 'smoke (it) again'

Where SPIRANTIZATION-STOP would transform /T/ (underlined) to [ʔ] in 152-154, the surface manifestation is in fact [t], which clearly indicates that the underlying forms of 152-154 must have a different segment for T. How can we account for this anomaly? First, it is important to recognize how many forms have an initial [t] that never alternates with [ʔ]. There are just six such forms in Angave:

- (155) [#təʔnə#] 'he is putting' (The two verb stems
 (156) [#təʔnə#] 'he is smoking (it)' have an invariant [t]).
 (157) [#təʔəʔ#] 'have'
 (158) [#təʔnə#] 'with'
 (159) [#taʔəʔ#] ~ [#ndaʔəʔ#] 'from (origin)'
 (160) [#taʔnə#] ~ [#ndaʔnə#] 'from (location)'

Second, note that 159 and 160 have idiolect variants with initial [nd]. Third, not only are there very few forms with a non-alternating initial [t], the number of syntactic classes they represent is even slimmer. 155 and 156 represent two verb stems. 157-160 are postpositions. It is peculiar that there are no nominals and no adverbials among these forms. Fourth, it is also peculiar that Angave has no postpositions that begin with [ʔ]. On the other hand, there are many verb stems that begin with /T/, and their surface forms are correctly produced by SPIRANTIZATION-STOP. In fact, 155 and 156 are minimally contrastive with two such verb stems:

(161)	(a)	(b)
U.F.	/#T̥t̥aT̥t̥n̥t̥#/ /t/ DELETION (352)	/#ToaaT̥t̥n̥t̥#/ -----
MONOPHTHONGIZATION (295)	----- TaT̥t̥n̥t̥	TɔT̥t̥n̥t̥
SPIRANTIZATION-STOP (87)	fḁt̥n̥t̥	fɔ̥t̥n̥t̥
S.F.	['f̥ḁɾn̥ə]	['f̥ɔ̥ɾn̥ə]
	'he is talking'	'he is removing'

169a,b show that SPIRANTIZATION-STOP does apply to verb stems (minimally contrastive with 155 and 156 with invariant [t]) with initial /T/ across an internal word boundary. So 155 and 156 must have an underlying representation that does not contain /T/, initially. But, must we scrap SPIRANTIZATION-STOP's application to the alveolar point of articulation and adopt a classical phonemic analysis insisting on */t/ and */r/ because of contrasting minimal pairs initial and medial? I think to do so would allow a tiny amount of data (six forms) to overturn the weighty evidence pervading the rest of the language. It seems better to maintain /T/ and SPIRANTIZATION-STOP intact as previously stated, and to seek an alternate way to account for the six forms with invariant [t].

Now how does a language end up with or maintain six forms with a non-alternating initial [t] when there are hundreds with /T/, i.e. [f̥] varying with [t] as predicted by SPIRANTIZATION-STOP? Note that all six forms occur frequently. In fact, five of them are among the most frequently occurring forms in Angave ([#t̥ɔ̥ɾn̥ə#] 'smoking' is the least frequently occurring). The two anomalous verb stems (155 and 156) are minimally contrastive with two verb stems (161a,b) which also occur very frequently. It could be that as SPIRANTIZATION-STOP spread through the lexicon, invariant [t] was maintained in 155 and 156, otherwise intolerable ambiguity would have resulted. Elsewhere (other verbals and all nominals) the distinction between *t̥ and *r̥ was not necessary to maintain semantic distinctness and so the contrast was neutralized. So, the

two verb stems with invariant [t] can be explained by functional (semantic) considerations as argued by Matthew Chen (1974:60-65).

The postpositions (157-160) cannot be explained by an appeal to functionalism. They are probably to be explained by a combination of factors, high frequency, their special status as clitics, and the idiolect variation [t]~[nd], but I have come to no conclusion which satisfy me. I prefer to mark these six anomalous forms in the lexicon and retain SPIRANTIZATION-STOP as stated. In the orthography these and only these six words have t. Students must learn them by sight, otherwise they think of the sound and write r (which represents /T/).

3.3.1.4 The Sequence /tʃ/

We have seen that first CLASS CHANGE (26) and then PALATALIZATION (45) operate on strings with the sequence /tʃ/ and produce [ʃ]. [ʃ], however, only occurs word initial while a voiceless affricate [tʃ] only occurs medially. For example, [a'tʃiʔ] 'grandmother' and [atʃoʔ'waʔ] 'bath'. In order to account for medial [tʃ], the rule AFFRICATION has been formulated. It transforms medial [ʃ] to the voiceless affricate, and thus is intrinsically ordered after PALATALIZATION.

$$(162) \quad \text{AFFRICATION} \quad \left[\begin{array}{c} \text{C} \\ \text{-anterior} \\ \text{+coronal} \\ \text{+high} \\ \text{-voice} \end{array} \right] \quad \text{--->} \quad \text{[+delayed release]} / \text{V _ V}$$

AFFRICATION states that the voiceless alveopalatal fricative [ʃ] is affricated when it occurs intervocalically. Now there is nothing about the intervocalic environment which would account for [ʃ] being changed to an affricate. I think that historically [tʃ] must have come from an underlying /ʔtʃ/ and [ʃ] from an underlying /tʃ/. If so, then *ʃ only occurred word initial, and the contrast between *ʃ and *tʃ medially was eventually neutralized, so that now only

[tš] occurs. There is, however, no synchronic evidence for maintaining such a distinction since now only [tš] occurs in word medial position. Perhaps the phonetic distinction between medial [tš] and initial [š] has been maintained because the neutralization between medial *š and *tš was so recent that there has not been time for initial [š] and medial [tš] to be collapsed into a single phonetic manifestation, or because there exists a potential partial neutralization of contrast between /t/ and /y/. If /t/ resulted in [š] when medial, it could possibly come under pressure from the preceding environment to assimilate in voicing. This would be a natural extension of the widespread process of assimilation to preceding voicing in Angave accounted for by SPIRANTIZATION-STOP. That there is such pressure on [š] can be seen in forms like [ʃ̣ɪməʔnaɾnə] 'you like', for it is transformed to [ʃ̣əʃ̣ɪməʔnaɾnə] 'would you like?' by some speakers and [ʃ̣əʒ̣ɪməʔnaɾnə] 'would you like?' by others. [ʒ̣], a voiced alveopalatal fricative, is usually the surface manifestation of /y/ when occurring medially and in a stressed syllable. Since /t/ eventually surfaces as [tš] medially, the contrast between /t/ and /y/ in this environment no longer rests on the single (non-class) feature 'voice', but also on 'continuant':

(163) /t/ --> [š] -->	<div style="text-align: center; margin-bottom: 5px;">C</div> -anterior +coronal +high -continuant -sonorant -voice +delayed release	/y/ -->	<div style="text-align: center; margin-bottom: 5px;">C</div> -anterior +coronal +high +continuant +sonorant +voice
-----------------------	---	---------	---

The necessity to maintain a distinction between /t/ and /y/ may well account for why phonetic [tš] is synchronically being maintained in medial position rather than neutralizing with [š]. Derivations 164a-d illustrate the application of CLASS CHANGE (26),

PALATALIZATION (45) and AFFRICATION (162) on strings containing /Ti/:

(164)	(a)	(b)	(c)	(d)
U.F.	/ˈTɪaŋf/	/aˈTɪf/	/aTɪóˈwá/	/ˈɲwaTɪf/
CLASS CHANGE	ˈTyaŋf	aˈTyf	aTyóˈwá	ˈɲwaTyf
PALATALIZATION	ˈʃaŋf	aˈʃf	ašóˈwá	ˈɲwaʃf
AFFRICATION	-----	aˈtʃf	atšóˈwá	ˈɲwatʃf
S.F.	[ˈʃaŋaʔ] ˈheavy	[aˈtʃɪʔ] ˈgrandmother	[atšóʔˈwaʔ] ˈbath	[ɲˈwatʃɪʔ] ˈwombat

One more rule is needed to account for the surface manifestations of /Ti/. In forms where the sequence /#TIVTIV/ occurs, both /Ti/ sequences surface as the affricate [tʃ]. The rule AFFRICATE ASSIMILATION has been formulated to account for these occurrences of [tʃ]:

(165) AFFRICATE ASSIMILATION

^C -anterior +coronal +high -voice	--> [+delayed release] / # __ V	^C -anterior +coronal +high -voice +delayed release	V
--	---------------------------------	--	---

AFFRICATE ASSIMILATION states that initial occurrences of /Ti/ surface as an affricate when the following syllable begins with an affricate. It is fed by AFFRICATION for its structural description can only be met by strings which have undergone the operation of AFFRICATION first. Derivations 166a-c illustrate:

(166)	(a)	(b)	(c)
U.F.	/#ˈTɪɪTɪfá#/	/#ˈTɪoTɪfá#/	/#TɪɪˈTɪoɔfá#/
CLASS CHANGE	ˈTyɪTyfá	ˈTyoTyfá	TyɪˈTyoɔf
PALATALIZATION	ˈʃɪʃfá	ˈšoʃfá	ʃɪˈšoɔf
AFFRICATION	ˈʃɪtʃfá	ˈšoʔtʃfá	ʃɪˈtʃoɔf
AFFRICATE ASSIMILATION	ˈtʃɪtʃfá	ˈtʃoʔtʃfá	tʃɪˈtʃoɔf

S.F. [tʃi:ʃaʔaʔ] [tʃo:ʃaʔaʔ] [tʃi:ʃo:ndaʔ]
 'a fern' 'stomping' 'a bird'

3.3.2 Nasal Obstruents

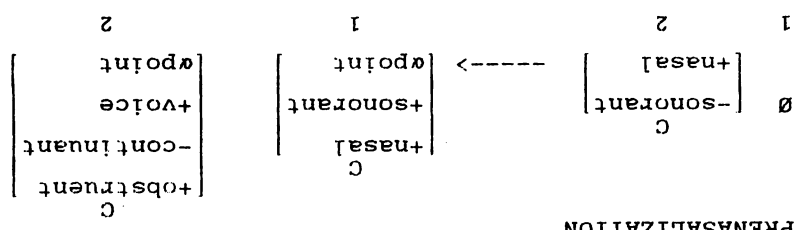
Nasal obstruents have no variants (except for the morphological variation of /b/ discussed later). Their underlying representations match their surface representations, as 167-180 show:

- (167) /b̄famt/ [m̄baʔama] 'outside'
- (168) /b̄f/ [m̄b̄iʔ] 'a bird'
- (169) /d̄fʔ/ [n̄daʔaʔ] 'hair'
- (170) /d̄fwt/ [n̄d̄uʔwuʔ] 'mountain'
- (171) /gʔ/ [n̄gaʔ] 'mine'
- (172) /ḡwt.Planʔ/ [ŋ̄wuʔbʔanaʔ] 'a mushroom'
- (173) /ḡweŋwt/ [ŋ̄ḡweŋwuʔ] 'a sugar cane'
- (174) /l̄b̄tnt/ [l̄mb̄anaʔ] 'cucumber'
- (175) /t̄ifaʔb̄/ [ʃaʔamb̄eʔ] 'wild banana'
- (176) /o.d̄tʔf/ [on.d̄vʔvʔ] 'a palm'
- (177) /l̄meŋb̄/ [l̄meŋb̄eʔ] 'downhill'
- (178) /l̄ḡf/ [l̄uʔḡiʔ] 'scar'
- (179) /a.ḡwt.Ptwt/ [aŋḡwt.Ptwtwuʔ] 'owl'
- (180) /t̄loŋwt/ [ʃoŋḡwuʔ] 'sun'

The nasal that precedes each voiced stop in the surface representations is homorganic with the stop. The rule

PRENASALIZATION assigns each nasal obstruent its appropriate nasal:

(181) PRENASALIZATION



PRENASALIZATION states that underlying prenasalized stops (voiced stops) surface sequentially as a homorganic nasal and voiced stop. Derivations 182a-c illustrate its application:

(182)	(a)	(b)	(c)
U.F.	/bʃ/	/'dʃwʃ/	/'gʃ/
PRENASALIZATION	m'bʃ	n'dʃwʃ	lŋ'gʃ
S.F.	[m'bʃʔ]	[n'duʔwuʔ]	[lŋ'gʃʔ]
	'a bird'	'mountain'	'scar'

/b/, the bilabial nasal obstruent, presents one exception to the statement that the underlying and surface forms of nasal obstruents are the same. Consider the following verbals:

(183)	/nʃ+ <u>b</u> ʃTʃ/	['nəmbəʃə]	'to <u>come</u> '
(184)	/nʃ+wea+ <u>b</u> ʃTʃ/	[nu'wəbəʃə]	'to <u>come</u> down'
(185)	/nʃ+ya+ <u>b</u> ʃTʃ/	[nə'yəbəʃə]	'to <u>come</u> up'

The verb stem /bʃ-/ 'come' surfaces as [bə] in compound verb stems (184-185). It is only in compounds containing /bʃ-/ that /b/ surfaces as [b]. The rule /b/ WEAKENING describes this morphological variation:

(186)		^C	
/b/ WEAKENING	$\left[\begin{array}{l} +\text{bilabial} \\ +\text{nasal} \\ -\text{sonorant} \end{array} \right]$	----->	$\left[\begin{array}{l} -\text{nasal} \\ +\text{continuant} \end{array} \right] / V+\underline{\quad} / bʃ-/$

/b/ WEAKENING is a morphological rule, and it states that the /b/ in the verb stem /bʃ-/ surfaces as the voiced fricative [b] in compounds.

Two gender markers (/ba/ and -bʃ/) surface with an [mb] when syllable initial coincides with word initial, and [b] when medial. The Angave seem to handle these variants as a further generalization of 186, i.e. /b/--->[b]/V+___, but it is quite certain that they came from another source historically.

Consider 187-189:

	(a)	(b)	(c)	(d)
(187)	['aɟə wɪ 'waʔ]	['wɪgə wu 'řɪʔ]	['aʔma 'wɪʔ]	[kɪ 'řa m 'baʔ]
	'one house'	'one vein'	'one woman'	'one axe'
(188)	['aɟə řɪ 'waʔ]	['wɪgə řə 'řɪʔ]	['aʔma 'řɪʔ]	[kɪ 'řa řə 'baʔ]
	'this house'	'this vein'	'this woman'	'this axe'
(189)	['aɟɪwaʔ]	['wɪgəřɪʔ]	['aʔmaɪʔ]	[kɪ 'řabaʔ]
	'the house'	'the vein'	'the woman'	'the axe'

In columns a-c the gender markers remain invariant in their surface manifestation, but such is not the case in column d. In d [m'baʔ] varies with [baʔ]. [m'baʔ] (187d), however, is more than just a gender marker. It is a cardinal number with a marker suffixed to it. The cardinal numbers with the other eight gender markers suffixed all begin with [w] and may be constructed by the formula /wɪ-/ + gender marker. So most likely the [mb] in [mbaʔ] 'one' and [mbə] 'one' came historically from *wup. Since *w and *p are homorganic, the central vowel separating them probably was deleted (cf. /t/ DELETION' (363)) and eventually *wp--->mb. It seems to me from the reaction of new literates that speakers handle the variation in 187-189d as two variants of the same gender marker whose underlying form is /-ba/. When /b/ is medial, /b/ surface as [b]. Furthermore, there are two variants for the cardinal number formative, /wɪ-/ and Ø; and Ø is prefixed to gender markers beginning with /b/. This is a good example of the generalization of a morphological process. Furthermore, it demonstrates that speakers may combine historically distinct phonetic processes into a single morphological generalization in the synchronic grammar. The rule /b/ WEAKENING' extends 186 to account for the variation in 187-189d:

$$\begin{array}{l}
 (190) \\
 /b/ \text{ WEAKENING}'
 \end{array}
 \left[\begin{array}{c}
 \text{C} \\
 +\text{bilabial} \\
 +\text{nasal} \\
 -\text{sonorant}
 \end{array} \right]
 \text{---->}
 \left[\begin{array}{c}
 -\text{nasal} \\
 +\text{continuant}
 \end{array} \right]
 \text{V+} \underline{\quad} \quad / \text{ bɪ-} / , \\
 \text{gend m}$$

/b/ WEAKENING' is a morphological rule which states that the verb stem /bʰ-/ in compounds and the suffixed gender markers /-ba/ and /-bʰ/ surface with [b].

3.3.3 Nasals

Nasals have no variants. Their surface manifestation is the same as their underlying representation (for [n] coalescing with [ʃ] see NASAL-FLAP COALESCENCE (369)) as 191-201 show:

(191)	[m̄nʰtʰʌʔ /	[m̄nʰtʰʌʔ	'frog'
(192)	[n̄nʰtʰnʌʔ /	[n̄nʰtʰnʌʔ	'all'
(193)	[n̄tʰnʰtʰeʔ /	[n̄tʰnʰtʰeʔ	'locust'
(194)	[n̄w̄eʌnʰwʰtʰ /	[n̄w̄eʌnʰwʰtʰ	'a banana'
(195)	[n̄m̄nʌʔ /	[n̄m̄nʌʔ	'man'
(196)	[n̄nʰtʰ /	[n̄nʰtʰ	'widow'
(197)	[n̄n̄tʰgʰtʰ /	[n̄n̄tʰgʰtʰ	'water'
(198)	[n̄nʰtʰ /	[n̄nʰtʰ	'house'
(199)	[n̄tʰn̄tʰtʰ /	[n̄tʰn̄tʰtʰ	'briar'
(200)	[n̄tʰn̄wʰtʰ /	[n̄tʰn̄wʰtʰ	'neck'
(201)	[n̄w̄tʰe /	[n̄w̄tʰe	'nearby'

3.3.4 Semivowels

202-210 include examples of the range of variation of the high front semivowel /y/:

(202)	[ʎanʌʔ /	[ʎanʌʔ	'gift'
(203)	[ʎunʌʔ /	[ʎunʌʔ	'kindling'
(204)	[ʎoyʌ /	[ʎoyʌ	'he (focus)'
(205)	[ʎayʌʔ /	[ʎayʌʔ	'double banana'
(206)	[ʎoyʌ /	[ʎoyʌ	'yes'
(207)	[pʰtʰʎʌʔ /	[pʰtʰʎʌʔ	'wet'
(208)	[ʎayʌʔ /	[ʎayʌʔ	'poison'
(209)	[ʎeyʌʔ /	[ʎeyʌʔ	'whiskers'
		[ʎeʎʌʔ /	+ andante
		[ʎayʌʔ /	+ andante

(210) /n+y|t/ [nə'y|fə] 'to ascend'
 [nə'ž|fə] + andante

In careful speech, i.e. largo, [y] occurs formative initial (202, 203, 210), and medial in unstressed syllables (204-205). [ž] only occurs medially in stressed syllables characterized by largo (206-207), but in unstressed (205, 209) and stressed syllables (210) characterized by andante. The rule STRIDENCY has been formulated to account for the variation in largo:

(211)	C	-anterior	
	+coronal		
STRIDENCY	+high		-----> [+strident] / V'___V
	+voice		
	-nasal		

STRIDENCY states that /y/ surfaces as the strident alveopalatal [ž] when occurring medially in a stressed syllable. The rule STRIDENCY' has been formulated to account for the alternation between [y] and [ž] medially when characterized by andante style:

(212)	C	-anterior	
	+coronal		
STRIDENCY'	+high		-----> [+strident] / V___V] andante
	+voice		
	-nasal		

STRIDENCY' states that /y/s that occur medially and surface as [y] in largo become [ž] in andante. Derivations 213a-d illustrate both stridency rules operating on strings containing /y/:

(213) U.F.	(a)	+ andante	(b)	+ andante
	/'yaŋf/		/P+'yʃ/	
STRIDENCY	----		P+'žʃ	
STRIDENCY'	----		-----	

S.F.	['yaŋəʔ]	['pəʒɪʔ]
	'gift'	'wet'
	(c)	(d)
U.F.	/'meyf/ + largo	/'meyf/ + allegretto
STRIDENCY	-----	-----
STRIDENCY'	-----	'meʒf
S.F.	['meyɪʔ]	['meʒɪʔ]
	'whiskers'	'whiskers'

213b shows that if STRIDENCY has applied, STRIDENCY' only applies vacuously. In fact, STRIDENCY' can only produce [ʒ] if the string containing /y/ does not meet the structural description of STRIDENCY. 213d shows that strings undergo STRIDENCY when the speech style is andante or faster.

In contrast to /y/, the high back semivowel /w/ has no variants, as 214-217 show:

(214)	/'wɪɫfá/	['wɪɫaʔaʔ]	'lungs'
(215)	/'wajf/	['ɪ'wajəʔ]	'projectile'
(216)	/'alwá/	['aɪwəʔ]	'food'
(217)	/'wogf/	['wogəʔ]	'a banana'

4 VOWELS

4.1 Underlying Vowels

(218)	-round		+round
	-back	+back	
+low -low -high +high	/ɪ/	/u/	
	/e/	/ɪ/	/o/
	(/ea/)	/a/	(/oa/)

The array of underlying vowels along with its features is straightforward except that the vowel sequences /oa/ and /ea/ have been included within parentheses to indicate that following the operation of MONOPHTHONGIZATION (295) they pattern as low vowels. The array was not set up as 219 for three reasons. First, the patterning of /ea/ and /oa/ mentioned above.

(219)

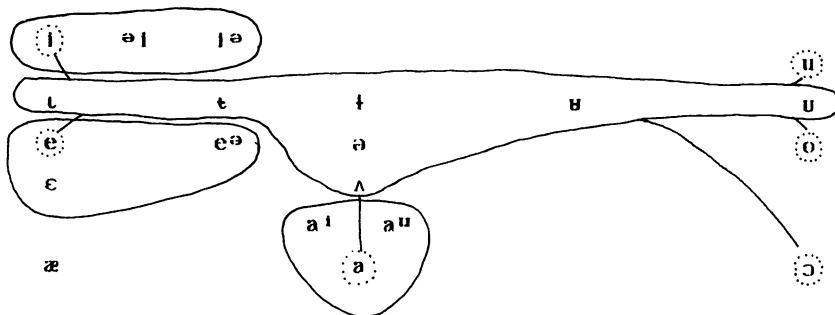
/ɪ/	/ɨ/	/u/
/e/	/a/	/o/

Second, rules such as VOWEL REDUCTION (350) would need to include features that not only centralize reduced vowels, but also raise them, which would require more complexity. And third, high vowels do not undergo VOWEL REDUCTION whereas mid and low vowels do, which indicates that there is no high central vowel in Angave to which they could reduce.

4.2 Surface Manifestations of Vowels

The following work chart (220) catalogues the surface manifestations of vowels. Each solid circle (or segment not enclosed within a solid circle) encloses the surface manifestations of a single underlying segment. The segments with glides could have been omitted since they are accounted for by insertion rules, but they have been included to make the array exhaustive in cataloguing the surface forms. For example, [ɪ], [eɪ], and [iə] are circled together and are the surface variants of /ɪ/. In addition to the

(220) Surface Manifestations of Vowels



grouping of [ɪ], [eɪ], and [iə] together by a solid circle, [ɪ] by itself has a broken circle around it that is linked by a solid line to the grouping of surface manifestations of the central vowel. It indicates that some occurrences of [ɪ] are the surface manifestation of /ɪ/. Therefore, some occurrences of [ɪ] will be accounted for by rules operating on strings containing /ɪ/ and others by rules operating on strings containing /ɪ/. Note that nearly every underlying vowel (and vowel sequence) arrayed in 218 has a surface form which overlaps with one of the surface forms of /ɪ/. This overlap plus the sheer number of variants manifested by /ɪ/ are some of the more interesting aspects of Angave phonology. Rules operating on /ɪ/ and the other underlying vowels will be motivated and illustrated after a brief discussion of the feature specifications for Angave vowels.

The full feature specification chart (221) indicates the articulatory nature of each vowel's variants and features necessary to specify contrastively:

(221) Full Feature Specification of Vocalic Segments

	ɪ	u	e	ɛ	ɨ	ɛ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ
high	+	+	-	-	+	+	+	+	+	-	-	-	-	-	-	-
low	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+
back	-	+	-	-	-	-	+	+	+	+	+	+	+	-	+	+
round	-	+	-	-	-	-	-	+	+	-	-	+	-	-	-	+
tense	+	+	+	-	-	-	-	-	-	-	+	+	+	+	+	+
central	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-
vocalic	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

The feature 'central' and 'tense' have been included out of necessity in order to make the oppositions required by so many variants. Variants with glides have not been included in 221, for the glides will be accounted for by insertion rules. Let us now

consider the vowels in three groups, front, central, and back. Note that the central vowels have the most variants and the back vowels the least.

4.3 Phonological Processes that Account for Surface Representations of Vowels

4.3.1 Front Vowels

In 220 we saw that non-low front vowels have similar variants [i^ə] and [e^ə]. 222-224 show the environment in which these variants occur:

	(a)		(b)	
(222)	['lɪnɪŋəʔ]	'wind'	['eməʔ]	'a beetle'
(223)	['lɪəŋʌʔ]	'a tree'	['eəŋʌʔ]	'a tree'
(224)	['pɪəŋ ^h ʌnə]	'what'	[wə'meəŋʌʔ]	'a sugar cane'

223-224a and 223-224b have [i^ə] and [e^ə] respectively. Whenever non-low front vowels are followed by a postvelar segment, a mid central glide occurs between them. Elsewhere [i] and [e] occur (222a,b). The rule POST GLIDE INSERTION has been formulated to account for this variation:

$$(225) \quad \text{POST GLIDE INSERTION} \quad \emptyset \text{ ---} \rightarrow \begin{matrix} \text{V} \\ \left[\begin{array}{l} \text{-low} \\ \text{-round} \\ \text{+back} \end{array} \right] \end{matrix} / \begin{matrix} \text{V} \\ \left[\begin{array}{l} \text{-low} \\ \text{-back} \end{array} \right] \end{matrix} \text{ --- } \begin{matrix} \text{C} \\ \left[\begin{array}{l} \text{-anterior} \\ \text{-high} \end{array} \right] \end{matrix}$$

POST GLIDE INSERTION states that the mid central vowel [ə] is inserted after non-low front vowels when they are followed by a postvelar segment. This glide is the consequence of the radical change in configuration the tongue must make to get from a front vowel to the postvelar segment. The tongue lies high and front during the articulation of non-low front vowels. To assume the articulatory shape necessary for postvelars it must shift back where the roof of the tongue is raised to the region just preceding the uvula. At the same time the tip of the tongue lowers. It is

during the radical movement in between the articulation of the front vowel and the postvelar segment that the transitional vowel is heard. This transitional glide is quite prominent (less so for [e^ə]) due to the length of time required to reshape the tongue for the articulation of such disparate sounds. Some speakers insert [y] before the transitional vowels, which is predictable on the basis of SEMIVOWEL EPENTHESIS' (329). That there is not an underlying syllable */y+/- between the non-low front vowel and postvelar segment is demonstrated by forms like 224a, which has the underlying form /Pí+Ḳṭn+/. Other occurrences of /Pí/ 'what' (i.e. /PíTe/ ['píte] 'What could it be?'), where it does not precede a postvelar, show that the transitional vowel in ['pí^əḳḥʌnə], which is [píyəḳḥʌnə] for others, cannot be an underlying /y+/. Derivations 226a-d illustrate POST GLIDE INSERTION operating on strings with non-low front vowels:

(226)	(a)	(b)	(c)	(d)
U.F.	/ 'íḲf/	/ 'íṃṭɥf/	/ 'Péẉf/	/ 'eḲf/
POST GLIDE INSERTION	'í ^ə Ḳf	-----	-----	'e ^ə Ḳf
S.F.	['í ^ə q̣ʌʔ]	['íṃṭɥəʔ]	['peʔwuʔ]	['e ^ə q̣ʌʔ]
	'a tree'	'cold'	'spoiled'	'a tree'

In addition to the variant [í^ə], /í/ also has a mirror image variant [éí] that occurs in the mirror image environment of [í^ə]. Whenever /í/ is preceded by /Ḳ/, a very short transitional vowel is heard during the time the tongue's articulatory configuration reverses from back to front. The duration of the transitional vowel in [éí] is much shorter and less prominent than the transitional vowel in [í^ə]. I've never heard it stretched to a surface CV as some speakers do with the glide in [í^ə]. The rule PRE-GLIDE INSERTION has been formulated to account for this variation:

(227)	PRE-GLIDE INSERTION	∅ -->	$\left[\begin{array}{c} \text{V} \\ -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right]$	/	$\left[\begin{array}{c} \text{C} \\ -\text{anterior} \\ -\text{high} \\ -\text{round} \end{array} \right]$	---	$\left[\begin{array}{c} \text{V} \\ +\text{high} \\ -\text{back} \end{array} \right]$
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The operation of PRE-GLIDE INSERTION on strings meeting its structural description and inserting a short transitional [ə] in between /k/ and following /i/ is illustrated by derivations 228a-d.

(228)	(a)	(b)	(c)	(d)
U.F.	/'aP+kɪ/	/'kɪf/	/'kʷlogwɪ/	/'kɛgɪ/
VOWEL COPY (259)	-----	'kɪf	-----	-----
PRE-GLIDE INSERTION	'aP+kəɪ	'kəɪf	-----	-----
S.F.	['aɪəgəɪʔ]	['kʰəɪʔɪʔ]	['kʷyoŋgwɪʔ]	['kʰɛŋgəʔ]
	'woman'	'hers'	'season'	'its'

In 228c PRE-GLIDE INSERTION does not insert a glide preceding /i/ even though it follows a postvelar segment. The rule's application is blocked by the stipulation in the structural description that the postvelar segment preceding /i/ cannot be labialized. That the rule does not operate in this particular environment can be explained by the nature of labialization. The labialization articulated subsequent to the postvelar fills the transitional time required to reach /i/, and therefore the transitional vowel is covered up or excluded by the labialization.

That /e/ does not have a variant *[əe] corresponding to [əɪ] is probably accounted for by the combination of two factors. First, the preceding transitional vowel in [əɪ] is very short. And second, since the tongue is not as high for /e/ as /i/, it does not need to move quite so far from the point of articulation of postvelars to get to /e/ as /i/. So when /e/ follows /k/ there is no *[əe] because the disparity between the segments is not great enough for there to be sufficient time for a transitional vowel to be inserted (228d).

Since both POST GLIDE INSERTION (225) and PRE-GLIDE INSERTION (227) insert [ə] in strings meeting their structural descriptions they may be combined into a single rule:

$$(229) \quad [\text{ə}] \text{ GLIDE INSERTION } \emptyset \rightarrow \begin{array}{c} \text{V} \\ \left[\begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} / \begin{array}{c} \text{V} \\ \left[\begin{array}{l} -\text{low} \\ -\text{back} \end{array} \right] \end{array} \text{---} \begin{array}{c} \text{C} \\ \left[\begin{array}{l} -\text{anterior} \\ -\text{high} \end{array} \right] \end{array} \\ \begin{array}{c} \text{C} \\ \left[\begin{array}{l} -\text{anterior} \\ -\text{high} \\ -\text{round} \end{array} \right] \end{array} \text{---} \begin{array}{c} \text{V} \\ \left[\begin{array}{l} +\text{high} \\ -\text{back} \end{array} \right] \end{array}$$

The final variant of /e/ to be accounted for is [ɛ]. The following forms illustrate the range of its occurrences:

	(a)	(b)	(c)
(230)	['mɛʔ]	['peʔwuʔ]	['kweʔ] ~ ['kweʔ]
	'lips'	'spoiled'	'large'
(231)	['peʔɛwɪʔ]	['eʔmə]	['teʔɛʔ] ~ ['teʔɛʔ]
	'a bird'	'above'	'a plant'
(232)	['weʔ]	['eʔməʔ]	
	'hand'	'moon'	

Some forms manifest only [ɛ] (230-232a). Others manifest only [e] (230-232b). Still others (230-231c) manifest a variation between [e] and [ɛ]. The variation in column c has not been found to be attributable to any conditioning factors like word tone or style of speech. I once thought that glottal closure and stress conditioned the occurrences of [ɛ] since it rarely occurs without following glottal closure. I cannot, however, find any consistent pattern upon which to formulate a rule that will generate [ɛ] from /e/. I have observed, however, that new literates have no trouble reading and writing /e/ for both [ɛ] and [e]. Because of the reaction of new literates and the apparent free variation between [ɛ] and [e] in some forms, I treat both as variants of /e/.

4.3.2 Central Vowels

The work chart, in which the phonetic manifestations of vowels are arrayed (220), includes a wide range of variants of /t/. Rather than attempt to work with all of the variants at once, I will treat them in three stages: First [ɿ, ɛ, ɪ, ʊ, u], second [ə, ʌ, o, u], and third [ɪ, e, a, ɔ, o]. The first group of variants is spread horizontally across the work chart on a level in between the high and mid vowels. 233-237 illustrate the environments in which they occur:

	(a)	(b)	(c)	(d)	(e)
(233)	[ʃʌɿʔ] 'marsupial'	[ʃsɛŋəʔ] 'new'	[ʃmɪŋəʔ] 'head'	[ʃuʔwʊŋəʔ] 'second'	[ʃwɪŋwʊʔ] 'shaking'
(234)	[pəʒɿʔ] 'dead'	[pəʒɛŋəʔ] 'insect'	[ʃnɪŋŋəʔ] 'mine'	[aʊŋgʷwʊŋəʔ] 'contemporary'	[ʃkwɪʃəʔ] 'magic'
(235)	[ʃkʰotɿʔmaʔ] 'a pitpit'		[ʃɪŋŋəʔ] 'a bird'		[ʃlwʊʔ] 'a lizard'
(236)	[ʃʌboŋɿʔ] 'snare'	[ʃlɪŋŋəʔ] 'water'	[ʃtʰkɪŋəʔ] 'a rodent'		[ʃaʊŋgʷwʊʔ] 'now'
(237)	[ʃmaŋɿʔ] 'wombat'	[ʃaʔtɿŋəʔ] 'sneeze'			[ʃɪkwʊʔ] 'leaf'

Note that /t/ has a different variant in each column: [ɿ], [ɛ], [ɪ], [ʊ], and [u]. In column a the variant of /t/ in focus is [ə]. It is preceded by [ʃ, ʒ, ŋʃ, ŋ, tʃ], all of which are alveopalatals. Each of these segments has a plus value for the feature 'high'. In each example the central vowel has moved upward and forward assimilating to the height of the preceding alveopalatal. The resulting [ɿ] is [+high] and [-back]. It differs from /ɪ/ by its value for 'tense'. The rule /t/ FRONTING has been formulated to account for [ɿ]:

(238)	V		C
/t/ FRONTING	$\begin{bmatrix} -\text{low} \\ -\text{round} \\ +\text{back} \end{bmatrix}$	----->	$\begin{bmatrix} +\text{high} \\ -\text{back} \\ -\text{tense} \end{bmatrix} / \begin{bmatrix} -\text{anterior} \\ +\text{coronal} \\ +\text{high} \end{bmatrix}$