

/ɪ/ FRONTING states that /ɪ/ surfaces as [ɪ], a high front lax variant, when preceded by alveopalatals, and therefore it is intrinsically ordered after PALATALIZATION (45) (cf. 245a).

In 233-237e [u], a round back variant of /ɪ/, occurs in each example. It is always preceded by [w], the high round semivowel, or [Cw], segments previously analyzed as labialized velar and postvelar consonants. The central vowel has moved upward and back assimilating to the height and roundness of the preceding [w]. The resulting [u] is [+high] and [+round]. It differs from /u/ by its value for the feature 'tense'. The rule /ɪ/ ROUNDING has been formulated to account for these occurrences of [u]:

$$(239) \quad /ɪ/ \text{ ROUNDING} \quad \begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \quad \text{-----} \rightarrow \quad \begin{array}{c} \left[ \begin{array}{l} +\text{high} \\ +\text{round} \\ -\text{tense} \end{array} \right] / \begin{array}{c} \text{C} \\ [+round] \end{array} \quad \underline{\quad} \end{array}$$

/ɪ/ ROUNDING states that /ɪ/ surfaces as [u], a high back round lax variant, following labialized segments or the high back semivowel.

In 233-237c [ɨ], a high central variant of /ɪ/, occurs in each example. It is always followed by [ŋ] or [ŋg]. As in the two previous cases where /ɪ/ has been seen to assimilate to [ɪ] following alveopalatals and [u] following round segments, this is also a case of assimilation. The body of the tongue is drawn upward in the articulation of [ŋ] and [ŋg]. The preceding central vowel moves upward in anticipation of the tongue configuration necessary for articulating [ŋ] and surfaces as [ɨ]. It remains central as there is nothing about its environment to move it backward or forward. The rule /ɪ/ RAISING has been formulated to account for these occurrences of [ɨ]:

$$(240) \quad /ɪ/ \text{ RAISING} \quad \begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \quad \text{---} \rightarrow \quad [+high] / \quad \underline{\quad} \quad \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \\ -\text{round} \end{array} \right] \end{array}$$

/ɨ/ RAISING states that /ɨ/ surfaces as [ɨ], a high central variant, when preceding a velar nasal or velar nasal obstruent. The following segment is specified [-round] to block it from applying to the labialized velar nasal and the labialized velar nasal obstruent, which will be seen to cause a preceding /ɨ/ to surface as [u] (cf. /ɨ/ REGRESSIVE ROUNDING (251), which eventually will be ordered before /ɨ/ RAISING so that the blocking feature may be dropped as in rules 241 and 242).

233-237b have [ɨ], a variant of /ɨ/ that results when the environments generalized for columns a and c (233-237) are combined. 233-237d have [ɥ], a variant of /ɨ/ that results when the environments generalized for columns c and e (233-237) are combined. When /ɨ/ is preceded by an alveopalatal and followed by a velar nasal (233-237b) it is raised and fronted. It does not, however, move as far forward as [ɨ]. It is located on a continuum between [ɨ] and [ɨ] as it was arrayed in the chart cataloguing the surface manifestations of vowels. When /ɨ/ is preceded by a round segment and followed by a velar nasal (233-234d) it is raised and rounded (rounding assumes backing here). Again, the variant does not move as far back as [u] and has been represented as [ɥ] lying in between [ɨ] and [u]. In each case the following velar nasal retards /ɨ/ from assimilating as completely as when the following environment was neutral (i.e. 233-237a,e). The rule /ɨ/ FRONTING-RAISING has been formulated to account for [ɨ], and the rule /ɨ/ ROUNDING-RAISING to account for [ɥ]:

(241) /ɨ/ FRONTING-RAISING

$$\begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \left[ \begin{array}{l} +\text{high} \\ -\text{back} \\ +\text{central} \end{array} \right] \end{array} / \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{coronal} \\ +\text{high} \end{array} \right] \end{array} \quad \text{---} \quad \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \end{array}$$

(242) /t/ ROUNDING-RAISING

$$\begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} \rightarrow \begin{array}{c} \left[ \begin{array}{l} +\text{high} \\ +\text{round} \\ +\text{central} \end{array} \right] \end{array} / \begin{array}{c} \text{C} \\ [+ \text{round}] \end{array} \text{ \_\_\_ } \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \end{array}$$

All five rules formulated to account for variants of /t/ can be combined into a single rule that eliminates the necessity of ordering /t/ FRONTING-RAISING and /t/ ROUNDING-RAISING before /t/ FRONTING, /t/ RAISING, and /t/ ROUNDING. /t/ FRONT-RAISE-ROUND combines these five rules in a single statement:

(243) /t/ FRONT-RAISE-ROUND

$$\begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} \text{ \textasciitilde\textasciitilde\textasciitilde\textasciitilde } \left\{ \begin{array}{l} \left[ \begin{array}{l} +\text{high} \\ \alpha\text{back} \\ -\text{tense} \\ \langle +\text{central} \rangle \end{array} \right] / \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} \alpha\text{round} \\ \alpha\text{back} \\ +\text{high} \end{array} \right] \end{array} \text{ \_\_\_\_ } \left\langle \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \right\rangle \\ \left[ \begin{array}{l} +\text{high} \\ +\text{central} \\ -\text{tense} \end{array} \right] / \text{ \_\_\_\_ } \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \end{array} \end{array} \right.$$

/t/ FRONT-RAISE-ROUND states first that if /t/ is followed by a velar nasal (PRENASALIZATION (182) is intrinsically ordered before rule 243 and feeds it by transforming /g/ to [ŋg]), it is assigned plus for 'central'. Next, the segment preceding /t/ is inspected to see if its values for 'round' and 'back' agree, and if its value for 'high' is plus. If so, it assigns /t/ the  $\alpha$  value for 'back'. By specifying the preceding consonant [+high], the rule is blocked from applying when segments like /P/, /T/, /d/ etc. precede /t/ even though their values for 'round' and 'back' agree. In those cases the second half of the rule applies and produces [t]. By specifying both 'back' and 'round' with  $\alpha$  variable the rule is blocked from applying when unround velars precede /t/ even though they are [+high]. But by requiring that 'round' and 'back' have the same value in order to block the rule from operating when unround

velars precede /t/, /w/ is blocked, for it also has opposite values for 'round' and 'back'. In this rule it is natural that /w/ and /C<sup>w</sup>/ would act as a class; and if we had a feature common to both aside from 'round', it could be substituted for 'back' and then /w/ would not be blocked. Such feature is 'grave' which once was discarded by phonologists, but recently has been reinstated (Hyman, 1973:329-337). Its value is seen in the fact that it allows bilabials and back consonantals to act as a natural class in the same process. Therefore, rule 230 will be restated using 'grave' instead of 'high':

(244) /t/ FRONT-RAISE-ROUND'

$$\begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} \text{ ----> } \left\{ \begin{array}{l} \left[ \begin{array}{l} +\text{high} \\ \alpha\text{back} \\ -\text{tense} \\ \langle +\text{central} \rangle \end{array} \right] \\ \left[ \begin{array}{l} +\text{high} \\ +\text{central} \\ -\text{tense} \end{array} \right] \end{array} \right. / \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} \alpha\text{round} \\ \alpha\text{grave} \\ +\text{high} \end{array} \right] \end{array} \text{ --- } \left\langle \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \right\rangle > \\ \text{C} \\ \left[ \begin{array}{l} -\text{anterior} \\ +\text{nasal} \end{array} \right] \end{array}$$

Unround velars are still blocked because they have opposite values for 'round' and 'grave', whereas the structural description requires that they be the same. Derivations 245a-e illustrate /t/ FRONT-RAISE-ROUND' operating on strings containing /t/ and producing the variants [t], [t̥], [t̚], [w], and [u]:

| (245)                  | (a)           | (b)           | (c)         |
|------------------------|---------------|---------------|-------------|
| U.F.                   | /t̥t̚'Ponl̥f/ | /P̥t̚'y̥t̥ŋf/ | /'n̥t̥ŋf/   |
| PALATALIZATION (45)    | ʃt̚'Poŋf      | -----         | -----       |
| PRENASALIZATION (182)  | -----         | -----         | 'n̥t̥ŋf     |
| STRIDENCY (211)        | -----         | P̥t̚'ʒ̥t̥ŋf   | -----       |
| /t/ FRONT-RAISE-ROUND' | ʃt̚'Poŋf      | P̥t̚'ʒ̥t̥ŋf   | 'n̥t̥ŋf     |
| S.F.                   | [ʃt̚'Poŋt̚?]  | [p̥ə'ʒ̥t̥ŋə?] | ['n̥t̥ŋgə?] |
|                        | 'snare'       | 'insect'      | 'mine'      |

|                        | (d)         | (e)        |
|------------------------|-------------|------------|
| U.F.                   | /Tf'wɪŋf/   | /'lwf/     |
| /t/ FRONT-RAISE-ROUND' | Tf'wŋŋf     | 'lŋŋ       |
| S.F.                   | [řu?'wŋŋə?] | ['lŋŋ?]    |
|                        | 'second'    | 'a lizard' |

As indicated earlier, the second group of variants of /t/ we shall consider is [u, o, ʌ, ə]. 246-250 illustrate the range of environments in which each variant occurs:

|       | (a)                                     | (b)   | (c)   | (d)   |
|-------|---|---|---|---|
| (246) | ['š <u>u</u> g <u>wu</u> ?]<br>'foot'   | [š <u>o</u> 'k <u>wu</u> ?]<br>'a tree'                                       | ['m <u>ʌ</u> g <u>ʌ</u> ?]<br>'fight'               | ['p <u>ə</u> n <u>ə</u> ?]<br>'a tree'                                      |
| (247) | [o?'n <u>u</u> 'wa?]<br>'aromatic'      | [ř <u>o</u> 'g <u>wa</u> ?]<br>'banana'                                       | ['w <u>ə</u> g <u>ʌ</u> ?]<br>'flood'               | ['m <u>ə</u> n <u>ə</u> ]<br>'to'   |
| (248) | ['n <u>u</u> ŋ <u>g</u> wu?]<br>'shell' | [ř <u>o</u> 'g <u>wa</u> ř <u>o</u> ?]<br>'bandicoot'                         | ['k' <u>h</u> <u>ʌ</u> ?ŋnə]<br>'be on'             | [nu'y <u>ə</u> k' <u>h</u> <u>ʌ</u> ?m <u>o</u> ř <u>ə</u> ]<br>'to thread' |
| (249) | ['š <u>u</u> wu?]<br>'custom'           | [ř <u>o</u> 'g <u>wa</u> ?m <u>t</u> ŋ <u>ə</u> ?]<br>'edible fern'           | ['ř' <u>ʌ</u> g <u>ʌ</u> ?]<br>'different'          | ['š <u>ə</u> g <u>ʌ</u> ?]<br>'bamboo'                                      |
| (250) | ['š <u>u</u> g <u>wu</u> ?]<br>'eye'    | [ř <u>ə</u> ř <u>o</u> 'g <u>wa</u> ř <u>ə</u> m <u>ə</u> ]<br>'make barrier' | [' <u>e</u> g <u>ʌ</u> n <u>ə</u> ]<br>'it's there' | [n' <u>d</u> ə?]<br>'brush pile'  |

In 246-250a [Cw] is always preceded by [u]. The sequences \*[əCw] and \*[əw] never occur in Angave.<sup>20</sup> Even in verb formatives where they are expected, [uCw] and [uw] always occur. For example, [ř'řəřuŋlyt] 'they say (3dl)' is transformed to [ř'řəřuŋwlyt] 'we say (1dl)', and it is the added /-w/ '1pl, 1dl' that causes the regressive assimilation of the central vowel preceding [ŋ]. Therefore, when [u] occurs before round segments it is considered a variant of /t/ that anticipates their rounding and height. Recall that /t/ ROUNDING (239) describes round segments causing the /t/ that follows to be raised, rounded, and lax. In contrast, /t/ REGRESSIVE ROUNDING accounts for those occurrences of [u] that are the result of regressive assimilation to a following round segment:

$$(251) \quad /t/ \text{ REGRESSIVE ROUNDING} \quad \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \quad \text{--->} \quad \left[ \begin{array}{c} +\text{high} \\ +\text{round} \\ +\text{tense} \end{array} \right] / \text{---} \text{ } \begin{array}{c} \text{C} \\ [+round] \end{array}$$

/t/ REGRESSIVE ROUNDING states that /t/ is manifested as [u], a tense high back round variant, when preceding the high back semivowel /w/ or a labialized segment /C<sup>w</sup>/.

In 246-250c the mid central vowel surfaces as [ʌ], a mid central lax variant, when contiguous to the postvelar segment /K/. The central vowel moves downward in anticipation of the lowering of the front of the tongue and its retraction to articulate the following segment at the uvular region. The rule /t/ LOWERING has been formulated to account for these occurrences of [ʌ]:

$$(252) \quad /t/ \text{ LOWERING} \quad \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \quad \text{----->} \quad \left[ \begin{array}{c} -\text{high} \\ -\text{round} \\ -\text{tense} \end{array} \right] / \text{---} \text{ } \begin{array}{c} \text{C} \\ \left[ \begin{array}{c} -\text{anterior} \\ -\text{high} \\ -\text{round} \end{array} \right] \end{array}$$

/t/ LOWERING is a mirror image rule<sup>21</sup> stating that the non-low central vowel is realized as [ʌ], a lax mid central variant, when contiguous to the postvelar segment /K/.

In 246-250b /t/ is realized as [o] in an environment which combines the environments described in /t/ REGRESSIVE ROUNDING (251) and /t/ LOWERING (252). There is again regressive assimilation to the labialization of the following segment for the surface form is round. This time, however, the variant is not as high as [u]. The postvelar segment, as described in /t/ LOWERING, would cause the vowel to move downward. There is a tension between the regressive assimilation to labialization (which would raise and round /t/) and the lowering before a postvelar. The resulting [o] is a compromise between these two forces. /t/ has assimilated to the rounding of the following segment, but is neither raised nor lowered, for the forces pushing raising and lowering have negated each other. This analysis is similar to one proposed by Chen

(1974:50) who describes environmental conditioning as analogous to vectors which pulled Lower Mandarin vowels in several directions. He proposes that combinations of environments may reinforce or cancel each other similar to the situation here. The rule /t/ REGRESSIVE MID ROUNDING has been formulated to account for these occurrences of [o]:

$$(253) \quad \begin{array}{c} \text{V} \\ \text{/t/ REGRESSIVE MID} \\ \text{ROUNDING} \end{array} \begin{bmatrix} -\text{low} \\ -\text{round} \\ +\text{back} \end{bmatrix} \text{ ---> } \begin{bmatrix} -\text{high} \\ +\text{round} \\ +\text{tense} \end{bmatrix} / \text{ --- } \begin{array}{c} \text{C} \\ \begin{bmatrix} -\text{anterior} \\ -\text{high} \\ +\text{round} \end{bmatrix} \end{array}$$

/t/ REGRESSIVE MID ROUNDING states that /t/ surfaces as [o], a mid back round variant, when preceding the round postvelar segment /kʷ/.

248-249d present another situation similar to the tension between processes described by /t/ REGRESSIVE MID ROUNDING. Here again, the surface form of /t/ is a compromise between processes in tension. As already described (238), alveopalatals preceding /t/ move it upward and forward; a following non-round postvelar pulls it downward (252). In this case the forces completely cancel each other and [ə] surfaces. The rule /t/ FRONT CANCEL LOWER has been formulated to account for these occurrences of [ə]:

(254) /t/ FRONT CANCEL LOWER

$$\begin{array}{c} \text{V} \\ \begin{bmatrix} -\text{low} \\ -\text{round} \\ +\text{back} \end{bmatrix} \end{array} \text{ ----> } \begin{array}{c} \begin{bmatrix} -\text{high} \\ +\text{tense} \end{bmatrix} / \begin{array}{c} \text{C} \\ \begin{bmatrix} -\text{anterior} \\ +\text{coronal} \\ +\text{high} \end{bmatrix} \end{array} \text{ --- } \begin{array}{c} \text{C} \\ \begin{bmatrix} -\text{anterior} \\ -\text{high} \\ -\text{round} \end{bmatrix} \end{array}$$

/t/ FRONT CANCEL LOWER states that /t/ surfaces as [ə], a tense mid central variant, when preceded by alveopalatals and followed by the unround postvelar /k/. It is not necessary to formally state rule 254 since it describes /t/ surfacing as [ə] in just one of the environments of the elsewhere case. It has been included for two reasons. First, it shows the compromise between two competing processes which helps us better understand each of those processes.

And second, it adds credence to rule 253, which accounts for [o] preceding /Kʷ/ as a variant of /t/ because they describe similar combinations of processes in tension.

Except for one other environment ([\_?V?] to be developed later on), 246-250d show that elsewhere /t/ is realized by [ə]. Now, that /t/ REGRESSIVE ROUNDING (251), /t/ LOWERING (252), /t/ REGRESSIVE MID ROUNDING (253), and /t/ FRONT CANCEL LOWER (254) are related is evident due to overlapping in their structural descriptions. If /t/ LOWERING was not a mirror image rule it could be combined with /t/ REGRESSIVE ROUNDING and /t/ REGRESSIVE MID ROUNDING. We must settle for a combination of the second two rules:

$$(255) \quad \begin{array}{l} \text{/t/ REGRESSIVE ROUNDING-} \\ \text{LOWERING} \end{array} \quad \begin{array}{c} \text{V} \\ \left[ \begin{array}{l} -\text{low} \\ -\text{round} \\ +\text{back} \end{array} \right] \end{array} \quad \text{--->} \quad \begin{array}{c} \left[ \begin{array}{l} \alpha\text{high} \\ +\text{round} \\ +\text{tense} \end{array} \right] / \text{---} \quad \begin{array}{c} \text{C} \\ \left[ \begin{array}{l} \alpha\text{high} \\ +\text{round} \end{array} \right] \end{array}$$

The combined rule states that /t/ surfaces with the same value for 'high' as the following round segment. If the following round segment is [-high] (i.e. /Kʷ/), then /t/ surfaces as [ə], a non-high round back variant. If the following round segment is [+high] (i.e. /ŋʷ/, /w/, etc.), /t/ surfaces as [u], a high back round variant. Derivations 256a-d illustrate the operation of /t/ REGRESSIVE ROUNDING-LOWERING along with /t/ FRONT CANCEL LOWER (254) and /t/ LOWERING (252) in the disjunctive ordering 254, 252, 255.<sup>22</sup>

|                                     |            |           |
|-------------------------------------|------------|-----------|
| (256)                               | (a)        | (b)       |
| U.F.                                | /'nɪgʷɪ/   | /Tɪ'Kʷá/  |
| /t/ REGRESSIVE<br>ROUNDING-LOWERING | 'nugʷɪ     | To'Kʷá    |
| S.F.                                | ['nuŋgʷu?] | [ʔo'ɕʷa?] |
|                                     | 'shell'    | 'banana'  |



|              |          |                           |          |
|--------------|----------|---------------------------|----------|
|              | (c)      |                           | (d)      |
| U.F.         | /'m+Kf/  | U.F.                      | /'Tl+Kf/ |
| /+/ LOWERING | 'mAKA    | PALATALIZATION            | 'S+Kf    |
| S.F.         | ['mAgA?] | /+/ FRONT<br>CANCEL LOWER | 'Sakf    |
|              | 'fight'  | S.F.                      | ['SagA?] |
|              |          |                           | 'bamboo' |

If /+/ FRONT CANCEL LOWER (254), /+/ LOWERING (252), and /+/ REGRESSIVE ROUNDING-LOWERING (255) are disjunctively ordered before /+/ FRONT-RAISE-ROUND' (244), then no further blocking features are required in their structural descriptions. This order bleeds away strings containing /+/ that potentially meet the structural description of a later rule whose operation would produce an incorrect surface representation. For example, without the ordering as stated, /'n+gwf/ 'shell' (256a) could meet the structural description of 244, which would incorrectly produce \*['n+gwu?]. By ordering 255 before 244, ['nugwu?] is correctly produced and 244 is blocked from applying. If the rules were to remain unordered they would require blocking features that would add considerable complexity and gain little, for (the stated) disjunctive ordering does not promote abstractness any more than blocking features would.

There is one more group of variants manifested by /+/, but since the structural description of the rule that produces them is unlike the other rules that operate on /+/, it need not be ordered in relation to them. This third and final group of variants of /+ to be discussed is [i, e, a, ɔ, o]. 257 and 258 illustrate the environments in which these variants occur:

|       |          |            |          |                 |            |
|-------|----------|------------|----------|-----------------|------------|
|       | (a)      | (b)        | (c)      | (d)             | (e)        |
| (257) | ['p ? ?] | ['pɛ?cwl?] | ['řa?a?] | ['wyɔ?ɔ]        | ['afo?o?]  |
|       | 'eaves'  | 'a bird'   | 'fire'   | 'man's<br>name' | 'cockatoo' |

(258) ['š<sub>1</sub>?1?]    ['e?e?]    ['wa?a?]    ['ik<sub>0</sub>?o]    ['š<sub>0</sub>?o?]  
           'trash'    'arrow'    'light'    'the lumber'    'knife'

Each form in 257-258 contains the sequence [V<sub>1</sub>?V<sub>2</sub>?] where [V<sub>1</sub>] = [V<sub>2</sub>]. There is alternation in verb formatives which indicates that [V<sub>1</sub>] is a surface manifestation of /t/. For example, /Tó1t/ ['fo?wlyt] 'you cut (2dl)' is constructed from the verb stem /To-/ and the suffix /-t/ (the acute accent is glottal closure). The [w] in the surface form is inserted because the stem vowel of the verb is round (cf. SEMIVOWEL EPENTHESIS' (329)). For verb stems like /Tt-/ 'talk', the stem vowel surfaces as [i] when this dual formative is suffixed: /Tt1t/ ['f1?lyt] 'you talk (2dl)'. On the basis of such alternation I have formulated the rule VOWEL COPY:

(259) VOWEL COPY

|   |        |   |               |  |
|---|--------|---|---------------|--|
| $\begin{array}{c} \text{V} \\ \text{-low} \\ \text{-round} \\ \text{+back} \end{array}$ | -----> | $\begin{array}{c} \alpha\text{high} \\ \beta\text{low} \\ \gamma\text{back} \\ \delta\text{round} \\ \text{+tense} \end{array}$ | /    ___    ? | $\begin{array}{c} \text{V} \\ \alpha\text{high} \\ \beta\text{low} \\ \gamma\text{back} \\ \delta\text{round} \end{array}$ |
|---|--------|---|---------------|--|

VOWEL COPY states that /t/ surfaces as a copy of the following vowel when they are only separated by glottal stop. Though motivated by alternation in verbals, its application is extended to nominals even though nominals don't manifest such alternation.

In my first attempts to teach new literates nouns that end with the phonetic sequence [a?a?], which then I was symbolizing orthographically as \*áá, they read them as [a?a?] or [a?wə?]. (At the time I was symbolizing [w̄] as wh, though in the present stage of the orthography it is left unwritten (cf. [w̄] EPENTHESIS' (342)) so that [a?wə?] is symbolized as áf.) It occurred to me that by extending VOWEL COPY to nominals, [a?a?] could be written as áá. When I began writing [a?a?] as áá, I found that new literates read it correctly and did not tend to insert the epenthetic non-round back semivowel [w̄] in between the vowels. This indicates to me that the Angave perceive the first vowel in the phonetic sequence [a?a?]

as weaker than the second, otherwise they want to insert a semivowel to break up a sequence of strong vowels (see sec. 4.3.4). We know that the mid central vowel is phonologically the weakest vocalic segment in Angave because it is the surface manifestation of other underlying vocalic segments which have undergone VOWEL REDUCTION (350), and because it functions in both vowel deletion (cf. 352 and 363) and vowel insertion (cf. 225 and 227) rules. Since /ɨ/ is phonologically weak, new literates do not try to insert a semivowel to break up fá. Instead, they apply VOWEL COPY and the first vowel surfaces as [a], a copy of the second vowel, with no tendency to insert an epenthetic semivowel. We have already seen that the mid central vowel is very flexible and that its surface manifestation is influenced frequently by contiguous segments, so it is not surprising that [aʔaʔ] is perceived as /fá/. Therefore, on the basis of alternation in the verbals noted earlier, and on the basis of reader reaction, I consider the extension of VOWEL COPY to nominals to be well-motivated. Derivations 260a-e illustrate the application of VOWEL COPY producing the appropriate variants from strings containing /fá/.

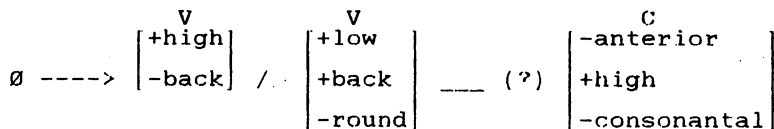
|                           |              |                      |          |
|---------------------------|--------------|----------------------|----------|
| (260)                     | (a)          | (b)                  | (c)      |
| U.F.                      | /'aTfó/      | /'Pff/               | /'wfá/   |
| VOWEL COPY                | 'aTóó        | 'Pff                 | 'wáá     |
| S.F.                      | ['aʔoʔoʔ]    | ['pɪʔɪʔ]             | ['waʔaʔ] |
|                           | 'cockatoo'   | 'eaves'              | 'light'  |
|                           | (d)          |                      | (e)      |
| U.F.                      | /'wífá+o/    | U.F.                 | /'tɛ/    |
| MONOPHTHONGIZATION' (306) | 'wífɔ        | VOWEL COPY           | 'éé      |
| VOWEL COPY                | 'wíɔɔ        | [e]~[ɛ]<br>(230-232) | 'éé      |
| S.F.                      | ['wɪɔʔɔ]     | S.F.                 | ['eʔɛʔ]  |
|                           | 'man's name' |                      | 'arrow'  |

Having formulated rules which capture the processes relating /t/ to its surface forms, let us now turn our attention to the other central vowel, /a/. This low central vowel can be viewed as surfacing in four variants, [a], [a<sup>l</sup>], [a<sup>u</sup>], and [æ]. 261-264 have a different variant in each column:

|       | (a)                                       | (b)  | (c)   | (d)               |
|-------|---|--|---|-------------------|
| (261) | [ <u>a</u> <sup>?</sup> ma <sup>?</sup> ] | [ <u>wa</u> <sup>l</sup> ?yt <sup>?</sup> ]        | [ <u>a</u> <sup>u</sup> ? <u>wa</u> ŋə <sup>?</sup> ] | [ <u>wy</u> æɾnə] |
|       | 'man'                                     | 'fear'   | 'report'  | 'procure (vine)'  |
| (262) | [ <u>pya</u> <sup>?</sup> ]               | [pa <sup>l</sup> pa <sup>l</sup> yt <sup>?</sup> ] | [ <u>a</u> <sup>u</sup> <u>g</u> wæŋə <sup>?</sup> ]  | [ <u>ky</u> æɾnə] |
|       | 'a bamboo'                                | 'a tree'   | 'barbed arrow'  | 'he is chewing'   |
| (263) | [a <sup>l</sup> .lʂ <sup>l</sup> ?]       | [a <sup>u</sup> wa <sup>l</sup> .ʂlnə]             | [ <u>ma</u> ŋg <sup>u</sup> wu <sup>?</sup> ]         | [ <u>my</u> æɾnə] |
|       | 'grandmother'                             | 'easy'   | 'full'  | 'he is digging'   |
| (264) | [ <u>a</u> <sup>?</sup> wə <sup>?</sup> ] | [ <u>a</u> <sup>l</sup> ya <sup>?</sup> ]          | [ <u>wa</u> <sup>u</sup> ?wu <sup>?</sup> ]           | [yabə'n+ŋowu]     |
|       | 'taro'                                    | 'liver'  | 'hornet'  | 'he will come'    |

261-264a are examples of environments in which the surface representation of /a/ matches its underlying representation. In columns b and c, however, /a/ is manifested by the variants [a<sup>l</sup>] and [a<sup>u</sup>]. The [l] glide is conditioned by the following front semivowel /y/. The [u] glide occurs when /a/ is followed by a round segment. That labialized consonants condition /a/ so that it surfaces as [a<sup>u</sup>] is seen in idiolect variants such as [l'kwyəŋə<sup>?</sup>] 'mat' and [l'kwya<sup>u</sup>ŋwu<sup>?</sup>] 'mat'. In these two variants the one containing [a<sup>u</sup>] is also the one containing a following [ŋw]. Either glide may be separated from its conditioning environment by glottal stop (261b,c). FRONT GLIDE INSERTION and BACK GLIDE INSERTION have been formulated to account for these occurrences of [a<sup>l</sup>] and [a<sup>u</sup>]:

(265) FRONT GLIDE INSERTION



## (266) BACK GLIDE INSERTION

$$\emptyset \text{ ----} \rightarrow \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} +\text{high} \\ +\text{back} \end{array} \right] / \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} +\text{low} \\ +\text{back} \\ -\text{round} \end{array} \right] \end{array} \text{ --- } (?) \left[ \begin{array}{c} \text{C} \\ +\text{round} \end{array} \right]^{24}$$

These two rules inserting glides cannot be collapsed into a single rule linking the inserted vowel's value for 'back' to the following segment's value for 'round' by a variable. The semivowels /y/ and /w/ could be combined in the structural description of a single rule of /w/ and /Cw/ as in 266, but the three conditioning environments cannot be stated in one rule. Derivations 267a-d illustrate FRONT and BACK GLIDE INSERTION operating on strings containing /a/ and producing [a<sup>i</sup>] and [a<sup>u</sup>].

| (267)                    | (a)                      | (b)                     | (c)                      | (d)                      |
|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|
| U.F.                     | /Pá'Payf/                | /'wáyf/                 | /á'wanf/                 | /'magwf/                 |
| FRONT GLIDE<br>INSERTION | Pá'Pa <sup>i</sup> yf    | 'wa <sup>i</sup> yf     | -----                    | -----                    |
| BACK GLIDE<br>INSERTION  | -----                    | -----                   | a <sup>u</sup> 'wanf     | 'ma <sup>u</sup> gwf     |
| S.F.                     | [pa'pa <sup>i</sup> ylʔ] | ['wa <sup>i</sup> ʔylʔ] | [a <sup>u</sup> ʔ'wanəʔ] | ['ma <sup>u</sup> ŋgwuʔ] |
|                          | 'a tree'                 | 'fear'                  | 'report'                 | 'full'                   |

Another of /a/'s variants is illustrated by 261-263d where [æ] surfaces. Each of these is a verb and it is only in verbals that /a/ has the variant [æ]. Nominals like /'yanf/ ['yanəʔ] 'gift' and /'yaPf/ ['yabəʔ] 'lie', where /a/ surfaces as [a] following /y/, are common. Moreover, the [æ] variant of /a/ is restricted to a particular subset of verb formatives as 264d indicates. When the suffix /-aTf-/ 'continuous action' is suffixed directly to an /l/-stem verb it surfaces as [æʔə] (cf. 22-25). The rule /a/ FRONTING, a morphological rule, has been formulated to account for this change:



|       |  |       |           |   |     |          |   |
|-------|--|-------|-----------|---|-----|----------|---|
| (270) | $\begin{array}{ c } \hline \text{V} \\ \hline \begin{array}{c} +\text{low} \\ +\text{back} \\ -\text{round} \end{array} \\ \hline \end{array}$ | ----> | [-back] / | $\begin{array}{ c } \hline \text{V} \\ \hline \begin{array}{c} -\text{low} \\ -\text{back} \end{array} \\ \hline \end{array}$ | ] + | _____ T† | $\begin{array}{c} \text{vb} \\ \text{stem} \end{array}$ |
|-------|--|-------|-----------|---|-----|----------|---|

For Wiokwa and Angai derivations 269a-c are identical. Wiokwa, on the other hand, has some /e/-stem verbs (the initial consonant of the verb stem must be a bilabial) which undergo /a/ FRONTING' and yield the following surface forms:

|               |                    |               |
|---------------|--------------------|---------------|
|               | (a)                | (b)           |
| U.F.          | /meaT†n†/          | /PeaT†n†/     |
| /a/ FRONTING' | meæT†n†            | PeæT†n†       |
| /e/-->[y]     | myæT†n†            | PyæT†n†       |
| S.F.          | ['myæɾnə]          | ['pyæɾnə]     |
|               | 'he is caring for' | 'he is dying' |

How Angai derives all /e/-stem verbs including 271a,b will be described by MONOPHTHONGIZATION (295). For now, note that 269c and 271a are homophonous in Wiokwa lect.

#### 4.3.3 Back Vowels

The back vowels /u/ and /o/ exhibit no variants as 272-275 indicate:

|       |  |  |
|-------|--|--|
|       | (a)                                      | (b)                                    |
| (272) | /m <u>u</u> /      ['m <u>u</u> ʔ]       | /o'Ká/      [o'ʔaʔ]                    |
|       | 'sauce'                                  | 'a bamboo'                             |
| (273) | /'y <u>u</u> n†/      ['y <u>u</u> nəʔ]  | /á'P <u>o</u> /      [a'p <u>o</u> ]   |
|       | 'kindling'                               | 'father'                               |
| (274) | /'T <u>l</u> uy†/      ['š <u>u</u> ʒtʔ] | /'K <u>f</u> o/      ['k <u>h</u> oʔo] |
|       | 'a tree'                                 | 'he'                                   |
| (275) | /' <u>u</u> T†/      [' <u>u</u> ʔəʔ]    | /ó'naw†/      [oʔ'naww†ʔ]              |
|       | 'rotten'                                 | 'cockroach'                            |

We have completed the discussion of processes which affect individual underlying vowels. There are other processes which affect sequences of vowels, and it is these processes which we will examine next.

#### 4.3.4 Sequences of Vowels

In the array of underlying vowels (218) the sequences /ea/ and /oa/ were included parenthetically where [æ] and [ɔ] are located in the array of surface manifestations of vowels (220). Morphological alternation in verb formatives motivates setting up the underlying sequences /ea/ and /oa/ for [æ] and [ɔ]:

|                  | (a)          | (b)      | (c)          | (d)        |
|------------------|--------------|----------|--------------|------------|
| (276) [na'mōra]  | /nt+mō+Tt/   | ['mōra]  | /mō+āTtnt/   | 'throw'    |
| (277) [na'kōra]  | /nt+kō+Tt/   | ['kōra]  | /kō+āTtnt/   | 'cut'      |
| (278) [na'yōra]  | /nt+yō+Tt/   | ['yōra]  | /yō+āTtnt/   | 'sprinkle' |
| (279) [na'mēra]  | /nt+mē+Tt/   | ['mēra]  | /mē+āTtnt/   | 'care for' |
| (280) [na'bēra]  | /nt+pē+Tt/   | ['pēra]  | /pē+āTtnt/   | 'die'      |
| (281) [na'gēra]  | /nt+kē+Tt/   | ['kēra]  | /kē+āTtnt/   | 'catch'    |
| (282) ['nambāra] | /nt+bt+Tt/   | [m'bāra] | /bt+āTtnt/   | 'come'     |
| (283) ['nārāra]  | /nt+rā+Tt/   | ['rāra]  | /rā+āTtnt/   | 'say'      |
| (284) ['nāda]    | /nt+nā+Tt/   | ['nāra]  | /nā+āTtnt/   | 'eat'      |
| (285) [na'māra]  | /nt+mā+Tt/   | ['māra]  | /mā+āTtnt/   | 'get'      |
| (286) [na'yāra]  | /nt+yā+Tt/   | ['yāra]  | /yā+āTtnt/   | 'cook'     |
| (287) [nī'gāra]  | /nt+īgā+Tt/  | ['gāra]  | /īgā+āTtnt/  | 'light'    |
| (288) [na'yōra]  | /nt+yō+Tt/   | ['yōra]  | /yō+āTtnt/   | 'pull up'  |
| (289) [na'kōra]  | /nt+kō+Tt/   | ['kōra]  | /kō+āTtnt/   | 'remove'   |
| (290) [nī'gōra]  | /nt+īgō+Tt/  | ['gōra]  | /īgō+āTtnt/  | 'harvest'  |
| (291) [na'mīra]  | /nt+mī+Tt/   | ['mīra]  | /mī+āTtnt/   | 'dig'      |
| (292) [na'būra]  | /nt+pi+ū+Tt/ | ['pūra]  | /pi+ū+āTtnt/ | 'pass by'  |

Limiting our initial observations to column a of 276-292, we

observe that all the verb stems (underlined) from 276-278 have [o],



whereas 279-281 all have [e]. Let's assume that the underlying representations of these verb stems include /o/ and /e/ respectively. By comparison, the /o/ and /e/ we assumed as stem vowels in 276 through 281 are realized differently in 276-281c. 276-278c have [ɔ] where the infinitive had [o], and 279-281c have [æ] where the infinitive had [e]. [ɔ] and [æ] occur in the verbs with the present continuous formative as a result of a systematic phonological change arising from a certain sequence of segments. The suffix /-aT+n+/ (whose underlying form is verifiable from 291, 292, 282-284) is attached directly to a verb stem (cf. column d). An [ɔ] surfaces when /o/ is followed by /a/ (276-278c), and an [æ] surfaces when /e/ is followed by /a/ (279-281c). 282-284c,d show that /t/ stem verbs have [a] in the formation of the present continuous tense. It results from an underlying /a/ following /t/. 285-290a,c have an [ɔ] and [æ] that do not alternate between the infinitival form (cf. column a) and present continuous form (cf. column c). 291-292a have [i] and [u] which alternate with the corresponding semivowels in 291-292c. The alternation is schematized in 293:

|       | (a)           | (b)          | (c)                   |
|-------|---------------|--------------|-----------------------|
| (293) | /i+a/--->[yæ] | /e+a/--->[æ] | /ea+a/ = (æ+a)--->[æ] |
|       | /u+a/--->[wa] | /o+a/--->[ɔ] | /oa+a/ = (ɔ+a)--->[ɔ] |
|       |               | /t+a/--->[a] |                       |

In 293 only stems with high vowels followed by /a/ (293a) have a sequential surface representation (cf. CLASS CHANGE (26) which accounts for [y] and [w]). Mid stem vowels and following /a/ (293b) surface in a single segment. In each case they coalesce with /a/, maintaining their value for 'back' (horizontal positioning on the vowel chart) and lowering to the height of /a/. Stems with low vowels followed by /a/ (293c) also monophthongize into a single segment. But since they are already low, they cannot be lowered any

further. Instead, the /a/ is simply absorbed. 294 summarizes the lowering of vowels when they coalesce with /a/:

|       |                        |     |             |
|-------|------------------------|-----|-------------|
| (294) | Vowel Coalescence: V+a |     |             |
|       | /i/                    |     | /u/         |
|       | -----                  |     |             |
|       | /e/                    | /ɪ/ | /o/         |
|       | ↓                      | ↓   | ↓           |
|       | /ea/<br>[æ]            | /a/ | /oa/<br>[ɔ] |

293b,c describes a process of merger where the resulting surface manifestation preserves the value for 'back' of the first underlying vowel of a vowel sequence and the value for 'low' of the second. MONOPHTHONGIZATION, a transformational rule, has been formulated to capture this process of vowel coalescence that affects mid and low vowels.<sup>26</sup>

|                          |   |   |       |  |   |
|--------------------------|---|---|-------|--|---|
|                          | $\begin{matrix} V \\ \text{-high} \\ \alpha\text{back} \\ \beta\text{round} \end{matrix}$ | $\begin{matrix} V \\ \text{+low} \\ \text{+back} \\ \text{-round} \end{matrix}$ | ----> | $\begin{matrix} V \\ \alpha\text{back} \\ \beta\text{round} \\ \text{+low} \end{matrix}$ | ∅ |
| (295) MONOPHTHONGIZATION | 1   | 2   |       | 1  | 2 |

MONOPHTHONGIZATION states that mid vowels are lowered, maintaining the same values for 'back' and 'round', when they are followed by an /a/ that is elided. It also operates on sequences of already low vocalic segments, vacuously lowering them. In such sequences the rule merely deletes the second segment. Derivations 296a-d illustrate the application of MONOPHTHONGIZATION on verb forms.

|                    |                     |                     |                       |                    |
|--------------------|---------------------|---------------------|-----------------------|--------------------|
| (296)              | (a)                 | (b)                 | (c)                   | (d)                |
| U.F.               | /ToaTɪnɪ/           | /ToaaTɪnɪ/          | /meaTɪnɪ/             | /meaaTɪnɪ/         |
| MONOPHTHONGIZATION | TɔTɪnɪ              | TɔaTɪnɪ             | mæTɪnɪ                | mæaTɪnɪ            |
| MONOPHTHONGIZATION | -----               | TɔTɪnɪ              | -----                 | mæTɪnɪ             |
| S.F.               | ['fɔɹnə]            | ['fɔɹnə]            | ['mæɹnə]              | ['mæɹnə]           |
|                    | 'he is<br>chopping' | 'he is<br>removing' | 'he is<br>caring for' | 'he is<br>getting' |

MONOPHTHONGIZATION applies only once to 296a,c, but twice to 296b,d. In each of the derivations mid vowels coalesce with a following /a/ and are lowered in the first application of the rule. 296b,d then have a low vowel followed by /a/, so the rule operates again and the /a/ is lost, resulting in homophonous forms, i.e. 296a vs. 296b and 296c vs. 296d.

I have extended the sequences /ea/ and /oa/, just illustrated by the formation of the present continuous tense, to all occurrences of [æ] and [ɔ] in non-verbals.<sup>27</sup> (see Appendix B for contrasts between vowels and the portmanteaus /ea/ and /oa/). The principle of 'free ride' as articulated by Schane (1974:298) is invoked here in order to prevent a swelling in the inventory of underlying segments. In other words, I take advantage of the process of MONOPHTHONGIZATION which has been motivated by alternation in verb forms, and 297-299 illustrate the extension of /ea/ and /oa/ to nominals:

|       | (a)                               |  | (b)                                 |
|-------|-----------------------------------|--|-------------------------------------|
| (297) | /' <u>me</u> ɪŋf/ [ 'mæɪŋəʔ ]     |  | /' <u>Ko</u> aKf/ [ 'kʰɔɪŋʌʔ ]      |
|       | 'cooing'                          |  | 'a tree'                            |
| (298) | /' <u>Te</u> ɪŋwʰf/ [ 'tʰæɪŋwʰʔ ] |  | /wau' <u>mo</u> amf/ [ wau' mɔmʌʔ ] |
|       | 'saliva'                          |  | 'a bee'                             |
| (299) | / <u>ea</u> 'wá/ [ æ'waʔ ]        |  | /' <u>Tl</u> oaKf/ [ 'ʃaɪŋʌʔ ]      |
|       | 'a sugar cane'                    |  | 'a bird'                            |

MONOPHTHONGIZATION was stated so that it would be blocked from operating within forms where a vowel sequence is interrupted by glottal closure. Derivation 300a shows why this restriction is necessary. It shows that MONOPHTHONGIZATION unblocked would produce an incorrect surface representation (the reason for making this explicit will become apparent later). 300b, on the other hand, shows it blocked and yielding the correct surface representation:

|                    |         |          |
|--------------------|---------|----------|
| (300)              | (a)     | (b)      |
| U.F.               | /'fKfá/ | /'fKfá/  |
| MONOPHTHONGIZATION | 'fKá    | -----    |
| VOWEL COPY         | -----   | 'fKáá    |
| S.F.               | *[fkaʔ] | [fkaʔaʔ] |
|                    | 'tree'  | 'tree'   |

Alternation in other forms indicates that [æ] and [ɔ] are also the surface manifestations of the sequences /a+/e/ and /a+/o/. Each has been observed in just the kinds of contexts illustrated by 301-305:

|       |  |               |  |
|-------|--|---------------|--|
|       | (a)                                      | (b)           | (c)                                      |
| (301) | /' <u>da</u> +e/                         | [n'dæ]        | /' <u>dam</u> t/ and /e/                 |
|       | 'aside'                                  |               | 'over' 'there'                           |
| (302) | /'we'ɥ <u>wa</u> +ene/                   | [weɥ'wæne]    | /'we'ɥ <u>wát</u> t+n/ and /'nene/       |
|       | 'we who slept'                           |               | 'we would sleep' 'we(fem)'               |
| (303) | /' <u>ám</u> t'ná+o <u>K</u> t/          | [aʔmə'nɔʔΛ]   | /' <u>ám</u> t'ná/ and /'dlo <u>K</u> t/ |
|       | 'you (are) old'                          |               | 'old' 'you(masc)'                        |
| (304) | /'Tl <u>f</u> ɥá+o/                      | ['ʃtʔɥɔ]      |  |
|       | 'the stone'                              |               |  |
| (305) | /'K <u>w</u> f <u>ná</u> #'o <u>K</u> f/ | ['kwuʔ'nɔʔΛʔ] |  |
|       | 'fence stake'                            |               |  |

In 301-305 the vowels that coalesce do so across a formative or internal word boundary. 302-304 show that the vowel preceding a formative boundary may be terminated by glottal closure. 305 shows that the vowels will coalesce even when separated by an internal word boundary. By reversing the order of the two Vs in MONOPHTHONGIZATION (295), and revising its restriction on intervening glottal closure, 301-305 can be accounted for. The rule MONOPHTHONGIZATION' accounts for these factors:

|                     |           |       |       |       |        |        |      |   |
|---------------------|-----------|-------|-------|-------|--------|--------|------|---|
| (306)               | V         | V     | V     |       |        |        |      |   |
| MONOPHTHONGIZATION' | +low      | +back | -high | αback | βround | βround | +low | ∅ |
|                     | { (?) + } |       |       |       | ---    |        |      |   |
|                     | { # }     |       |       |       |        |        |      |   |
|                     | 1         | 2     | 3     |       | 1      | 2      | 3    |   |

MONOPHTHONGIZATION' states that when /a/ is followed by a non-high vowel the two will coalesce if there is a formative or internal word boundary between them. If the boundary is a formative boundary, then it may be preceeded by a glottal stop (any glottal stops preceding an internal word boundary will be removed by GLOTTAL DELETION (392)). If a glottal stop interrupts the vowels, then a boundary is obligatory, which indicates that glottal stop functions just like a boundary in this rule. If the boundary conditions are met, the vowels coalesce the same way as described by 295. Derivations 307a-c illustrate:

| (307)               | (a)         | (b)           | (c)            |
|---------------------|-------------|---------------|----------------|
| U.F.                | /'Tɪfŋá+o/  | /'Kʷfna#'oKf/ | /weŋwá+ene/    |
| GLOTTAL DELETION    | -----       | 'Kʷfna'oKf    | -----          |
| MONOPHTHONGIZATION' | 'Tɪfŋɔ      | 'Kʷf'noKf     | weŋwɔne        |
| S.F.                | ['ʃɪ'ŋɔ]    | ['kʷu?'noqʌ?] | [weŋ'wɔne]     |
|                     | 'the stone' | 'fence stake' | 'we who slept' |

There is another process of vowel coalescence in Angave which is related to the two monophthongization rules already stated. It occurs in a restricted environment in andante and allegretto styles of speech, and indicates the propensity Angave speakers have for coalescing vowels when the right conditions are met. That the monophthongization of vowel sequences is a function of speed is not surprising. These cases are undoubtedly motivated by the same systematic factors motivating synaeresis, cf. 292a, the reduction of complex vowel sequences in syllables to single nuclei. For example, in English the sequence ia (two syllables) goes in rapid styles to

ya in words such as Australia. 308 and 309 illustrate vowels coalescing in rapid speech in Angave:

- |       |                   |                           |                  |
|-------|-------------------|---------------------------|------------------|
|       | (a)               | (b)                       | (c)              |
| (308) | /Te#uT+ŋ+nI+g+nI/ | ['ře 'uř+ŋǎñ+ŋgǎnə]       | ['řoř+ŋǎñ+ŋgǎnə] |
|       | 'he said this'    |                           |                  |
| (309) | /ře#uI+#To/       | ['eʔ <u>ř</u> ? 'uyɫ 'řo] | ['eʔ'ø'řo]       |
|       | 'move, you!'      | (largo)                   | (andante)        |

308 and 309 show that an underlying /e/ and /u/, which may be kept distinct by speaking slowly (308-309b), are coalesced in casual speech styles (308-309c). The surfacing [o] maintains /e/'s height and /u/'s backness and roundness. MONOPHTHONGIZATION" describes /e/ and /u/ coalescing and resulting in [o]:

- |                     |   |   |   |     |  |     |         |
|---------------------|---|---|---|-----|--|-----|---------|
| (310)               |   |   |   |     |  |     |         |
| MONOPHTHONGIZATION" | $\begin{bmatrix} \text{V} \\ -\text{high} \\ -\text{back} \\ -\text{low} \end{bmatrix}$ | # | $\begin{bmatrix} \text{V} \\ +\text{high} \\ +\text{back} \\ +\text{round} \end{bmatrix}$ | --> | $\begin{bmatrix} \text{V} \\ -\text{high} \\ +\text{round} \\ -\text{low} \end{bmatrix}$ | ∅ ] | andante |
|                     | 1   | 2 | 3   |     | 1  | 2   | 3       |

Derivation 311 illustrates MONOPHTHONGIZATION" producing [o] in casual speech:

- |       |                     |                   |            |
|-------|---------------------|-------------------|------------|
| (311) | U.F.                | /Te#uT+ŋ+nI+g+nI/ | (+andante) |
|       | MONOPHTHONGIZATION" | ToT+ŋ+nI+g+nI     |            |
|       | S.F.                | ['řoř+ŋǎñ+ŋgǎnə]  |            |
|       |                     | 'he said this'    |            |

Just as MONOPHTHONGIZATION (295) was found to have a complementary rule which reversed its sequence of vowels, so MONOPHTHONGIZATION" (310) has a complementary rule in which the vowel sequence is reversed. It allows us to give a phonological explanation for alternation in verb paradigms that otherwise would appear to contain cases of suppletion. I first formulate the rule and then explain how it operates:

$$\begin{array}{ccccccc}
 (312) & & & & & & \\
 \text{MONOPHTHONGIZATION''} & & & & & & \\
 & & \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} +\text{high} \\ +\text{back} \\ +\text{round} \end{array} \right] \\ 1 \end{array} & + & \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} -\text{high} \\ -\text{back} \\ -\text{low} \end{array} \right] \\ 2 \quad 3 \end{array} & \text{-->} & \begin{array}{c} \text{V} \\ \left[ \begin{array}{c} -\text{high} \\ +\text{round} \\ -\text{low} \end{array} \right] \\ 1 \quad 2 \quad 3 \end{array} & \emptyset
 \end{array}$$

MONOPHTHONGIZATION'' states that the sequence of vowels /u+e/ coalesces into [o] across a formative boundary. Derivation 313 illustrates its application:

|                             |                 |                                |
|-----------------------------|-----------------|--------------------------------|
| (313) U.F.                  | /P†+u+e+†/      | (pass + go + down<br>+ impv s) |
| SEMIVOWEL EPENTHESIS' (329) | P†uey†          |                                |
| /†/ DELETION (352)          | Puey†           |                                |
| MONOPHTHONGIZATION''        | Poy†            |                                |
| S.F.                        | ['poy†]         |                                |
|                             | 'descend past!' |                                |

Exactly why 312 should apply to some members of a verb paradigm (i.e. 313), but not others (i.e. /P†uent††o†/ [pwe'nt†owu] 'he will descend past', but /P†uém†an†/ [po?'ma?ana] 'I will descend past') is not clear. It does, however, provide a plausible phonological account of these surface variants. Furthermore, it explains why ['poy†] (313) has an inserted [y] rather than [w] following the final stem vowel of this compound verb form. If SEMIVOWEL EPENTHESIS' (329) operates before MONOPHTHONGIZATION'', then a [y] is inserted because the preceding stem vowel is [-round]. If the rules were applied in the reverse order and /u+e/--->[o] before the semivowel was inserted, then SEMIVOWEL EPENTHESIS' would insert the round semivowel [w] because the preceding vowel would be [+round].

So far in our discussion of phonological processes related to vowel sequences we have seen how underlying sequences of vowels coalesce and surface as a single segment, retaining some features common to each of the underlying vowels. There is another process that operates on Angave verbals breaking up sequences of vowels

rather than fusing them together. We will turn our attention to an examination of this process after taking an inventory of Angave's underlying vowel sequences in order to see the overall pattern that emerges. Consider the vowel sequences arrayed in 314:

|       |          |      |      |       |      |       |       |       |
|-------|----------|------|------|-------|------|-------|-------|-------|
| (314) | /ʔi/     | /ʃi/ | /éi/ | /ʔi/  | /óí/ | /eǰi/ | /aí/  | /oǰi/ |
|       | /le/     |      |      | /fe/  |      |       | /ae/  |       |
|       | /leai/   |      |      |       |      |       |       |       |
|       | /lea(a)/ |      |      | /tea/ |      |       |       |       |
|       | /ʔt/     | /ʃt/ | /ét/ | /ʔt/  | /ót/ | /eát/ | /át/  | /oát/ |
|       | /ʔa/     | /ʃa/ | /éa/ | /ʔa/  | /óa/ | /eǰa/ | /ǰa/  | /oǰa/ |
|       | /tu/     |      |      | /tu/  |      |       | /au/  |       |
|       | /ʔo/     | /úo/ | /éó/ | /ʔo/  | /óo/ | /eáo/ | /áo/  | /oáo/ |
|       | /loa(a)/ |      |      |       |      |       |       |       |
|       | /lai/    |      |      |       |      |       | /áai/ |       |
|       | /lau/    |      |      |       |      |       | /áau/ |       |
|       |          |      |      |       |      |       | /áae/ |       |

314 catalogues all Angave vowel sequences<sup>28</sup> up to three vowels including those that are interrupted by glottal closure. If both /V<sub>1</sub>V<sub>2</sub>/ and /ʔ<sub>1</sub>V<sub>2</sub>/ occur (i.e. the only difference is intervening glottal closure), then /V<sub>1</sub>V<sub>2</sub>/ has been entered in the array to show that both occur. When glottal closure interrupts a sequence of vowels, those vowels are heterosyllabic in both underlying and surface representations (though /ʔV/ may surface as a single laryngealized vowel in the most casual speech). Other vowel sequences may be tautosyllabic, but not necessarily so (cf. sec. 2.2.3).

Two fairly complete columns and four rows of vowel sequences are arrayed in 314. The decision to analyze palatalization as /i/ (cf. sec. 2.2.1) accounts for the vowel sequences in the first column where the first vowel is /i/. Likewise, the decision to set up vowel sequences permitting /aí/ and /au/ along with the portmanteaus /oa/, /ea/, /ao/, and /ae/ account for many of the



other uninterrupted sequences. The four rows of interrupted sequences are not vowel sequences in surface forms and have not been accounted for (except the column with /fV/, which is accounted for by VOWEL COPY (259)). In the ensuing discussion we will begin by focusing on these interrupted sequences in order to understand the phonological process that maps them onto surface forms.

Consider 315-321:

|       | (a)         | (b)         | (c)       |            |
|-------|-------------|-------------|-----------|------------|
| (315) | ['řaʔənə]   | ['řuʔwunə]  | ['ŋdəřə]  | 'talk'     |
| (316) | ['miʔyɪnə]  | ['miʔwunə]  | [nə'miřə] | 'dig'      |
| (317) | ['meʔyɪnə]  | ['meʔwunə]  | [nə'meřə] | 'care for' |
| (318) | ['maʔyɪnə]  | ['maʔwunə]  | [nə'mæřə] | 'get'      |
| (319) | ['uʔwunə]   | ['uʔwunə]   | ['nuřə]   | 'go'       |
| (320) | ['řoʔwunə]  | ['řoʔwunə]  | [n'dořə]  | 'cut'      |
| (321) | ['řaʊʔwunə] | ['řaʊʔwunə] | [n'dořə]  | 'take out' |

(immed past 2s) (immed past 1 pl) (infin)

/t/-stem verbs have been taken as the standard pattern in working with alternation in verbals. Deviations from the patterns observed in /t/-stem verbs can frequently be accounted for by phonological processes. The stem vowel of 315 is /t/ and it surfaces as [ə], a mid central variant in 315a,c. The suffix attached to the verb stem is /-ʔnʔ/. Note that it surfaces as [ʔənə] when attached to an /t/-stem verb (315a). For the rest of the forms in column a such is not the case. Whenever the stem vowel of the verb is front and unround (316-318) ([aʰ] will be shown to be a variant of /æ/), it surfaces as [ʔyɪnə] with a [y] following glottal stop and preceding the central vowel. Whenever the stem vowel of the verb is back and round (319-321a), it surfaces as [ʔwunə] with a [w] following glottal stop and preceding the central vowel. In each case the variant of /t/ that surfaces is sensitive to the vowel that is inserted before it. These patterns are not confined to one example, but can be seen throughout verb paradigms.<sup>29</sup> The semivowel is

inserted during the transition of one vowel to another and is probably motivated by pressure to have the optimal syllable pattern of CV in the surface structure (Hooper, 1976:242). The morphological rule SEMIVOWEL EPENTHESIS has been formulated to account for these predictable occurrences of [y] and [w] in verbals:

$$(322) \quad \text{SEMIVOWEL EPENTHESIS } \emptyset \text{ ---} \rightarrow \left[ \begin{array}{c} \text{C} \\ \text{-consonantal} \\ \text{+sonorant} \\ \alpha\text{round} \end{array} \right] / \left[ \begin{array}{c} \text{V} \\ \alpha\text{round} \\ \alpha\text{back} \end{array} \right] \text{ ? } \text{ \_\_\_\_\_\_ V ]}_{vb}$$

SEMIVOWEL EPENTHESIS states that in verbals [y] is inserted after glottal stop in the sequence /V<sub>1</sub>?V<sub>2</sub>/ when /V<sub>1</sub>/ is a front unround vowel; and [w] is inserted when /V<sub>1</sub>/ is a back round vowel. By specifying both 'back' and 'round' with  $\alpha$  variable the rule is blocked from operating when the first vowel is a central vowel. Derivations 323a-d illustrate the application of SEMIVOWEL EPENTHESIS:

| (323)                      | (a)         | (b)        | (c)        | (d)        |
|----------------------------|-------------|------------|------------|------------|
| U.F.                       | /mɪʔnɪ/     | /ʔɪʔnɪ/    | /uʔnɪ/     | /ʔoʔnɪ/    |
| SEMIVOWEL<br>EPENTHESIS    | mɪyɪnɪ      | -----      | úwɪnɪ      | Tówɪnɪ     |
| /ɪ/ FRONT-<br>RAISE-ROUND' | mɪyɪnɪ      | -----      | úwunɪ      | Tówunɪ     |
| S.F.                       | ['mɪʔyɪ.nə] | ['ʔəʔənə]  | ['uʔwunə]  | ['ʔoʔwunə] |
|                            | 'you dug'   | 'you said' | 'you went' | 'you cut'  |

SEMIVOWEL EPENTHESIS provides a phonological account of the homophony between 319-321a and 319-321b. From a further inspection of these two columns we observe that it is only when the verb stem has a round vowel that homophony results. The formative indicating first person plural and dual is the suffix /-w/, and when it is attached to the verb, it separates the vowels and blocks SEMIVOWEL EPENTHESIS from applying. Derivations 324a-d show how the homophones arise:

|                         |           |            |                |                 |
|-------------------------|-----------|------------|----------------|-----------------|
| (324)                   | (a)       | (b)        | (c)            | (d)             |
| U.F.                    | /úwɪnt/   | /únt/      | /méwɪnt/       | /mént/          |
| SEMIVOWEL<br>EPENTHESIS | -----     | úwɪnt      | -----          | méyɪnt          |
| S.F.                    | ['uʔwunə] | ['uʔwunə]  | ['meʔwunə]     | ['meʔyɪnə]      |
|                         | 'we went' | 'you went' | 'we cared for' | 'you cared for' |

Looking again at 315-321, note that only in 318 and 321 does the stem vowel of the verb vary. If we extrinsically order MONOPHTHONGIZATION (295) before SEMIVOWEL EPENTHESIS (322), then the alternation in the stem vowels is explained by phonological processes already well-motivated.<sup>30</sup> For example:

|                              |            |               |
|------------------------------|------------|---------------|
| (325)                        | (a)        | (b)           |
| U.F.                         | /meáɪnt/   | /Toáɪnt/      |
| MONOPHTHONGIZATION (295)     | mæɪnt      | Tɔɪnt         |
| SEMIVOWEL EPENTHESIS (322)   | máyɪnt     | Tɔwɪnt        |
| VOWEL REDUCTION' (cf. 350)   | máyɪnt     | Táwɪnt        |
| FRONT GLIDE INSERTION (265)  | ma'yɪnt    | -----         |
| BACK GLIDE INSERTION (266)   | -----      | Taúwɪnt       |
| /t/ FRONT-RAISE-ROUND' (244) | ma'yɪnt    | Taúwunt       |
| S.F.                         | ['ma'yɪnə] | ['ʔaúʔwunə]   |
|                              | 'you got'  | 'you removed' |

By ordering MONOPHTHONGIZATION (295) before SEMIVOWEL INSERTION (322), we can further generalize the latter so that it can account for other predictable occurrences of [w] and [y], but ones that do not meet its structural description as presently stated. Consider the underlined semivowels in the surface representations of 326 and 327:

|       |                           |                        |
|-------|---------------------------|------------------------|
|       | (a)                       | (b)                    |
| (326) | ['mɪʔyɪɹɪ] 'you dug (dl)' | ['mɪɹɪ] 'dig (impv s)' |
| (327) | ['ʔoʔwɪɹɪ] 'you cut (dl)' | ['ʔowu] 'cut (impv s)' |

The underlined [y] and [w] in 326 and 327 follow the same insertion pattern observed earlier except that in each of these instances the

vowel sequence is not interrupted by glottal stop. If we had stated SEMIVOWEL EPENTHESIS without glottal stop in its structural description before ordering the rule after MONOPHTHONGIZATION, then incorrect derivations like 328a,b would have been possible:

|                      |                    |                 |
|----------------------|--------------------|-----------------|
| (328)                | (a)                | (b)             |
| U.F.                 | /meaTɪnɪ/          | /ToaTɪnɪ/       |
| SEMIVOWEL EPENTHESIS | meyaTɪnɪ           | TowaTɪnɪ        |
| S.F.                 | *[me'yaɾnə]        | *[řo'waɾnə]     |
|                      | 'he is caring for' | 'he is cutting' |

Since MONOPHTHONGIZATION has been ordered before SEMIVOWEL EPENTHESIS, those cases where the latter would incorrectly apply are bled away by producing a single [V]. And, now we can generalize the rule that inserts semivowels and state it so that glottal stop optionally interrupts the vowel sequence to which it applies:

(329) SEMIVOWEL EPENTHESIS'

$$\emptyset \text{ ---> } \left[ \begin{array}{c} \text{C} \\ \text{-consonantal} \\ \text{+sonorant} \\ \alpha \text{round} \end{array} \right] / \left[ \begin{array}{c} \text{V} \\ \alpha \text{round} \\ \alpha \text{back} \end{array} \right] (?) \text{ \_ V } ]_{\text{vb}} \text{ (if first V is low} \\ \text{? is obligatory)}$$

SEMIVOWEL EPENTHESIS' states that semivowels are inserted to break up /VV/ and /V̆V/ sequences in verbals. Derivations 330a-d illustrate the application of SEMIVOWEL EPENTHESIS'. (The reason for the added restriction will become apparent later).

|                        |            |            |          |         |
|------------------------|------------|------------|----------|---------|
| (330)                  | (a)        | (b)        | (c)      | (d)     |
| U.F.                   | /mɪɪɪ/     | /Tóɪɪ/     | /mɪɪ/    | /Toɪ/   |
| SEMIVOWEL EPENTHESIS'  | mɪyɪɪ      | Tówɪɪ      | mɪyɪ     | Towɪ    |
| /ɪ/ FRONT-RAISE-ROUND' | mɪyɪɪ      | Tówɪɪ      | mɪyɪ     | Towɪ    |
| S.F.                   | ['mɪ'yɪɪɪ] | ['řo'wɪɪɪ] | ['mɪyɪɪ] | ['řowɪ] |
|                        | 'you dug'  | 'you cut'  | 'dig!'   | 'cut!'  |
|                        | (dl)       | (dl)       | (impv)   | (impv)  |

We have seen that SEMIVOWEL EPENTHESIS' accounts for many of the underlying vowel sequences arrayed in 314. 331, a truncated verb paradigm, illustrates those vowel sequences:

|       | (a)       | (b)        | (c)     | (d)              | (e)     |                     |
|-------|-----------|------------|---------|------------------|---------|---------------------|
|       |           | (perfect)  |         | (immediate past) |         |                     |
| (331) | /u-/      | /úáTtnt/   | /útnt/  | /úit/            | /úot/   | 'go'                |
|       | /To-/     | /TóáTtnt/  | /Tótnt/ | /Tóit/           | /Tóot/  | 'cut'               |
|       | /Toa-/    | /ToááTtnt/ | /Toánt/ | /Toáit/          | /Toáo+/ | 'remove'            |
|       | /mi-/     | /míáTtnt/  | /mínt/  | /míit/           | /míot/  | 'dig'               |
|       | /me-/     | /méáTtnt/  | /mént/  | /méit/           | /méot/  | 'raise'             |
|       | /mea-/    | /meááTtnt/ | /meánt/ | /meáit/          | /meáo+/ | 'get'               |
|       | /Tt-/     | /TfáTtnt/  | /Tfnt/  | /Tfíit/          | /Tfáo+/ | 'say' <sup>31</sup> |
|       | (vb stem) | (1s)       | (1,2s)  | (2,3dl)          | (2,3pl) |                     |

Another process in Angave is similar to that described by SEMIVOWEL EPENTHESIS' and relates to sequences of vowels where the first is a central vowel. I will begin by independently motivating another semivowel insertion rule. Then I will relate it to SEMI-VOWEL EPENTHESIS'. Consider the following nominals and imperative verb forms:

|       | (a)          |           | (b)                     |
|-------|--------------|-----------|-------------------------|
| (332) | ['aʔwəʔ]     | 'taro'    | ['awə] 'hit (it)!'      |
| (333) | ['šaʔwəʔ]    | 'thigh'   | ['mawə] 'get (it)!'     |
| (334) | [aʔzaʔwəʔ]   | 'poison'  | ['řawə] 'remove (it)!'  |
| (335) | [šlɣ'gaʔwəʔ] | 'eyebrow' | [eə'kħawə] 'pull (it)!' |

The [w̄], a non-high round semivowel, in 332-335 occurs only in these two environments: [Caʔwəʔ] in nominals and [Cawə] in imperative singular verb forms. By comparing Winoyit and Angai lects (cf. sec. 3.3.1) we can see where this [w̄] came from historically and understand better how it differs from the high round semivowel /w/. Compare the reflexes for Angai and Winoyit in the light of a historical reconstruction:

|       | (a)            | (b)          | (c)     |
|-------|----------------|--------------|---------|
| (336) | *Vʔkʰaʔ#       | [akʰaʔ]      | [aʔaʔ]  |
| (337) | *Vʔkwʉʔ#       | [akwʉʔ]      | [aʔwʉʔ] |
| (338) | *Vʔkaʔ#        | [akəʔ] (few) | [aʔaʔ]  |
| (339) | *Vʔkwʉʔ#       | [akwʉʔ]      | [aʔwʉʔ] |
|       | (Proto-Angave) | (Winyoit)    | (Angai) |

Winyoit speakers have lost glottal stop before velars and post-velars (336-339b). Angai speakers have lost the velar and postvelar stops, but retained labialization and glottal stop (336-339c). In 337c the reflex of labialization is the non-high round semivowel [w̄]. But in 339c it is the high round semivowel [w]. Whereas the contrast between 337b and 339b in Winyoit is maintained by [kw] vs. [kw̄], between 337c and 339c in Angai it is maintained by [w̄] vs. [w]. Note further that [w̄] does not condition rounding in the following central vowel as [w] does. Note also that [w̄] does not condition the insertion of a high round glide before glottal stop as [w] does. Recall from sec. 4.3.2 that /Kw/ was depicted as a combination of competing environments. When \*kw-->[w̄] in Angai, the phonetic manifestation of the preceding vowel was not an [ɳ] and so labialization carried the contrast as [w̄]. This labialization was reinterpreted as a non-high round semivowel, and a new and potentially contrastive segment entered the language. It has not yet entered the underlying inventory of segments, however, because its occurrence is predictable from the unique word final vowel sequence in which it occurs (in nominals). Therefore, on the basis of 332-335a we should formulate an insertion rule for [w̄] that does justice to its very limited distribution:

|       |            |      |                |        |
|-------|------------|------|----------------|--------|
| (340) |            |      |                |        |
| [w̄]  | EPENTHESIS | Ø--> |                |        |
|       |            |      | C              | V      |
|       |            |      | [-consonantal] | [+low] |
|       |            |      | +sonorant      | +back  |
|       |            |      | -high          | -round |
|       |            |      | /              | ʔ      |
|       |            |      |                | [-low] |
|       |            |      |                | +back  |
|       |            |      |                | -round |
|       |            |      |                | ʔ#]    |
|       |            |      |                | nom    |

[w̄] EPENTHESIS states that the sequence /áí#/#/ in nominals is broken up by inserting [w̄] in between the vowels. This process is certainly related to SEMIVOWEL EPENTHESIS' (329). It inserts a semivowel in the environment where the latter is blocked from operating, that is, when the first vowel in a sequence is 'back' but not 'round'. We might speculate that [w̄] EPENTHESIS may eventually be conflated with SEMIVOWEL EPENTHESIS', and thus [w̄] could begin appearing in verbals in the environments where neither [y] nor [w] can occur. Such an incipient association may be argued for on the basis of 332-335b, which is the only other environment where [w̄] occurs. Consider derivations 341a,b, which do not undergo [w̄] EPENTHESIS because they do not meet its structural description, i.e. no glottal stop interrupts the sequence of vowels. If [w̄] EPENTHESIS can be reformulated to meet the environment in 341a,b, then the surface form of these imperatives can be accounted for:

|                            |             |               |
|----------------------------|-------------|---------------|
| (341)                      | (a)         | (b)           |
| U.F.                       | /meaɪ/      | /moaɪ/        |
| MONOPHTHONGIZATION         | mæɪ         | mɔɪ           |
| VOWEL REDUCTION' (cf. 350) | maɪ         | maɪ           |
| [w̄] EPENTHESIS' (342)     | maw̄ɪ       | maw̄ɪ         |
| S.F.                       | ['maw̄ə]    | ['maw̄ə]      |
|                            | 'get (it)!' | 'throw (it)!' |

SEMIVOWEL EPENTHESIS' does not apply to the output of MONOPHTHONGIZATION in 341,b because it will not insert a semivowel between /VV/ if the first vowel is low and not terminated by glottal closure. Both strings meet the structural description of VOWEL REDUCTION (350) (subsequent to stress assignment) and [a] results. The sequence /aɪ/ potentially meets a more generalized version of [w̄] EPENTHESIS (minus the glottal stop between the vowels). [w̄] is therefore inserted, and 341a,b are accounted for on the basis of phonological processes. Furthermore, such a revision

of [w̄] EPENTHESIS parallels the earlier revision of SEMIVOWEL EPENTHESIS (322) to SEMIVOWEL EPENTHESIS' (329):

## (342) [w̄] EPENTHESIS'

$$\emptyset \text{ ---} \rightarrow \left[ \begin{array}{c} \text{C} \\ \text{-consonantal} \\ \text{+sonorant} \\ \text{-high} \end{array} \right] / \left[ \begin{array}{c} \text{V} \\ \text{+low} \\ \text{+back} \\ \text{-round} \end{array} \right] (?) \text{ ---} \left[ \begin{array}{c} \text{V} \\ \text{-low} \\ \text{+back} \\ \text{-round} \end{array} \right] (?) \# \text{ nom, impv}$$

Another morphological process limited to verbals that was included in the derivation of 341 is a neutralization of contrast between (1) /oa/ and /ea/, and (2) /e/ and /o/. Consider 343-348 and the patterns which emerge:

|       | (a)             | (b)            | (c)             | (d)        |
|-------|-----------------|----------------|-----------------|------------|
| (343) | /mɪPɪtáot/      | /mɪmfant/      | /mɪtnt/         |            |
|       | [mɪbə'taʔowu]   | [mɪ'maʔanə]    | ['mɪʔyɪnə]      | [nə'mɪfə]  |
| (344) | /PɪuPɪtáot/     | /Pɪumfant/     | /Pɪútn/         | 'dig'      |
|       | [pubə'taʔowu]   | [pu'maʔanə]    | ['puʔwunə]      | [nə'buʔə]  |
| (345) | /PePɪtáot/      | /Pémfant/      | /Pétn/          | 'pass'     |
|       | [pəbə'taʔowu]   | [pəʔ'maʔanə]   | ['peʔyɪnə]      | [nə'beʔə]  |
| (346) | /ɪKWɔPɪtáot/    | /ɪKWómfant/    | /ɪKWótnt/       | 'die'      |
|       | [ɪgwubə'taʔowu] | [ɪgwuʔ'maʔanə] | [ɪ'gwɔʔwunə]    | [nɪ'gwɔʔə] |
| (347) | /eaPɪtáot/      | /eámfant/      | /eátn/          | 'separate' |
|       | [abə'taʔowu]    | [aʔ'maʔanə]    | ['aɪʔyɪnə]      | ['næʔə]    |
| (348) | /ToaPɪtáot/     | /Toámfant/     | /Toátn/         | 'hit'      |
|       | [fabə'taʔowu]   | [faʔ'maʔanə]   | ['faʔʔwunə]     | [n'dɔʔə]   |
|       | (immed fut 3pl) | (immed fut 1s) | (immed past 1s) | (infin)    |

Notice that among 343-348 /ɪ/ and /u/-stem verbs (343-344) never alternate. /e/ and /o/-stem verbs surface with [e] and [ɔ] (345-346c) and with [ə,u] (345-346a,b). /ea/ and /oa/-stem verbs (347-348) surface with [a, a', aʊ] and with [ɔ] and [æ]. 349 summarizes the alternation:



(349) Vowel Neutralization  
 /i/                    /u/  
 /e/----->/ɨ/<-----/o/  
 /ea/---->/a/<-----/oa/

This is a process of neutralization of the contrast between non-high vowels in certain environments. VOWEL REDUCTION describes the process with attendant environments as may be determined from the alternation in 343-348:

(350) VOWEL REDUCTION  $\left[ \begin{array}{c} \text{V} \\ \text{-high} \\ \alpha\text{low} \end{array} \right] \text{---} \rightarrow \left[ \begin{array}{c} \text{+back} \\ \text{-round} \\ \alpha\text{low} \end{array} \right] / \left\{ \begin{array}{c} \text{[-st̄r̄ess]}^? \\ \text{CV'CV} \end{array} \right\} \text{Vb}$

VOWEL REDUCTION states that non-high vowels in verbals reduce to central vowels of the same height when filling a syllable that precedes the stressed syllable by two. In addition, /e/ and /o/ reduce to /ɨ/ when terminated by glottal closure and unstressed, and /oa/ and /ea/ (following the operation of MONOPHTHONGIZATION [ɔ] and [æ]) reduce to /a/ when terminated by glottal closure and unstressed. Derivations 351a-c illustrate its operation and its ordering relative to MONOPHTHONGIZATION (295):

| (351)              | (a)           | (b)           | (c)               |
|--------------------|---------------|---------------|-------------------|
| U.F.               | /PePɨtÁot/    | /Toámfanɨ/    | /mɨPɨtÁot/        |
| stress assignment  | PePɨ'tÁot     | Toá'mfanɨ     | mɨPɨ'tÁot         |
| MONOPHTHONGIZATION | -----         | Tó'mfanɨ      | -----             |
| VOWEL REDUCTION    | PɨPɨ'tÁot     | Tá'mfanɨ      | -----             |
| S.F.               | [pəbə'taʔowu] | [faʔ'maʔanə]  | [mɨbə'taʔowu]     |
|                    | 'they'll die' | 'I'll remove' | 'they'll harvest' |

The vowel sequences not yet accounted for in 314 are /ɨV/, and they only occur within complex forms. Each sequence surfaces minus its first member as /ɨ/ DELETION states:

(352) /t/ DELETION  $\left[ \begin{array}{c} \text{V} \\ \text{-low} \\ \text{-round} \\ \text{+back} \end{array} \right] \text{ ----> } \emptyset / \text{ \_\_\_\_ } + \text{V}$

/t/ DELETION states that the mid central vowel is deleted if it is followed by another vowel. /t/ (not terminated by glottal closure) only precedes other vowels if there is an intervening formative boundary. Derivations 353a-c illustrate its application:

|              |   |   |  |
|--------------|---|---|--|
| (353)        | (a)   | (b)   | (c)  |
| U.F.         | /n <sup>+</sup> +aT <sup>+</sup> n <sup>+</sup> / | /P <sup>+</sup> +u+aT <sup>+</sup> n <sup>+</sup> / | /m <sup>+</sup> +eaaT <sup>+</sup> n <sup>+</sup> n <sup>+</sup> / |
| /t/ DELETION | naT <sup>+</sup> n <sup>+</sup>                   | PuaT <sup>+</sup> n <sup>+</sup>                    | m <sup>+</sup> eaat <sup>+</sup> n <sup>+</sup> n <sup>+</sup>     |
| S.F.         | ['naɾnə]  | ['pwaɾnə]   | ['mæɾɾnə]  |
|              | 'he is eating'                                    | 'he is passing'                                     | 'he isn't hitting'   |

/t/ also deletes between homorganic consonantals. The process that deletes /t/ between consonantals feeds another process, and these two processes are the subjects of the final section dealing with /t/ and /T/.

4.3.5 The Mid Central Vowel and the Alveolar Non-Nasal Obstruent  
Across formative boundaries and across internal word boundaries there is an alternation in some forms involving the manifestation of /t/ as 354-357 indicate:

|       |                                |  |   |  |
|-------|--------------------------------|--|---|--|
|       | (a)                            | (b)  | (c)   | (d)  |
| (354) | [m <sup>+</sup> a'naɾɾnə]      | /m <sup>+</sup> t+n <sup>+</sup> aT <sup>+</sup> n <sup>+</sup> n <sup>+</sup> / | [ɾm <sup>+</sup> 'baɾɾnə]   | /m <sup>+</sup> t+b <sup>+</sup> aT <sup>+</sup> n <sup>+</sup> n <sup>+</sup> / |
|       | 'he isn't eating'              |  | 'he isn't coming'   |  |
| (355) | [n <sup>+</sup> əmbəfə]        | /n <sup>+</sup> t+b <sup>+</sup> T <sup>+</sup> /                                | ['ɾnd <sup>+</sup> əfə]   | /n <sup>+</sup> t+d <sup>+</sup> T <sup>+</sup> /                                |
|       | 'to come'                      |  | ['ɾnd <sup>+</sup> ɾə] +andante                                       | 'to pick'  |
| (356) | [a <sup>+</sup> mənəbə'taʔowu] | /'am <sup>+</sup> t#n <sup>+</sup> P <sup>+</sup> fTáot/                         | ['a <sup>+</sup> m <sup>+</sup> m <sup>+</sup> 'n <sup>+</sup> tɾowu] | /'am <sup>+</sup> t#m <sup>+</sup> ean <sup>+</sup> tɾot/                        |
|       | 'they'll eat somewhere'        |  | 'he'll get (it) somewhere'  |  |
| (357) | ['wajə'manə]                   | /'waj <sup>+</sup> f#man <sup>+</sup> / <sup>32</sup>                            | ['waj <sup>+</sup> ɾn <sup>+</sup> 'ganə]                             | /'waj <sup>+</sup> f#gan <sup>+</sup> /  |
|       | 'take the greens'              |  | 'give me the greens'  |  |

354-357a have an [a] occurring between heterorganic consonants (underlined) that corresponds to an underlying central vowel in column b. 354-357c, however, have no vocalic segment in the surface representation that corresponds to the underlying central vowel in column d, except that the consonant preceding an 'expected [a]' is [+syllabic]. No [a] surfaces between homorganic consonants (column c). The observation that /t/ is deleted between homorganic consonants can be extended beyond the environments illustrated by 354-357. If by the principle of 'free ride' we extend our observation to include geminates that do not occur across formative boundaries, then all surface geminate consonants in Angave can be accounted for. Consider 358-362:

- (358) [l<sub>u</sub>'maʔwaʔ] /l<sub>u</sub>t'máʔ/ 'a taro'  
 (359) [e'máɪna] /e'máɪnɪt/ 'it is the moon'  
 (360) ['l<sub>u</sub>páʔ] + andante /'l<sub>u</sub>páʔ/ 'crosslegged'  
           ['l<sub>u</sub>páʔʔ]  
 (361) [m'baɪna] /bɪtáɪnɪt/ 'he is coming'  
 (362) [t<sub>u</sub>'laʔwaʔ] + andante /t<sub>u</sub>'Táʔ/ 'hearth'  
           [t<sub>u</sub>'laʔwaʔʔ]

By writing a general rule to predict the deletion of /t/ between homorganic consonants, geminate consonants are eliminated from underlying representations. The rule /t/ DELETION' captures this process. It operates across internal word and formative boundaries as well as within formatives:

- (363) /t/ DELETION'  

$$\begin{array}{ccccccc} & & C & & V & & \\ & & \left[ \begin{array}{l} +\text{consonantal} \\ -\text{round} \end{array} \right] & & \left[ \begin{array}{l} -\text{low} \\ -\text{round} \end{array} \right] & & \left( \begin{array}{l} + \\ \# \end{array} \right) \\ \alpha\text{point} & & & & & & C \\ & & & & & & \left[ \text{point} \right] \end{array} \begin{array}{l} \text{-->} \\ \text{-->} \\ \text{-->} \\ \text{-->} \\ \text{-->} \\ \text{-->} \\ \text{-->} \\ \text{-->} \end{array} \begin{array}{l} [+syllabic] \\ \emptyset \\ \emptyset \\ \emptyset \\ \emptyset \\ \emptyset \\ \emptyset \\ \emptyset \end{array}$$

/t/ DELETION states that /t/ is deleted when it occurs between consonants at the same point of articulation as restricted by the

features 'consonantal' and 'round', which have been specified to block the rule from operating if one is a semivowel or labialized consonant. The first consonant then takes on the feature [+syllabic] from the deleted /t/. The feature 'syllabic' is used to mean that the segment it characterizes picks up or preserves the weight allotted to a syllable. It is not necessarily [+voice].

When C<sub>1</sub> surfaces as a stop in the sequence /C<sub>1</sub>tC<sub>1</sub>V/, rather than delete entirely /t/ may surface as a very short transitional vowel. It is marked as a raised schwa in phonetic transcriptions (355c, 360, 362) and is only heard in slow or precise speech. It is probably to be accounted for on the basis of the relative difficulty for stops to be [+syllabic] as opposed to more vowel-like consonants, and thus in slow speech speakers reinsert a transitional vowel in order to make the initial member of the geminate strong enough perceptually to carry the weight of a syllable.

When /t/ DELETION' operates on strings containing the sequence /Tt/, the resulting [ɾ] does not match the phonetic manifestation, for it is no longer flapped. /t/ DELETION' alone is not capable of predicting this change in the manner of articulation of [ɾ]. The minor rule DEFLAP, which automatically operates subsequent to /t/ DELETION', will produce the correct surface manifestation:

|              |  |                       |
|--------------|--|-----------------------|
| (364) DEFLAP | $\begin{array}{c} C \\ +\text{coronal} \\ +\text{obstruent} \\ -\text{nasal} \\ +\text{continuant} \\ +\text{voice} \end{array}$ | -----> [-flap] / __ C |
|--------------|--|-----------------------|

DEFLAP states that [ɾ] no longer flaps when preceding another consonant as happens subsequent to the operation of /t/ DELETION'. 'Flap' has been included among the features necessary to specify oppositions in order to distinguish [ɾ] from [t]. Derivation 365 illustrates the operation of DEFLAP: