

NEW INSIGHTS INTO THE PHONOLOGY OF HIGHLAND CHONTAL*

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0. In his 1967 phonemicization of Highland Chontal, a Hokan language of Oaxaca, Turner posits twenty-seven native consonant phonemes, including /f'/, /t'/, /c'/, /č'/, /k'/, /N/, /s/ and /W/. With the elimination of these eight phonemes, a new analysis can be developed in which the phonemic inventory of consonants is reduced to nineteen. The reanalyzed phonemic inventory of Highland Chontal is as follows.

VOWELS

| | |
|---|---|
| i | u |
| e | o |
| a | |

CONSONANTS

| | | | | |
|---|------|---|---|---|
| p | t, c | č | k | ʔ |
| b | d | | g | |
| f | | š | | h |
| m | n | | ŋ | |
| | ɬ | | | |
| | l | | | |
| w | y | | | |

/β/, /ð/, /r/, /r̄/ and /s/ occur also, but only in Spanish loans. Below, I will present detailed arguments against each of the eight questionable phonemes. Transcriptions in [] brackets are phonetic, except that variation in vowel quality is not indicated. Each of the vowels has a tense and a lax allophone.¹ Stress is penultimate unless otherwise indicated.

1.1. Consider first Turner's phoneme [W]. Turner phonemicizes both native words and Spanish loans with /W/: /Wak/ [Wak] 'head'; /Weβes/ [Weβes] (cf. Spanish *jueves*) 'Thursday'. Instead, [W] can be phonemicized as /hu/. Consider the alternation of [W] and [hu]. The root 'to wrap' has two allomorphs, [hu?e] and [Wi?e], as in [d + i + hu?e + ?ma] 'NPST + he + wrap + FUT', 'he will wrap' vs. [d + i + Wi?e + go + ?ma] 'NPST + he + wrap + TRANS + FUT', 'he will wrap' (TRANS). Crucially, [hu] never occurs before a vowel. Thus, we can posit the rule of HU SIMPLIFICATION: hu ---> [W] / ___ V. The derivation of the two allomorphs of the verb 'to

wrap' will be as follows.

| | | |
|-------------------|--------|--------|
| | hu?e | hui?e |
| HU SIMPLIFICATION | ---- | Wi?e |
| | [hu?e] | [Wi?e] |

1.2. Consider now Turner's phoneme /s/. In the present analysis, the occurrence of native [s] can be predicted by the rule of DEAFFRICATION:

c ----> [s] / $\frac{\{c\}}{\#}$.

The following data show that [c] and [s] are clearly in complementary distribution.

| | |
|-------------------------------------|-----------------------------|
| [lip ^f as] | 'fellow' |
| [lip ^f ac + onas] | 'fellow + son in law' |
| [lip ^f ac + onac + ela?] | 'fellow + son in law + PLU' |
| [dans] | 'to be squeezed' |
| [danc + i] | 'to be squeezed + CONT' |
| [škas] | 'to pile up' |
| [škac + e] | 'to pile up + TRANS' |
| [d + i + das + ?ma] | 'NPST + he + twist + FUT' |
| [d + i + dac + i] | 'NPST + he + twist + CONT' |

In these forms, Turner phonemicizes phonetic [s] as /s/ and phonetic [c] as /c/. This seems to be an unnecessarily 'surfacy' analysis, considering that [s] and [c] are in complementary distribution. Notice that in Waterhouse's Highland Chontal data, DEAFFRICATION is optional in the environment / $\frac{\#}{\#}$. Waterhouse records [?emec], [?emes] 'seed' and [mol?ec], [mol?es] 'mamey fruit' (Waterhouse 1970). Turner records only [?emes] and [?mol?es] (Turner and Turner 1971).

Having posited the native phoneme /c/, one can now posit a foreign phoneme /s/ appearing only in Spanish loans. This neatly explains the occurrence of [s] in prevocalic position, where one would ordinarily expect [c], as in [bolsa] 'bag'; [mesa] 'table'; [klase] 'class'; [kosina] 'kitchen'; [kosa] 'thing'. The form [lacu] (cf. Spanish lazo) 'lasso' suggests that this word was borrowed before the adoption of the foreign phoneme /s/, so that prevocalic [s] would have been impossible.

1.3. Consider now Turner's glottalized phonemic series /f'/, /t'/, /č'/, /c'/ and /k'/. Below, it will be argued that all phonetic glottalized segments can in fact be derived from nonglottalized segments plus glottal stop. This can be accounted for by the simultaneous rules of GLOTTALIZATION and AFFRICATION.

| | | | | |
|-----------------|--|------------------|---|--|
| GLOTTALIZATION: | $\left\{ \begin{matrix} f \\ t \\ c \\ č \\ k \end{matrix} \right\}$ | ----> [+glottal] | / | $\frac{\left\{ \begin{matrix} ? \text{ (Morpheme Internal)} \\ +?X \text{ PLU} \\ +?e \text{ TRANS} \\ +?i \text{ BEN} \end{matrix} \right\}}{\#}$ |
| AFFRICATION: | $\left\{ \begin{matrix} f \\ t \end{matrix} \right\}$ | ----> [+affric.] | | |

where X represents a free variable.

1.3.1. Of Turner's glottalized consonant phonemes, /č'/ can be discussed first. Phonetic [č'] occurs in only one morpheme -- [č'iš] 'to be quiet'. This root is probably sound symbolic. It seems unnecessary to posit a phoneme occurring in only one morpheme. If [č'] is analyzed as /č?/, the phoneme /č'/ can be eliminated from the inventory. Thus, we can propose the representations /č'iš/ [č'iš] 'be quiet' and /ač'išga/ [ač'išga] 'quietly'. (By a late rule of GLOTTAL STOP PREFIXATION, $\emptyset \rightarrow ? / \# ___ V .$)

1.3.2. Consider now Turner's phoneme /c'/. Rather than deriving phonetic [c'] from /c'/, it can be derived from /c (+) ?/ by the rule of GLOTTALIZATION. Recall that [s] has already been derived from /c/ via the rule of DEAFFRICATION. Now consider the following proposed derivations.

| | | | | |
|-----------------------------|--------|----------------|-----------|------------------------|
| | minc | 'to be ruined' | minc + ?e | 'to be ruined + TRANS' |
| GLOTTALIZATION ² | ---- | | minc' + e | |
| DEAFFRICATION | mins | | ----- | |
| | [mins] | 'to be ruined' | [minc'e] | 'to ruin' |
| | ?mic | 'foot' | ?mic + ?i | 'foot + PLU' |
| GLOTTALIZATION | ---- | | ?mic' + i | |
| DEAFFRICATION | ?mis | | ----- | |
| | [?mis] | 'foot' | [?mic'i] | 'feet' |

Note that GLOTTALIZATION is crucially ordered before DEAFFRICATION. Otherwise the ungrammatical forms *[mins?e] and *[?mis?i] would be generated.

The proposed derivation of [c'] from /c + ?/ explains very clearly the [s]/[c'] alternations in Highland Chontal, as just illustrated. By analogy, all morpheme internal [c'] can now be derived from /c?/: /ašpac?a?i/ [ašpac'a?i] 'tamale'.

Note that as formulated, GLOTTALIZATION will apply to /c/ if it precedes /?e/ TRANS or /?i/ PLU, but it will not apply if /c/ precedes /?ma/ FUT. Instead, DEAFFRICATION will apply:

| | | |
|---------------|---------------------|---------------------------|
| | d + i + dac + ?ma | 'NPST + he + twist + FUT' |
| DEAFFRICATION | [d + i + das + ?ma] | 'he will twist' |

One more rule is still necessary to account for the data. This is the rule of GLOTTAL DELETION: $? \rightarrow \emptyset / [+glottal] ___$. Consider the following derivation.

| | | |
|-------------|--------------------|-------------------------|
| | d + edeci? + ?ma | 'NPST + distrust + FUT' |
| GLOTTAL DEL | [d + edeci? + ma] | 'he will distrust' |
| | (cf. [d + edeci?]) | 'he distrusts'.) |

As formulated, GLOTTAL DELETION will apply not only following a glottal stop, but also following a glottalized consonant. Thus, if the string [+glottal] [+glottal] occurs in the intermediate stages of a derivation, GLOTTAL DELETION will apply following GLOTTALIZATION.

| | | |
|----------------|---------------------|-----------------------------------|
| | d + i + bac? + ?ma | 'NPST + it + be sweaty + FUT' |
| GLOTTALIZATION | d + i + bac' + ?ma | |
| GLOTTAL DEL | [d + i + bac' + ma] | 'it will be sweaty', ³ |

(Cf. [ʔaɬ + bac' + gi] 'we + be sweaty + PROC', 'we are sweaty'.)

1.3.3. Consider now Turner's phoneme /ɬ'/, phonetically [tʰ]. Rather than deriving [tʰ] from /ɬ'/, it can be derived from /ɬ (+) ʔ/ by GLOTTALIZATION and AFFRICATION. In Highland Chontal, verbs are frequently marked for transitivity by the suffixation of /ʔe/ TRANS, cf. [gway] 'arrive' vs. [gway + ʔe] 'arrive + TRANS', 'bring'. [foɬ] 'gather' (INT) shows the transitive form [foɬʰ] 'gather' (TRANS). Thus, on analogy with the /ʔe/-suffixing verbs, it seems reasonable to derive [foɬʰ] from /foɬ + ʔe/. Similarly, [nanɬ] 'celebrate' shows the benefactive form [nanɬʰ] 'celebrate for'. This form can be assigned the underlying representation /nanɬ + ʔi/ 'celebrate + BEN'.

Further, vowel final nouns are frequently marked for plurality by the suffixation of /ʔ/ PLU, cf. [ʔak'wa], [ʔak'waʔ] 'fork in tree', 'forks in tree'; [ʔalibú], [ʔalibúʔ] 'gourd', 'gourds'; [ʔundešɪ], [ʔundešɪʔ] 'wasp', 'wasps'. Now consider the pairs [ʔabaɬ], [ʔabatʰ] 'tongue', 'tongues' and [moɬ], [motʰ] 'sheep', 'sheep' (PLU). On analogy with the /ʔ/-suffixing plurals, [ʔabatʰ] can be assigned the underlying form /abaɬ + ʔ/ 'tongue + PLU' and [motʰ] can be analyzed as /moɬ + ʔ/ 'sheep + PLU'. Now, taking a 'free ride', all morpheme internal [tʰ] can be derived from /ɬʔ/: /fuɬʔe/ [fuɬʰ'e] 'pimple'.

1.3.4. Next, consider Turner's phoneme /f'/, I will assume that phonetically this is the affricate [pʰ], although this is somewhat ambiguous in the literature.⁴ Rather than deriving [pʰ] from /f'/, in the present analysis it will be derived from /f (+) ʔ/ by the rules of GLOTTALIZATION and AFFRICATION. Recall the /ʔ/-suffixing plural forms, e.g. [ʔalibúʔ] 'gourds'. [ʔabof] 'arrow' has the plural form [abopʰ] 'arrows'. On analogy with the /ʔ/-suffixing plurals, it seems reasonable to derive [ʔabopʰ] from /abof + ʔ/. Other [f]/[pʰ] alternations also occur. [walfa] 'bed' has the plural [walpʰ'ay] 'beds' and [ʔomfaʔni] 'deer' has the plural [ʔompʰ'aʔniʔ] 'deers'. On analogy with /abof + ʔ/, [walpʰ'ay] can be analyzed as /walf + ʔ ay/ and [ʔompʰ'aʔniʔ] can be analyzed as /omf + ʔ + aʔni + ʔ/.

Further evidence for this analysis is provided by the forms [ʃpempʰ'a] [ʃpemfotʰ'a] 'potlid', 'potlids'. Notice that in the plural form [f] is not glottalized and affricated. Thus, the forms can be analyzed as /ʃpempʰ'a/ and /ʃpemf + oɬʔ + ʔa/ respectively. Infixation of /oɬʔ/ PLU between the posited underlying /f/ and /ʔ/ explains the surface forms.

| | |
|----------------|---|
| | ʃpempʰ + oɬʔ + ʔa |
| GLOTTALIZATION | ʃpempʰ + otʰ + ʔa |
| GLOTTAL DEL | [ʃpempʰ + otʰ + a] 'potlids' ⁵ |

Again, taking a 'free ride', all morpheme internal [pʰ] can be derived from /fʔ/: /anufʔga/ [ʔanupʰ'ga] 'full'.

1.3.5. Finally, consider Turner's phoneme /k'/, Some evidence for deriving [k'] from /k (+) ʔ/ is provided by [k'e] and [ʔe], surface allomorphs of the TRANSITIVE morpheme, cf. [ʃkay + ʔe] 'be wounded + TRANS', 'wound' vs. [ʃpay + k'e] 'be scared + TRANS', 'scare'. If [k'e] is analyzed as /k + ʔe/, the /k/ can be considered an infix occurring between the root and /ʔe/ for certain lexically marked verbs. The transitive suffix can be analyzed as /ʔe/ for both verbs under discussion. Thus, we can propose the

underlying representations /ʃkay + ?e/ 'be wounded + TRANS' and /ʃpay + k + ?e/ 'be scared + k + TRANS'.

Due to the absence of verbs in final [k] in Highland Chontal, glottalization of /k/ across a boundary occurs most frequently in the pluralization of nouns in final /k/. Recalling the frequent plural suffix /ʔ/, [k'] can clearly be derived from /k (+) ʔ/: [ʔajok], [ʔajok'] 'wart', 'warts' can be assigned the underlying representations /ajok/ and /ajok + ʔ/, respectively. Again, morpheme internal [k'] can be derived via a 'free ride', e.g. /elahwikʔoʔ/ [ʔelahwik'oʔ] 'nettle'.

1.4. Now that /W/, /s/ and the glottalized series have been eliminated from the underlying inventory of the language, only /N/ remains to be discussed. In Highland Chontal, the three voiceless nasal phones [M], [N] and [ɲ] occur, cf. [cuMma] 'yesterday'; [ʔiNna] 'pig'; [leɲga] 'cliff'. Voiceless nasals occur only before homorganic voiced nasals. Therefore, Turner assumes that the voiced nasals in the forms cited above are underlying, but that the voiceless nasals are reflexes of one phoneme, which we can represent by the variable X. Phonetically, X assimilates to the point of articulation of a following voiced nasal. Although it is by no means clear that X itself carries the feature [+nasal], Turner assumes that that is the case, thus limiting the possible values of X to /M/, /N/ or /ɲ/. Of the three, /N/ is arbitrarily assumed to be underlying in all cases, [M] and [ɲ] being derived in the appropriate environments by the rule of N ASSIMILATION:
$$N \rightarrow \begin{bmatrix} \alpha \text{ ant} \\ \beta \text{ cor} \end{bmatrix} / \text{---} \begin{bmatrix} \alpha \text{ ant} \\ \beta \text{ cor} \end{bmatrix}.$$

In addition to positing the phoneme /N/, Turner also posits the phoneme /h/. The phoneme /h/ is clearly motivated, as [h] appears phonetically in numerous environments: [haʔmuʔ] 'dove'; [diha] 'it melts'; [dumuyahʔma] 'he will be late'; [didayhʔma] 'he will grind'; [ʔafuhga] 'white'; [bahak] 'grass'.

Below, it will be argued that [M], [N] and [ɲ] should be derived from /h/. This would enable underlying /N/ to be eliminated from the analysis.

1.4.1. The first argument involves the form [hi + niya] 'here + DEM (PLU) (ANIM)'. Optionally, this word may be pronounced [ɲniya]. Thus, one can propose the following rules.

I DELETION: $i \rightarrow \emptyset / \# h \text{ + n V (OPTIONAL)}$

H NASALIZATION: $h \rightarrow [N] / \# \text{---} + n$

The derivation of [ɲniya] will be as follows:

| | | |
|----------------|------------|---------------------------|
| | hi + niya | 'here + DEM (PLU) (ANIM)' |
| I DELETION | h + niya | |
| H NASALIZATION | [N + niya] | 'DEM (PLU) (ANIM) (PROX)' |

Clearly, in this instance at least, [N] must be derived from /h/. In this form, since it is not adjacent to any vowel, /h/ assimilates to /n/.

1.4.2. The second argument involves a large class of verbs with stems in final vowel or /y/. These verbs take the 'process' suffix /h/ preconsonantly. Consider the following data.

| | |
|-----------------------|--|
| [?aɪ + gwa + h + ma] | 'we + be tired + PROC + DUR', 'we're tired' |
| [ga + go + h + ma] | 'I + love + PROC + DUR', 'I love' |
| [ga + le + h + ma] | 'I + accompany + PROC + DUR', 'I accompany' |
| [?aɪ + nay + h + ma] | 'we + be pregnant + PROC + DUR', 'we're pregnant' |
| [d + eʃamay + h + ma] | 'NPST + go blind + PROC + DUR', 'he's going blind' |
| [?aɪ + ?way + h + ma] | 'I + hope + PROC + DUR', 'I hope' |

Now consider the following form: [ga + dam + M + ma] 'I + soak + PROC + DUR', 'I soak' (TRANS).

Thus, [M] and [h] carry the same semantic value, and are in complementary distribution. [M] appears only following [m], and [h] appears only following a vowel or [y]. In describing the data, two options are open to us. We must posit either Rule Set A or Rule Set B.

Rule Set A
 PROC ---> h / {V} + ____
 {y}
 PROC ---> M / m + ____

Rule Set B
 PROC ---> h

H NASALIZATION 2: h ---> [M] / C + ____ m

Rule Set A is an un insightful approach to describing the data. It makes no attempt to establish a unique underlying representation for the 'process' morpheme. Further, it assumes that the [M] of [gadamMma] is underlying. This assumption is flawed, since [mhm] does not occur in the language, and only [mMm] is possible. Since [M] and [h] are in complementary distribution, Rule Set A is rejected.

Rule Set B is a more satisfactory solution. It establishes a unique underlying representation /h/ for the 'process' morpheme in preconsonantal position. (Additional word final allomorphs will be presented below.) [M] is derived from /h/ in the appropriate environment.

Note the formulation of H NASALIZATION 2. On analogy with other cases of H NASALIZATION, it can be argued that it is the /m/ which follows the underlying /h/, and not the /m/ which precedes it, which triggers nasalization of that /h/. Evidence is provided by the form [Nniya] 'DEM (PLU) (ANIM) (PROX)'. Here, there is no segment preceding the underlying /h/, so it is clear that /h/ is nasalized by the /n/ which follows it. Additional evidence is provided by such forms as [difuMm?ma] 'he will get fat' (see 1.4.3.). In this form, an underlying /h/ is preceded by the vowel /u/ so that it can only have been nasalized by the subsequent /m/. Thus, our formulation of H NASALIZATION 2 is correct.

One more rule is necessary in the derivation of [gadamMma]. This is the rule of NASAL ASSIMILATION (Turner and Turner 1971):

[+nasal] ---> [α ant] / ____ + (?) [α ant]
 [+voice] ---> [β cor] [β cor]

The rule of NASAL ASSIMILATION is illustrated by the following data:

[?unam + ba] 'make music + REC', 'he made music'; [d + unan + ɛe] 'NPST + make music + IMP (PLU)', 'let them make music'; [?unaj + wo?me] 'make music + REC (MOV) (PLU)', 'they made music'.

From these data, it is impossible to determine which of the three nasals is underlying in the stem 'to make music', but this is irrelevant to the discussion. The rule of NASAL ASSIMILATION accounts for the data very naturally

regardless of which nasal is underlying. Notice that an optional /?/ appears in the rule. The /?/ is needed to account for assimilation of nasals in verbs taking the future singular suffix /?ma/. An example of the operation of this rule with optional /?/ is provided by the forms [d + i + šk'wan + ?ma] 'NPST + he + grasp + FUT', 'he will grasp' and [d + i + šk'wan + a] 'NPST + he + grasp + CONT', 'he is grasping'. Clearly, the underlying form of the verb 'to grasp' is /šk?wan/, since [n] surfaces intervocalically. Thus, /d + i + šk?wan + ?ma/ ---> [d + i + šk'wan + ?ma] by NASAL ASSIMILATION.

Recall now the verb 'to soak'. The attested forms of this verb are [do + dan + go + la?] 'you + soak + TRANS + IMP', 'soak!' and [ga + dam + M + ma] 'I + soak + PROC + DUR', 'I soak'. Again, it is impossible to determine which nasal is underlying in this verb stem, but it is clear that the point of articulation of the stem final nasal is determined by NASAL ASSIMILATION. The derivation of [gadamMma] will be as follows. (Below, we will use the notation /n/ to symbolize an indeterminable underlying voiced nasal.)

ga + dan + h + ma
H NASALIZATION 2 ga + dan + M + ma
NASAL ASSIMILATION [ga + dam + M + ma]

1.4.3. The strongest evidence for deriving phonetic voiceless nasals from /h/ involves a large class of verbs with stems in final vowel or /y/ taking the word final 'process' allomorphs [gi] or [ga] and the preconsonantal 'process' allomorph [h]. We will refer to them as Class A verbs.

CLASS A

| | | | |
|--------------------|------------------|-------------------------|-----------------|
| [d + eba + gi] | 'he is washing' | [d + eba + h + ?ma] | 'he will wash' |
| [d + ede + gi] | 'he is carving' | [d + ede + h + ?ma] | 'he will carve' |
| [d + i + day + gi] | 'he is grinding' | [d + i + day + h + ?ma] | 'he will grind' |
| [d + i + mu + gi] | 'he is showing' | [d + i + mu + h + ?ma] | 'he will show' |

(The final vowel of the word final 'process' allomorph is not predictable, though /i/ occurs more frequently than /a/.)

There is another large class of verbs, Class B, which appear to take the word final 'process' allomorph [ŋe] and the preconsonantal 'process' allomorph [Mm].

CLASS B

| | | | |
|-------------------|---------------------|------------------|-------------------|
| [d + ebofi + ŋe] | 'he is standing' | [d+ebofi+Mm+?ma] | 'he will stand' |
| [d + efk'i + ŋe] | 'it is withering' | [d+ef'ki+Mm+?ma] | 'it will wither' |
| [d + i + da + ŋe] | 'he is beating' | [d+i+da+Mm+?ma] | 'he will beat' |
| [d + i + le + ŋe] | 'he is propping up' | [d+i+le+Mm+?ma] | 'he will prop up' |

Below, evidence will be presented that the Class B stems are underlyingly nasal final. In the data, these verbs are not attested with vowel initial suffixes, the only environment in which the underlying nasal would surface. Thus, from the data, it is not possible to determine whether this underlying final nasal is /m/, /n/ or /ŋ/. Accordingly, we will represent it as /n/. Evidence will also be presented that in Class B the underlying form for the word final 'process' allomorph is /gi/, just as in Class A, and that the underlying form of the preconsonantal 'process' allomorph is /h/, just as in Class A. That is, the Class B forms will be derived from the following underlying representations.

| | |
|--------------------|-------------------------|
| /d + ebofin + gi/ | /d + ebofin + h + ?ma/ |
| /d + efk?in + gi/ | /d + efk?in + h + ?ma/ |
| /d + i + dan + gi/ | /d + i + dan + h + ?ma/ |
| /d + i + len + gi/ | /d + i + len + h + ?ma/ |

Consider again the Class B surface forms. In order to derive [d + ebofi + ne], e.g., from /d + ebofin + gi/, two new rules must be included in the grammar. I LOWERING: $i \rightarrow e / \eta$ _____. (The phonetic sequence [ni] does not occur in the language. Therefore, our derivation of [ne] from /ni/ is justified.) G DELETION: $g \rightarrow \emptyset / \eta +$ ____ V. CONDITION: Applies with /go/ 'again' and /gi/ PROC, but not with /go/ TRANS. (Cf. [d + imeNj + go + ?ma] 'NPST + forget + TRANS + FUT'.)

Note that as formulated, the rule of G DELETION does not apply within a morpheme -- cf. [?aleNga] 'steep'; [?awelNga] 'close'; [?aldongay?] 'up'. The motivation for the rule is as follows. The underlying form of the verb 'to see' must be /šin/, since [n] surfaces intervocalically: [gašina] 'I see' can be derived from /ga + šin + a/ 'I + see + CONT'. The underlying form of the infix 'again' must be /go/, since [go] surfaces after a vowel or /y/: [?igwaygona] 'he came again' can be derived from /i + gway + go + na/ 'he + come + again + CONT (MOV)'. Consider now the form [šingo] 'to see again'. This form provides evidence for positing the rule of G DELETION. By means of that rule, [šingo] can be derived from /šin + go/ 'see + again'. The derivation will be as follows.

| | | |
|--------------------|-----------|---------------|
| | šin + go | 'see + again' |
| NASAL ASSIMILATION | šin + go | |
| G DELETION | [šin + o] | 'see again' |

Furthermore, since /šin + go/ is clearly the underlying form of [šingo], we can also posit /d + ebofin + gi/ as the underlying form of [debofine], deriving the surface form by the independently motivated rules of NASAL ASSIMILATION, G DELETION and I LOWERING.

| | | |
|--------------------|------------------|-----------------------|
| | d + ebofin + gi | 'NPST + stand + PROC' |
| NASAL ASSIMILATION | d + ebofin + gi | |
| G DELETION | d + ebofin + i | |
| I LOWERING | [d + ebofin + e] | 'he is standing' |

Having established that Class B stems have an underlying final nasal, it now seems more reasonable to posit /d + ebofin + h + ?ma/ as the underlying representation of [debofiMm?ma] 'he will be standing'. In order to derive the surface form, the rules of METATHESIS and H NASALIZATION must be included in the grammar.

METATHESIS: $[+nasal] + \begin{Bmatrix} ? \\ h \end{Bmatrix} [-nasal]^6$

| | | | |
|-----|---|---|---|
| SD: | 1 | 2 | 3 |
| SC: | 2 | 1 | 3 |

H NASALIZATION 3: $h \rightarrow [M] / \text{____} + m + C$

Both of these rules are independently motivated. Evidence is provided by processes involved in Highland Chontal word formation. Consider the following pairs of surface forms. [difuh?ma] 'he will have an appetite' vs. [difuMm?ma] 'he will get fat'; [dinah?ma] 'he will vomit' vs. [dinaMm?ma]

'he will throw water'. If we hypothesize that these pairs of surface forms are semantically and morphologically related, the following underlying representations may be posited: /d + i + fu + h + ?ma/ 'NPST + he + fu + PROC + FUT'; /d + i + fu + m + h + ?ma/ 'NPST + he + fu + m + PROC + FUT'; /d + i + na + h + ?ma/ 'NPST + he + na + PROC + FUT'; /d + i + na + m + h + ?ma/ 'NPST + he + na + m + PROC + FUT'. It appears that /m/ is a derivational affix in Highland Chontal: to /fu/ 'have an appetite' corresponds /fu + m/ 'get fat'; to /na/ 'vomit' corresponds /na + m/ 'throw water'. Note that in the form [ʔifumaʔ] 'fat' (NOUN), the phonetic sequence [fum] does surface. The derivation of [difummaʔ] will proceed as follows.

d + i + fu + m + h + ?ma 'NPST + he + fu + m + PROC + FUT'

METATHESIS d + i + fu + h + m + ?ma

H NASALIZATION 3 [d + i + fu + M + m + ?ma] 'he will get fat'

Unless METATHESIS and H NASALIZATION 3 are included in the grammar, [difummaʔ] and [difuhmaʔ] cannot be insightfully related.

Now, for the form /d + ebofin + h + ?ma/, whose underlying final nasal is indeterminable (/n/), the correct surface form can be generated with the inclusion of NASAL ASSIMILATION in the derivation.

d + ebofin + h + ?ma 'NPST + stand + PROC + FUT'

METATHESIS d + ebofi + h + n + ?ma

NASAL ASSIMILATION d + ebofi + h + m + ?ma

H NASALIZATION 3 [d + ebofi + M + m + ?ma] 'he will stand'

1.4.4. Above, several environments were illustrated in which Highland Chontal voiceless nasals clearly derive from /h/. The form [Nniya] 'DEM (PLU) (ANIM) (PROX)' derives from the underlying form /hi + niya/. The form [gadamma] 'I soak' derives from the underlying form /ga + dan + h + ma/. The class of verbs taking the future 'process' suffix [Mm] on the surface are derived from underlying forms showing the usual /h/. Thus, the environments in which H NASALIZATION has been shown to occur may be summarized in the following schema. H NASALIZATION:

1. h ---> [N] / # _____ + n
2. h ---> [M] / C + _____ m
3. h ---> [M] / _____ + m + C

1.4.5. At this point, it seems desirable to collapse H NASALIZATION 1, 2 and 3 into a single rule of H NASALIZATION. If we define the string /h/[+nasal] as tautosyllabic only if preceded or followed by C or #, we can state the rule as follows, based on the data presented thus far.

C

H NASALIZATION: h ---> $\left[\begin{array}{c} +nasal \\ \alpha_{ant} \\ \beta_{cor} \end{array} \right] / \text{---} \left[\begin{array}{c} +nasal \\ \alpha_{ant} \\ \beta_{cor} \end{array} \right]$

CONDITION: /h/ and C are tautosyllabic.

This rule correctly excludes from nasalization such forms as [ga + le + h + ma] 'I + accompany + PROC + DUR'. Further, it correctly predicts that nasalization will occur in such forms as [N + niya] 'here + DEM (PLU) (ANIM)'. The Formative Boundary Convention (FBC) (Chomsky and Halle 1968, p. 364) allows us to write the rule without mentioning + boundaries: by the FBC, + is not indicated in a phonological rule if that rule applies morpheme internally as well as across a formative boundary. Evidence that H NASALIZATION indeed applies morpheme internally will now be presented. Consider the fol-

lowing forms. [nibaNnya] 'possible'; [meNnya] 'slope'; [ʔadaʔaNnga] 'yellow'; [ʔawennga] 'close' (ADJ); [leNnga] 'cliff'. These forms show the surface sequence V[+nasal][+nasal] C. Now consider the forms [cuMma] 'yesterday' and [ʔiNna] 'pig'. These are the only two forms attested showing the surface sequence V[+nasal][+nasal] V.

$$\begin{matrix} [-voice] & [+voice] \\ [-voice] & [+voice] \end{matrix}$$

If these instances of voiceless nasal can be derived from /h/, then all voiceless nasals will have been accounted for, and it will be possible to eliminate /N/ from the phonemic inventory. Thus, as the final step in eliminating underlying /N/ from the analysis, the derivation of morpheme internal voiceless nasals could be accomplished by a 'free ride'. A 'free ride' would be highly motivated since the sequences [Vh] and [V $\begin{matrix} [+nasal] \\ [-voice] \end{matrix}$]

are in complementary distribution morpheme internally.

[V $\begin{matrix} [+nasal] \\ [-voice] \end{matrix}$] occurs only before a voiced nasal, e.g. [meNnya] 'slope'. [Vh]

occurs elsewhere, e.g. [ʔafuhga] 'white'.

Since we wish H NASALIZATION to apply morpheme internally, the unified formulation of H NASALIZATION, utilizing the FBC, is correct. We can now account for the morpheme internal sequences [VNg] and [VNny] as follows.

| | | |
|-------------------|------------------|-----------------------|
| | mehnya | adaʔahnga |
| H NASALIZATION | meNnya | adaʔaNnga |
| GLOTTAL STOP PREF | ----- | ʔadaʔaNnga |
| | [meNnya] 'slope' | [ʔadaʔaNnga] 'yellow' |

(GLOTTAL STOP PREFIXATION is unordered with respect to H NASALIZATION.)

Note that these data conflict with Pulgram's hypothesized syllabification condition. Pulgram makes the following proposal: "a syllable can be bounded only by a phoneme or a group of phonemes that is phonotactically possible in word-initial or word-final position" (Pulgram 1970). [meNnya] 'slope', however, is a clear counterexample. A priori, this word could be syllabified as [meNn\$ya] or [meN\$nya]. In order for the form to comply with our definition of tautosyllabicity, thus permitting the application of NASAL ASSIMILATION, the first of these solutions has been selected in this analysis. However, neither solution meets Pulgram's syllabification condition. The first solution fails to meet the condition because a Highland Chontal word cannot end in [Nn], and the second solution fails to meet the condition because a Highland Chontal word cannot begin with [ny].

Before underlying /N/ is eliminated from the analysis, we must account for the forms [cuMma] and [ʔiNna]. These are the only attested forms in which voiceless nasals have not been accounted for, and surely, we do not wish to claim that /N/ is in the underlying segmental inventory of the language, but occurs in only two surface forms. Since the string /h/ C fails to meet the requirement of tautosyllabicity in these forms, one could list them as exceptional cases. Other solutions are also possible. As a first approximation, the following extra rule could be proposed.

C

H NASALIZATION -- EXTRA: h ----> $\begin{bmatrix} +nasal \\ \alpha ant \\ \beta cor \end{bmatrix} / V \text{ --- } \begin{bmatrix} +nasal \\ \alpha ant \\ \beta cor \end{bmatrix}$

Thus, we could propose the following derivations.

H NASALIZATION -- EXTRA
GLOTTAL STOP PREF

cuhma 'yesterday' ihna 'pig'
cuMma iNna
----- ?iNna
[cuMma] [?iNna]

Immediately, though, it becomes apparent that H NASALIZATION -- EXTRA is not correct. H NASALIZATION -- EXTRA does correctly generate the form [?iNna], but it does not correctly account for [?ihnu] 'dry season', (cf. [?ihul] 'dry'). Comparison of the last two forms suggests that there is a morpheme /ih/ 'dry' and that /ih + nu/ is the underlying form of [?ihnu]. However, H NASALIZATION -- EXTRA will generate from /ih + nu/ the incorrect surface form *[?iNnu] since by the FBC the environment V ____ [+nasal] is optionally interpreted as V ____ + [+nasal]. Furthermore, there are no forms attested in which /h/ nasalizes in the environment V + ____ [+nasal]. Consider the large class of deverbal nouns taking the nominalizing suffix [hma?].

| | | |
|-------------------------------|------------------------------|---------------|
| [dap ^f 'u] 'sweep' | [dap ^f 'u + hma?] | 'broom' |
| [?uci] 'grind' | [l + uci + hma?] | 'his grinder' |
| [cayk'o] 'sift' | [cayk'o + hma?] | 'sifter' |
| [?ugwi] 'spin' | [l + ugwi + hma?] | 'his spindle' |

At this point, a paradox presents itself. In the case of [meNnya], etc., the FBC was used to take a 'free ride', permitting the derivation of morpheme internal voiceless nasals from /h/. However, in the case of [cuMma] 'yesterday' and [?iNna] 'pig', an extra rule predicting nasalization in these forms would have to bear the condition "FBC does not apply". This paradox can be resolved in the following manner. All instances of H NASALIZATION in the language can be collapsed in the following formulation.

C

H NASALIZATION: h ---> $\left[\begin{smallmatrix} +nasal \\ \alpha ant \\ \beta cor \end{smallmatrix} \right] / \text{---} \left[\begin{smallmatrix} +nasal \\ \alpha ant \\ \beta cor \end{smallmatrix} \right]$

CONDITION: If the structural description is met by the string /V h C V/, the rule does not apply if a + boundary occurs between any two segments of that string.

This formulation of the rule correctly blocks assimilation in such forms as [?ih + nu] 'dry season', [?aɬ + gwa + h + ma] 'we are tired' and [cayk'o + hma?] 'sifter', since boundaries occur in the environment of the rule. Furthermore, it correctly predicts that assimilation does occur in [cuMma] 'yesterday' and [?iNna] 'pig', where no boundaries occur.

2. It has now been demonstrated that the eight problematical phonemes of Turner's phonemicization should be excluded from the analysis. Only the nineteen underlying consonant segments diagrammed under 0. are actually necessary. It was also shown that Highland Chontal provides a counterexample to Pulgram's syllabification condition. Note further that the condition on the final formulation of H NASALIZATION constitutes a counterexample to the underlying assumption of the FBC. After stating the FBC, by which + is not indicated in a phonological rule if that rule applies morpheme internally as well as across a formative boundary, Chomsky and Halle make the following formal clarification: "The converse is not true, however: a rule that applies to the string X + Z does not also apply to the string XZ" (Chomsky and Halle 1968, p. 364). They then make the following hypothesis: "Processes operating within formatives normally also apply across formative boundary, whereas processes may be restricted to the position where two formatives come together. Under this empirical assumption, the grammar must be complicated in some way to permit a process to apply only when there is no formative boundary present" (Chomsky and Halle 1968, p. 364). The rule of H NASALIZATION is just such a case.

FOOTNOTES

*. I would like to express my sincere thanks to Paul R. Turner, who provided me with a copy of his "Highland Chontal Grammar". His very careful and exhaustive scholarship has been an invaluable resource, without which this analysis would not have been possible. All Chontal forms and glosses used are cited in Turner 1966 and/or Turner and Turner 1971. All grammatical terms except for NPST ('nonpast') are those of Turner and Turner 1971.

I would also like to thank Margaret Langdon, who read and commented on several earlier drafts of this article.

Abbreviations used here are: ADJ=adjective, ANIM=animate, BEN=benefactive, CONT=continuative, DEM=demonstrative, DUR=durative, FUT=future, INT=intransitive, IMP=imperative, MOV=movational, NPST=nonpast, PLU=plural, PROC=process, PROX=proximal, REC=recent, TRANS=transitive. /ř/ represents tapped r and /r̃/ represents trilled r.

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1. A complete description of their distribution may be found in Turner 1967, p. 29.
2. Although difficult to indicate in current generative phonological notation, we can assume that underlying /?/ simultaneously deletes as a preceding consonant is glottalized.
3. Although Turner consistently transcribes the future suffix as [ʔma], e.g. [dibatsʔma] 'it will be sweaty' (where Turner's ts=c), I assume this is merely a convention and that [cʔ] is not truly distinct from [c].
4. In Turner 1967, p. 28, it is stated that /fʔ/ corresponds to the glottalized fricative [fʔ]. However, in Turner and Turner 1971, p. 319, it is stated that the glottalics are affricates, with the exception of /kʔ/. Clearly, a [p]/[pʔ] contrast results in a more symmetric surface phonetic system, since [t] does contrast with [tʔ]. Note further that for the Lowland dialect, Waterhouse and Morrison do describe glottalized /f/ as a "lightly glottalized affricate" (Waterhouse and Morrison 1950, p. 35).
5. /oɬ/ cannot be posited as the underlying form of the plural infix, since /ɬ/ remains unglottalized when infixed before /?/: [deʔa] 'oldest son' has the plural form [de + ɬ + ʔa] 'oldest sons'.
6. Evidence that /?/ should be included in the structural description of METATHESIS is provided by such forms as [fen] 'move' (INT) vs. [feʔne] 'move' (TRANS); [man] 'be full' vs. [maʔne] 'fill'.

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