A Structural Analysis of Mutation*

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Mutation processes alter marginal segments of lexical items in specific morphological or syntactic environments. Recent accounts treat mutations as melody alternations (Lieber 1984, 1987, Press 1979, Rice and Cowper 1984, Scott 1978). Lieber (1987), for instance, describes all mutations as the association of features from an independent mutation tier. This approach essentially treats the surface variation as one between segments or allophones of a phoneme. I argue that mutations are not reducible to manipulations of segment content. I treat the surface variation as syntagmatic: mutations are defined by the relation between elements within a domain. That is, they are the result of language prosody, of the conditions or rules operating on phonological information organized above the segment level.

I assume a set of prosodic constituents such as those encoded in the Prosodic Hierarchy in (1) (Selkirk, 1978, 1980, 1984, 1986, Hayes, 1984, Nespor and Vogel, 1980).

(1) Utterance Phrase
    Intonational Phrase
    Phonological Phrase
    Phonological Word

This paper does not address the operation of such a Hierarchy per se, whether it is a module interfacing between surface level syntax and phonetic interpretation (Selkirk 1986) or whether

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these prosodic units are the output of a compositional analysis of language structure (Schafer 1987). The Hierarchy merely lays out the domains within which mutations operate (v. Scott 1978, Rice and Cowper 1984, Conteh, Rice and Cowper 1986).

My primary evidence for the structural nature of mutation, discussed in section one, is mutation marking Phonological Phrases in the Papuan language Fore. Section two opens with a comparison between the Fore analysis and that of a traditional prosodic process, French liaison. I then discuss the prosodic nature of a mutation in Chemehuevi, previously analysed as a melodic alternation (Press 1978, Lieber, 1987). I conclude that mutations are prosodic phenomena and as such crucially involve the syllabification of elements and the instantiation of domain edges which define the relationship between phonological units.

1. Evidence from Fore.

Mutation in Fore is reported in Scott (1978) to mark the Phonological Phrasing of several constructions listed there. Phonological Phrases are traditionally defined as units marked phonologically but determined syntactically. A syntactic analysis of phrased constructions in Fore is provided in Schafer (1987), but the syntactic nature of the phrases will not be of concern here. Mutation, as charted below, does not cross Phrase boundaries. The phonemes in the first row of (2) surface as one of three variant types, (V), (Q) or (N), when they occur as the initial segment of a morpheme internal to a Phonological Phrase.

(2) Mutation in Fore

phoneme		p	t	k	m	n	y	w	V	s
	(V)	b	r	g	m	n	y	w	fusion	s
varient types	(Q)	?p	?t	?k	?m	?n	?y	?w	?V	s
	(N)	?p	?t	?k	mp	nt	nt	nk	ntV/nkV	s

where r = flapped /d/ and V = vowel/diphthong

Scott states that within a Phonological Phrase, the shape of a morpheme initial segment depends on the variation type of the morpheme preceding it. For example, in (3) the m of ma `soil' surfaces as an m when preceded by the (V) morpheme te?te `red', as an ?m when preceded by the (Q) morpheme ka:sa `new', and as an mp when preceded by the (N) morpheme tunu `dark'.

(3) a.	te?te -V	te?te + ma-e	te?temawe	* te?te?mawe
		red soil	It's red soil.	* te?tempawe
b.	ka:sa -Q	ka:sa + ma-e	ka:sa?mawe	* ka:samawe
		new soil	It's new soil.	* ka:sampawe
c.	tunu -N	tunu + ma -e	tunumpawe	* tunumawe
		dark soil	It's dark soil.	* tunu?mawe

Te?te, ka:sa, and tunu are classified as (V), (Q) and (N) morphemes solely by their effect on the following morphemes.

The modeling of mutation as a lexical process ignores two clear patterns in the data. First, as illustrated by the examples in figure (4), type (V) alternation occurs internal to morphemes as well as between morphemes. Occurences of voicing or fusion internal to a morpheme are clearly independent of whatever mutation has targeted the morpheme's initial segment.

(4)	(V)		(Q)		(N)		
a.	yaga:rarawe	b.	ko?tarawe	c.	tu?tarawe	d.	*yaka:
	yaga: tarawe		ko tarawe		tu tarawe		*tatawe
	pig two		bag two		axe two		
	It's two pigs.		It's two bags.		It's two axes.		

The non-occurance of forms as in (4d) shows that consonants voice whenever they are intervocalic and vowels fuse whenever they are adjacent within a phonological phrase. Thus type (V) `mutation' contrasts with types (Q) and (N) which occur only at morpheme boundaries within phonological phrases.

Second, as illustrated in (5), type (Q) mutation is always realized as a glottal stop. Hence morphemes triggering type (Q) alternations can be analysed as containing a morpheme-final glottal stop. Its surface distribution is accounted for by the stipulation against phrase-final codas in (6), necessary apart from this analysis as no codas surface phrase-finally though they appear morpheme-internally as in ya?ku `fire', tu?na: `dish', and ke?pa `sand'.

(5)					
a.	ko?tarawe	b.	ko?maeye	c.	ko?antowe
	ko tarawe		ko maeye		ko antowe
	netbag two		netbag gets-3s		netbag diminutive
	It's two netbags.		He gets a netbag.		It's a small netbag.

(6) * phrase-final codas

These two generalizations alleviate the need for an arbitrary treatment of (Q) and (V) mutation. (Q) and (V) result when the underlying shape of the morphemes are subjected to the phonological rules and conditions of the domain. The Phonological Phrase is the domain of Fore voicing and vowel fusion -- in terms of Selkirk (1980) these are Domain Span Rules. In addition, condition (6) operates at the Phonological Phrase level -- again in the terms of Selkirk (1980) this is a Domain-Limit Rule.

In the remainder of this section, I propose an analysis of type (N) that is in keeping with the phonological analysis introduced thus far. As with the analysis of type (Q), I propose the morphemes triggering (N) alternations contain a morpheme-final segment whose realization is regulated by the prosody of the mutation domain, in its sensitivity both to the condition in (6) and to rules of syllabification which I show operate across the Phonological Phrase.

1.1 Type (N) mutation.

The surface realizations of type (N) mutation differ depending on whether the target segment is an oral stop, a nasal stop, a glide or a vowel. An example from each of these sub-classes is given in figure (7). When (N) alternations target a nonsyllabic sonorant, the m of maeye in (7a) or the y of yao in (7b), the nasal or glide is replaced by a prenasalized stop. When the target is an oral stop, such as the t of tara in (7c), a glottal stop surfaces before the segment.

(7) Example Fore phonological phrases
illustrating sub-types of (N)

a. tu mpaeye
tu maeye
axe gets-3s
He gets an axe.

b. tunu ntaowe
tunu yao -e
black forest -mood
It's a dark forest.

c. ma: nkaogi na:ma ?tara
ma: aogi na:ma tara
this good house two
these two good houses

d. naninta: gaba:re nkamuwe
naninta: kabare a-mu -0 -u -e
food Kabare 3s-give-pres-1s-mood
I give Kabare food.

When a vowel initial morpheme is targeted, such as the verbal amuwe in (7d), a prenasalized stop surfaces before that segment, just like the glottal stops of (Q).

I analyse this mutation as the affect of the Phrase-Final Coda Condition, (6), on morphemes with underlying, final prenasalized stops. (6) accounts for the failure of these segments to appear phrase finally. The surface realizations charted in (2) and depicted in (7) are accounted for by a syllabification process made sensitive to sonority. I argue syllabification in Fore operates to attain the maximal sonority difference between an onset and its nucleus, given the sonority hierarchy in (8). This characteristic has been argued for preferred syllables crosslinguistically (Clements, 1987).

(8) A Sonority Hierarchy (adapted from Clements, 1987)

Obstruent < Nasal < Glide < Vowel

I formalize syllabification after clarifying the assumptions of my analysis in section 1.2.

1.2 Representation of the trigger and other assumptions.

The analysis assumes that representations of segments are modeled as feature geometries. For the purpose of this discussion the geometry in (9) suffices, although a complete account of fusion and assimilation may require an articulated Place Node. Represented in (10) is a morpheme-final prenasalized stop, the proposed trigger of type (N) mutations.

(9) Feature geometry (Clements, 1985)

```
Root                o
                   / \            [g] = a subset of {[voi]}
Laryngeal       o [g] \           [h] = a subset of {[son],[cont],[nas]}
Supralaryngeal         o [h]      [i] is a subset of {[lab],[cor],[hi],
     (SL)              |                                [lo],[bk]}
Place                  o [i]
```

(10) Proposed trigger: morpheme-final prenasalized stop

```
                o             Root
              /   \
     [+nas] o       o [-son]  Supralaryngeal
```

The representation in (10) avoids technical difficulties created by representing the prenasalized stop with either an underlying [sonorant] contour or an underlying branching Root. The first of these representations, given in (11a) below is problematic for theories of radical underspecification as it posits more than one underlying value for the feature [son]. The represention in (11b) has essentially the same problem as the first: assuming that structure does not exist devoid of content (v. Archangeli and Pulleyblank, 1986) the Root may not branch minus the content requiring the branch, that is, minus the dual specification for the feature [sonorant].

```
(11)      a.    o             Root         b.    o
              /   \                            /   \
      [+son]o       o[-son]   SL              o      o [-son]
```

Since the analysis otherwise relies on radical underspecification theory, such as that in Archangeli and Pulleyblank, 1986, I have chosen to sidestep this problem by employing the feature [nasal], to which [+sonorant] redundantly associates.

I minimally distinguish the segments of Fore by the partial specifications given in the phoneme inventory in figure (12).

(12) A Fore phoneme inventory

	p	t	k	m	n	s	?	u	o	i	e	a	a:
cont	-	-	-										
son	-	-	-			-							
nas				+	+								
lab	+			+				+	+				
cor		+			+								
hi								+		+			
lo													+
bk			+									+	+

where /y/ and /w/ are positional variants of /i/ and /u/

Also in keeping with Archangeli and Pulleyblank, 1986, I assume

Default Rules assign values to segments for inventory features that complement the values found in the inventory, and that these operate after more specific Redundancy Rules.

1.3 Sonority sensitive syllabification

The Fore syllable template takes the shape XNX (following Levin, 1983, cf. /?/CV in Scott, 1978). The template applies as required by Prosodic Licensing and under the Universal Core Syllable Condition (UCSC) which favors onset formation (see Itô, 1986, on both these notions as well as the use of syllable templates, earlier work on these ideas includes, Kahn, 1976 on syllable rules; Selkirk, 1978 on syllable templates).

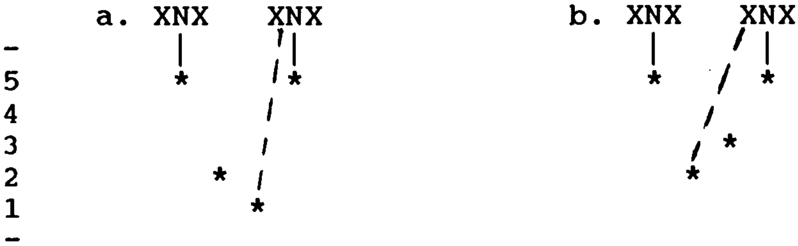
When parsing a series of syllabic and nonsyllabic segments, represented for clarity as a string ...XNXNXN..., the conditions are sufficient. Yet they are insufficient for parsing a string ...XNXXN..., created when a (Q) or (N) morpheme is concatenated with a glide, nasal, or stop initial morpheme. The XNX template parses any two adjacent Xs into two syllables, XNX.XN; but this results in incorrect surface structures in (N) mutation: it predicts prenasalized stops in codas before oral stops, glides and nasals. For this reason I argue mapping to the Fore syllable template is regulated by the Sonority Cycle (Clements, 1987).

The evidence is as follows. In (N), the partially specified prenasalized stop appearing before a vowel syllabifies as XN, an unsurprising result of the UCSC. More pertinent is the mapping of the prenasalized stop to the onset position of the template before nasals and glides, but not before oral stops. The prenasalized stop is more sonorant than an oral stop, but less sonorant than a glide or nasal. In each case the least sonorant segment is mapped to the onset position creating the preferred syllable according to the Sonority Cycle (Clements, 1987) -- one with a maximal rise in sonority from the syllable onset to its peak. (N) mutation in surface onsets then is attributable to the regular working of the sonority hierarchy.

The formal operation of syllabification is schematized in (13) and depicted in derivations (14) to (17). Syllabification assigns a template to a string as sonority dictates, with peaks aligned with N slots. Thus the sonority curve of the string acts as an interface between template and feature content: though I present no arguments, I am not assuming an underlying skeleton, rather a skeleton results from syllabification (cf. Carrier-Duncan 1984). This device simplifies the figures below.

Figure (13) schematizes onset formation when two nonsyllabic elements occur between Ns. The sonority cycle dictates that the template onset align with the least sonorant feature set. Two possiblities exist: the leftmost segment can be either more or less sonorous than the rightmost segment. Syllabification occurs as in (13a) when the leftmost segment is more sonorous; when it is less sonorous, syllabification occurs as in (13b). The y-axis in (13) measures level of sonority from least to greatest: 1. stops 2. prenasalized stops 3. nasals 4. glides and glottal stops and 5. vowels.[1]

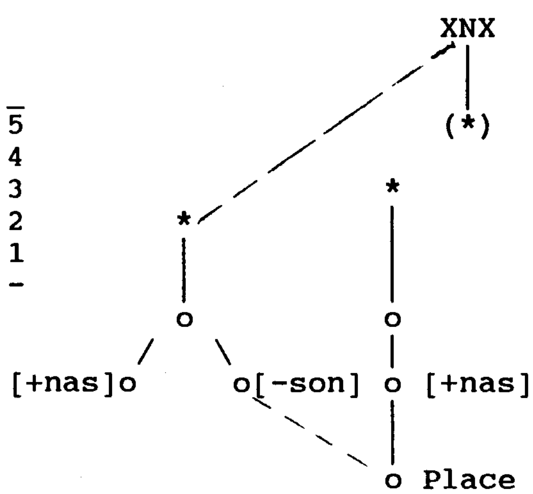
(13) Onset formation sensitive to sonority



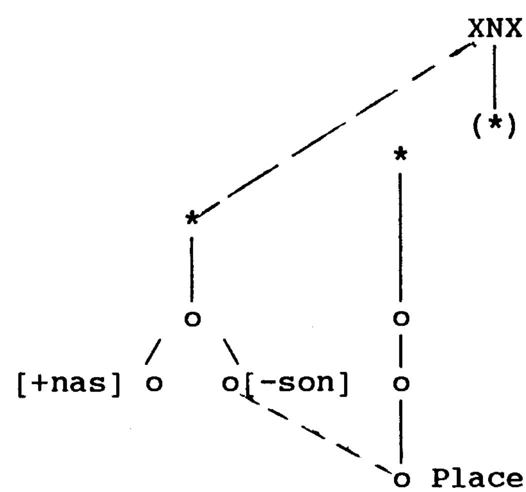
as (4c) t<u>u?.ta.</u>ra.we — It's two axes. (3c) tu.n<u>u.mpa.</u>we — It's dark soil.

The template associates with segments through their projection onto the sonority curve. Segments not mapped to the template are not prosodically licensed. This will account for onset formation in (N) mutated forms, as illustrated in the derivations in (14) and (15). In figure (14) a prenasalized stop occurs before a nasal, as in (7a) <u>tu</u> + <u>maeye</u> --> <u>tu mpaeye</u>, and in (15) it precedes a glide, as in (7b) <u>tunu</u> + <u>yaowe</u> --> <u>tunu ntaowe</u>. I assume the morphemes <u>tu</u> and <u>tunu</u> both have final prenasalized stops. Only the relevant segments, the prenasalized stop and the glide or nasal following it, are drawn in figures (14) and (15). In the sonority curves, peaks are also recorded.

(14) (N) before a nasal



(15) (N) before a glide

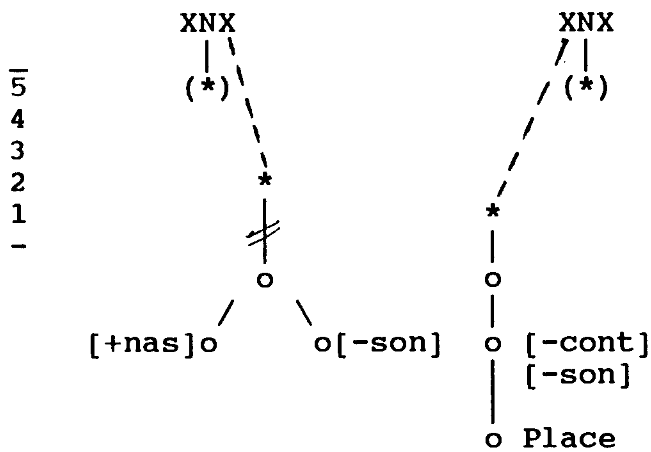


I handle these two cases together because the derivations are essentially the same. In both cases two segments occur before sonority peaks, and the leftmost is least sonorant. Therefore, syllabification assigns the leftmost segment the onset X slot. These prenasalized stop onsets assimilate the place specifications of the floating feature sets via spread.[2]

While this accounts for onset formation, it does not predict the appearance of the glottal stop when a prenasalized stop precedes an oral stop, as in (13a). Since codas are the fulfillment of a set of conditions, I attribute the glottal stop to the complete lack of conditions on the features of Fore codas. My intent is to treat Fore codas as units of quantity only: a timing unit (projection on the sonority curve) may be mapped into a coda, but the coda position is blind to quality and interprets no features. Featureless timing units surface in Fore as glottal stops.[3] In the derivation in (16), I use delinking notation to illustrate the failure of the coda to read feature content.

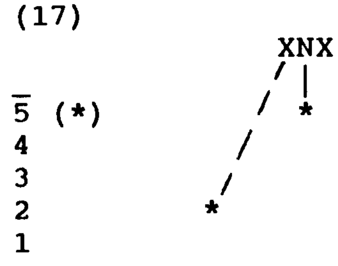
When a prenasalized stop precedes an oral stop, as in (7c) na:ma + tara, two segments again intervene between sonority peaks. In this case the rightmost segment is lowest in sonority: its syllabification in an onset will result in a maximal rise. Thus the template X onset maps with the rightmost segment, as shown in (16). The projection of the leftmost segment maps into the coda position which cannot interpret its content. It surfaces as a glottal stop, as in (7c) na:ma ?tara. Codification is not an option for unlicensed projections in (14) and (15) because of crossing constraints (Goldsmith, 1976, Kahn, 1976).

(16) (N) before an oral stop



In the final derivation to consider, the prenasalized stop appears before a vowel initial morpheme. To satisfy the template and the UCSC the single segment between peaks is syllabified as an onset, as in (17). Hence in (7d) when kabare precedes amuwe the surface form is kabare nkamuwe.

(17)



1.4 Synopsis

In the above sections I have shown that (N) mutations can be analysed as the same prosodically governed alteration apparent in (Q) given a syllabification process sensitive to sonority operative in the mutation domain. In this manner the type (N) alternation is subsumed in the prosodic analysis given in section one above. Syllabification and the prosodic condition in (6) barring phrase-final codas accounts not only for (Q) alternations but also for (N) alternations: (Q) and (N) morpheme-final segments are not realized phrase finally, but appear phrase internally as determined by syllabification.

What is called mutation in Fore is not mutation in any true sense of the word. It is the result of phonological functions operating in a domain, the Phonological Phrase. These functions create structure (syllabification) and regulate structure at a domain edge (the Phrase-Final Coda Condition). Thus mutation is a prosodic phenomenon: manipulation of segment content, for instance in the derivation of place features in (N), is secondary to structural, domain-dependent operations which account for the data. Syllabification and particularly syllable characteristics within a domain have traditionally and cross-linguistically been associated with language prosody and phrasing (Vaissière 1983, among others). Given the analysis in this section, mutation no longer falls outside the purview of these phrasing processes.

2. Mutations as phrasing.

The prosodic analysis I propose takes advantage of the structural characteristics of the domain into which Fore segments are organized. Since that domain is defined by syntax as well as by certain phonological processes, it is appropriate to label it a Phonological Phrase, and Fore mutation a Phrasing process.

In this light Fore mutation appears similar to French liaison, the following examples of which are taken from Selkirk, 1986. The underlined segments show where liaison -- onset syllabification between lexical items -- occurs within the bracketed domains, but notice also where it does not occur.

(18)
a. (Sais-tu) (quand ils inviteront) (un autre grand artiste)?
Do you know when they will invite another great artist?
b. (Ces tres aimables enfants) (en ont avale).
These very nice children some-have-drunk.

There is no liaison between the t of inviteront and the u of un in (18a); nor is there liason between the s of enfants and the e of en in (18b). When the morphemes undergoing liaison are uttered in isolation, or are otherwise phrase final, the coda is not pronounced, Ils inviteron~~t~~., Les enfan~~ts~~., likewise, Quan~~d~~?, Aimable~~s~~., Il est gran~~d~~., and so forth. Thus again the rule governing the realization of a final element operates in a domain. Both Selkirk (1972, 1986) and Kaisse (1985) argue the domain can be syntactically defined, Morin and Kaye (1982) argue the opposite, yet they do not deny that liaison is a phrase phenomena. Whether the domain for liaison is predictable or not, the phenomena is classified as phrasing, not as mutation. Yet it is the result of the same processes seen in Fore, syllabification and a coda condition: onset formation cannot cross a phrase boundary and rather than indiscriminately syllabify these edge segments the language fails to license them.

It is important to determine whether the Fore data is exceptional. The thesis of this paper is that mutation is structural in nature, that is, a result of the relation between elements within a domain. This relationship between phonological units is established in part by syllabification. The Fore analysis shows that mutation results from a structural process, syllabification, which implies that other mutations may be similarly reanalysed. Though this claim cannot be unconditionally supported in this brief report, below I sketch a structural analysis of mutation in Chemehuevi, previously analysed as a melodic alternation (Press, 1978, Lieber, 1987).

2.1 Chemehuevi.

The analysis I propose for Chemehuevi derives mutation from the operation of syllabification, particularly as it applies to morpheme-final elements. Chemehuevi is a Southern Numic language closely related to Southern Paiute. I assume an XV syllable given the fact that the majority of surface syllables in the lexicon provided by Press (1978) take this shape. Press notes that V initial lexical items are preceded by a glottal stop, evident in her lexicon when such items occur in compounds: <u>asi-?a</u> \`shell, skin' but <u>aaja-?asi-vi</u> \`turtle shell'.

Further, this lexicon of over 9,000 entries includes only 19 with consonant clusters, 13 of which are internal clusters all of which involve a non-syllabic sonorant followed by a glottal stop. Stress facts, recorded in the lexicon as marks preceding the stressed syllable, indicate that such clusters are actually glottalized consonants or at least tautosyllabic. Stress is predictable on the second syllable unless the first is long. Stress marks occur on disyllabics with clusters before the first cluster element, indicating syllabification as in (19).

(19)

ju.m?a	tired/dead (pl)
ti.m?a	bake
ha.w?isi	sneeze

Consonant final lexical items are the result of a rule of final voiceless vowel deletion. Even in these cases there appears to be evidence that the final vowel position is not deleted though the features associated with it are. Compensatory lengthening is evidenced in monosyllabics undergoing final vowel deletion: <u>moo</u> \`father' --> <u>mo</u>, phonetically [<u>moo</u>]; <u>paci</u> \`daughter' --> <u>pac</u>, phonetically [<u>paac</u>].

Assuming then an XV template[4], consider the mutation charted in (20) which occurs between affixes and their bases. The domain of this mutation appears to be a Phonological Word, since these effects are not realized across affixes which are attached to different bases. As with the Fore data, the standard analyses of this mutation (Press, 1979, Lieber 1987) rely on classifying morphemes according to the type of mutation they induce, stops, spirants, or nasals. The morpheme classification analysis of Press (1979) is exemplified in (21). Lieber's (1987) method assigns each set different features on her mutation tier.

(20) Chemehuevi

Stop series	Voiced continuants	Nasal clusters
p	v	mp
t	r	nt
k	γ	ŋk
k^w	$γ^w$	$ŋk^w$
c	c (~nc)	nc
s	s	s
m	w	m
n	n	n
ŋ	ŋ	ŋ

(21)

a. stops: pinka	pinka + tika keep-on eat	-->	pinka<u>t</u>ika keep on eating	*pinka<u>r</u>ika *pinka<u>nt</u>ika
b. nasals: ni	ni + po?otu?i person teach (Vtr)	-->	ni<u>mp</u>o?otu?i teach (Vintr)	*ni<u>v</u>o?otu?i *ni<u>p</u>o?otu?i
c. spirants: na	na tika reflex eat	-->	na<u>r</u>ika feed oneself	*na<u>t</u>ika *na<u>nt</u>ika

The critical point concerning these data is given in Press's text: neither the spirants nor the prenasalized stops ever occur word initially. The data can be accounted for as follows. Spirantization occurs by feature spread intervocalically in derived environments. Lack of spirantization indicates this intervocalic environment is no longer met: a morpheme final element, a nasal in the case of morphemes such as <u>ni</u> and a non-nasal in the case of morphemes such as <u>pinka</u>, intervenes, yielding underlying consonant clusters, <u>pinkaCtika</u> and <u>niNpo?otu?i</u>. Syllabification regulated by an XV template licenses only a single X before a sonority peak. The rightmost element in the cluster is syllabified, Supralaryngeal spread derives a prenasalized stop in <u>nimpo?otu?i</u>, but no consonant geminates-- no spread of root nodes -- occur in the language. (See Crowhurst 1987 for a similar analysis of Southern Paiute data.)

While the details of the Chemehuevi analysis are scanty, a viable alternative to the standard account has been proposed. The structural analysis shows this mutation to be prosodic, domain sensitive and rooted in syllable structure. Mutation rests on which morpheme-final element is prosodically licensed by Chemehuevi phonology.

2.2 Previous work.

The work of Clements and Keyser (1983) and Keyser and Kiparsky (1984) on Finnish mutation is implicitly a structural analysis. One instantiation of this mutation is the alternation between single and double voiceless oral stops, shown in (22).

(22) Finnish mutation (Olli 1958, Whitney 1956)

katto	roof	katolla	on the roof
kirkko	church	kirkon	of the church
nappi	button	napit	buttons
takki	coat	takin	of the coat

An informal statement of the rule, found in traditional grammars (Whitney 1956, Olli 1958) as well as in the work cited above, is that degemination occurs before a branching rime. A sensitivity to weight is also obtained in Finnish prosody, in the distribution of secondary stress and in the distribution of tautosyllabic consonant clusters which may appear only in the coda of the initial syllable (Whitney 1956). Thus structural organization, not feature specification, would be the logical starting point for an analysis of the weight dependent alternation labeled Finnish mutation. (Just such a prosodic approach is taken by Lehiste (1966) in her work on "phonemically distinct quantity" in another Baltic-Finnic language, Estonian.)

These structural analyses are similar in approach to the work in prosodic analysis undertaken by the London School of Oriental and African Studies under J.R. Firth (Palmer 1970) who argued for analysing phonetic features which occur at boundaries as prosodies of sentences and words (Firth 1948, Robins 1957). In linking mutation to syllabification, I treat it as precisely this sort of prosodic phenomenon.

3. Conclusions.

Given the above discussion I conclude that mutations are the result not of content manipulation, but of structural rules and conditions operating to create prosodic domains. These structural operations are twofold: those such as syllabification establish relations between units, while others strictly define domain edges. The analysis based on these operations predicts the identifying characteristic of mutations: mutations pattern with structural junctures, occuring in data considered here at syllable or morpheme junctures, and failing to occur in these data at Word or Phrase junctures.

Endnotes.

1. Sonority Profiles are traditionally defined according to the features of segments (Sievers, 1881, Jespersen, 1904, Chomsky and Halle, 1968, Foley, 1972, Zwicky, 1972, Hankamer and Aissen, 1974, Hooper, 1976 as cited in Clements, 1987). I assume such a device underlies this ranking. Clements (1987) provides an algorithm based on contrastive specifications for major class features syllabic, vocoid, approximant and sonorant. Spring (in progress) argues for an alternative based on the number of features per segment given radical underspecification theory: the greater the number of underlying features the lower the sonority.

2. The prenasalized stop realized before vowel initial morphemes also assimilates rightward: Mokenti `to Moke' from the place name Moke and the allative i, and ika:ntanawe `buying' from the verb ika: and the nominalizer ena, but nkamuwe in (7d), and tununkaene `It's a black seed.' from the adjective tunu, the noun ae and the indicative marker e.

3. The /?/ is the only coda in Fore, yet this cannot be expressed in terms of Itô's conditions preventing prosodic licensing, for underlying prenasalized segments in type (N) mutations before oral stops would be subject to stray erasure, rather than surface as /?/. Codification in Fore fails only when a segment projection is unavailable -- it is conditioned only by quantity, not by the quality of the segment.

4. Levin (1983), in work on Southern Paiute reduplication, assumes two template slots for prenasalized stops. Press (1978) assumes one in Chemehuevi, though the pertinent data is similar: timpi `rock', tintimpi `rocks', *titimpi; kani `house', kankani `houses', *kakani. If Levin is correct, Chemehuevi licenses a homorganic nasal coda, predictable with an XVX template where a coda associated with with a [+consonantal] segment is ill-formed (following Itô 1986 on Ponapean). Yet a separate nasal segment would also account for this data if reduplication occured prior to syllabification, an ordering that is independently motivated by mutation -- affixation must precede syllabification. Moreover stress marks in Press indicate that prenasalized stops are not heterosyllabic: na.mpa `foot', ta.ntivait `south', a.nkaga `red (verbal)'. Given counterevidence however the structural analysis of mutation would require only minor adjustments.

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