AN AUTOSEGMENTAL APPROACH TO METATHESIS IN ROTUMAN

Niko BESNIER*

University of Illinois at Urbana-Champaign, USA

Rotuman phonology is characterized by a complex system of rules involving the morphologically-conditioned metathesis of word-final vowels with the immediately preceding consonant, as well as umlauting, vowel shortening, and diphthongization, which apply disjunctively to the output of the metathesis rule. This paper shows that Autosegmental Phonoly provides a simpler account of these rules than previous descriptions. Positing Rotuman to have separate vowel and consonant tiers, this analysis shows that Rotuman phonology has a rule of V-truncation at the level of the CV skeleton, which triggers the leftward reassociation of the orphaned feature matrix to the preceding V-slot. The resulting double associations are resolved with the help of a series of disjunctive rules that refer to the featural conflicts between the two vocalic segments associated to the same V-slot. This account is superior to other accounts because of its simplicity and of the fact that it captures the anticipatory nature of what is traditionally described as metathesis.

1. Introduction

The theory of Autosegmental Phonology (AP), whose precursor, Suprasegmental Phonology, was initially motivated as an answer to problems posed by the independence of tone from segmental systems (Leben (1973)), has developed in the last decade into a theory whose explanatory power extends to many basic issues in phonology (Goldsmith (1976)). Besides allowing powerful characterizations of such previously problematic features as nasality (Hyman (1982)), vowel harmony (Clements and Sezer (1983)) and accent (Haraguchi

(1977)), to name but a few, the AP framework has also proved useful in areas in which morphology plays a determining role for the phonology of a language, like, for example, reduplication phenomena (Marantz (1982), Broselow and McCarthy (1983)). This paper presents an autosegmental analysis of metathesis, another phenomenon that crucially involves both the morphological and the phonological systems of a language. Metathesis, being much less prominent in its cross-linquistic distribution as a productive process than other morphological phenomena (Ultan (1978), Sohn (1980)), has not received much attention from students of AP to date.

In this study, I show that metathesis processes at play in one language, Rotuman, can be described with maximal simplicity in the AP framework, unlike more traditional models, in which a description of Rotuman metathesis requires a complex array of disparate rules. In this analysis, it will be shown that Rotuman metathesis can be reinterpreted as a V-truncation process at the level of the CV-tier, which triggers the reassociation of the orphaned vowel with the previous vocalic segment. This analysis posits that vowels and consonants are on separate tiers in this language; similar analyses have been proposed to solve various problems in other languages.

Rotuman is spoken by the 3400 inhabitants of the island of Rotuma, halfway between Fiji and Tuvalu, in the Central Pacific. The language is well-known in the areal literature because of its unusual characteristics in the context of general typological patterns found in the areas and the historical problems that are involved in characterizing these. Rotuman was at first thought to be genetically distant from the languages spoken on contiguous island groups (Dyen (1965)), but more recent work (Pawley (1979)) has shown that it is in fact closely related to other languages of the Fijian dialect chain. One feature of Rotuman worth mentioning here is the fact that the language appears to be the product of the convergence of several linguistic traditions, having received much influence on different levels of its structure from a variety of languages, Polynesian languages such as Tongan in particular (Biggs (1965), Geraghty (1983), Grace (1967), Milner (1971)).

Unfortunately, not much first-hand information is available on Rotuman. All analyses to date (Anttila (1972: 64–66), Basbøll (1982), Biggs (1959), Cairns (1976), Haudricourt (1958a,b), Janda (1984), Laycock (1982), Milner (1971)) have relied for data on Churchward's (1940) dictionary and grammar, a good but sometimes confusing description of the language. In particular, Churchward's imprecise characterization of Rotuman vowels and stress has given rise to widely divergent interpretations in the secondary literature. This study is based on field research which I conducted in 1985. Some of the data I

was able to elicit differs from data reported in Churchward's work, a fact that I shall not attempt to explain here. Where my data differ from what can be inferred from Churchward's work, I have presented my data.

2. The Data

Virtually all Rotuman words, whatever grammatical category they belong to, occur in two allomorphic forms (or 'phases', as Churchward (1940) calls them), that are phonologically derivable from one another:[1]

(1) hepa   hyap   'broad'
     fika   fyɔk   'number' (from English 'figure')
     mamhula mamhwɔl 'with bulging cheeks'
     karere   karer   'wild bean'

The semantic difference between the two forms is one of definiteness and specificity (or 'referentiality' in the sense given to the term by Donnellan (1966)). The words in the left-hand column of (1) are definite and specific, while the forms of the right-hand column are indefinite, unspecific, or both. I shall use the terms *complete* and *incomplete* respectively to refer to these variants, in keeping with the traditional terminology first devised by Churchward (1940).

All content words have complete and incomplete forms, not just nouns. The reason for this is straightforward: it is the final word of NP constituents that is marked for definiteness/specificity. Thus, adjectives, adverbs, and any element

---

[1] The transcription system used in this paper differs from the two standard Rotuman orthographies, one of which obscures the differences between several phonemes and allophones, and the other (developed by Churchward (1940)) involves a cumbersome system of diacritics. The vowel systems reads as follows:

	Front unrounded	Front rounded	Central unrounded	Back rounded
high	i	ü		u
mid-high	e	ø		o
mid-low	ε			ɔ
low	æ		a	

Slight allophonic variations exist between the mid-high and the mid-low vowels, the mid-high allophones occurring if the following syllable contains a high vowel, and the mid-low allophones occurring elsewhere. Antilla (1972: 64–66) claims that Rotuman /a/ has an allophone [ɑ] that occurs before the sequences /ʔo/ and /ho/, but I found no evidence of such an alternation. The symbol j stands for an unvoiced palatal affricate; all other consonant symbols are IPA symbols.

that may be the last element of a noun phrase or of a relative clause must have complete and incomplete forms. All non-final lexemes of an NP are in the incomplete form, including the head of relative clauses. Compare the complete forms of the noun phrases in (2a) and (2c) with the incomplete forms in (2b) and (2d):

(2a) iʔa
     'the fish'   (complete form)
(2b) iɔʔ
     'some fish'   (incomplete form)
(2c) [iɔʔ   [ne ŋou pō ʔe asa   ]]
     '[The fish [that I caught yesterday]]'
     (*iɔʔ* incomplete form, *asa* complete form)
(2d) [iɔʔ   [ne ŋou pō ʔe as   ]]
     '[Some fish [that I caught yesterday]]'
     (*iɔʔ* incomplete form, *as* incomplete form)

The syntactic sensitivity of this morphophonological process is found with exactly the same domain in Tongan, a Polynesian language from which Rotuman borrowed extensively at the lexical level in prehistorical times (Biggs (1965)). In Tongan, specificity is marked by the phonemic gemination of the last vowel of the right-most word of an NP (the so-called definitive accent; Churchward (1953), Clark (1974)):

(3) TON [ko e tamasiʔi [naʔe holā   ]]
        '[It is the boy [that ran away]]'

Both phenomena are undoubtedly akin to each other, and the specific forms of words in both languages is posited as having arisen historically as the result of suffixal deictic particles that dropped after having attracted the strictly penultimate stress in both languages to the last vowel of words marked for specificity. Residues of such particles are found in both languages (e.g. Rotuman *-ta* 'one', Tongan *-ni* 'this', etc.), but their effect on the morphological shape of the base to which they are affixed is different in Tongan and Rotuman:[2]

---

[2]   I shall ignore here the otherwise interesting questions that these two processes raise with respect to the level of the morphophonological derivation at which lexical insertion into the syntax is to take place, problems that are also raised, for example, by the 'pausal' forms of words in classical Hebrew (Dresher (1983)).

(4) ROT fɛeaŋ Rotuma   'the Rotuma language'
         fɛeaŋ Rotwam ta (ditto)
    TON ko e fale   'the house'
         ko e falē ni   'this house'

The incomplete forms of Rotuman words are derivable from the complete forms through the following processes: (a) a rule of metathesis inverting the order of the last vowel of the word and of the immediately preceding consonant, if there is one; (b) a rule of vocalic assimilation that reduces certain vocalic pairs obtained through metathesis to a single vowel whose phonological characterization is a combination of the distinctive features of the two vowels in the underlying pair; (c) a rule of reduction that changes the first vowel of other vocalic pairs into a glide, thus reducing the underlying pair to a diphthong; and (d) a rule of length reduction that shortens clusters of similar vowels obtained from (a) to single vowels.[3]

The following illustrate each of these rules:

(5)   *Complete form*   *Incomplete form*
    (a)   fɛeŋa   fɛyaŋ   'speech'
          hosa   hwas   'flower'
    (b)   forɔsi   foræs   'to spread out'
          hose   høs   'oar'
    (c)   rito   ryot   'to glitter'
          una   wɔn   'fish scale'
    (d)   hanuju   hanuj   'tale'
          toto   tot   'blood'

[3]   Vowel length is otherwise phonemic in Rotuman (it is marked here with a macron, in keeping with standard practice in the description of Oceanic languages):

nono	non	'to grip'
nōnō	nōnō	'to stay'
ma	ma	'and; just'
mā	mā	'to believe'

Long vowels are found in all positions in words, and are realized by the prolongation of the articulation of the vowel to approximately two morae.

High vowels that receive tertiary stress are also realized as glides in non-metathetic environments (as in *lelei* [leley] 'good'), although I have not transcribed them as such in this paper, since the phonetic realization of these vowels is not important for this discussion.

The underlying vowels of Rotuman are /i e a o u/. Through an assimilatory process independent of the metathesis process outlined above (since it occurs in both metathesized and complete forms, as well as word-internally), /a/ becomes [ɛ] if the vowel of the following syllable is /e/:

(6) *Surface form   Underlying form*
    vɛve   vave   'fast'
    fɛeŋa   faeŋa   'speech'
    vɛe   vae   'to divide'
    mɛneʔa   maneʔa   'to fool around'

In some words, this process applies cyclically leftward to all low vowels within the same morpheme, as long as a non-low vowel does not intervene between the triggering vowel and the target low vowel. The words in (7a), whose underlying form is of the shape /(C)a(C)a(C)e/, illustrate the cyclicity of the rule. However, the rule is lexically idiosyncratic, as witnessed by the monomorphemic words in (7b), which do not undergo the rule even though they meet its structural description:

(7)   *Surface form   Underlying form*
  (a) tɛvɛke   tavake   'tropic bird'
        sɛsɛve   sasave   'flying fish sp.'
        kɛlɛne   kalane   'gallon'
  (b) marɛʔe   maraʔe   'village green'
        tiavɛe   tiavae   'tree sp.'

The description of these rules makes no reference to the consonants that intervene between the low vowels. The presence or absence of intervening consonants, and the nature of these consonants simply do not affect the rule. The cyclicity of this rule is discussed by McCarthy (1986: 215–217) as evidence for the Obligatory Contour Principle, which states that adjacent identical elements are prohibited on melodic tiers. It also provides independent supporting evidence for the autosegmental approach proposed in the next section.

Another rule of allophony changes /a/ to [ɔ] if the vowel of the following syllable is either /i/ or /u/, and is illustrated in (8a). This rule is even more idiosyncratic than the previous rule, whose cyclicity only appears to be lexically determined. Whether or not this rule applies is lexically determined, and there is no phonological conditioning factor that predicts whether it

applies or not. The words in (8b) are examples of words which do not undergo the rule:

(8) *Surface form* *Underlying form*
   (a) rɔni   rani   'daylight'
          sɔi   sai   'free'
          mɔuri   mauri   'alive'
          vɔruʔu   varuʔu   'to nag'
   (b) ranisi   ranisi   'fern sp.'
          marū   marū   'gentle'
          rau   rau   'leaf'
          tanifa   tanifa   'man-eating shark'

Unlike the previous rule, this rule is not cyclical:

(9) *Surface form* *Underlying form*
   kanɔpu   kanapu   'gannet'
   papɔʔu   papaʔu   'wing'
   papɔi   papai   'swamp taro'
   ʔanɔsi   ʔanasi   'small fry'

Where the rule appears to apply cyclically, as in ɔlɔlumu 'wish of luck' and ɔmɔmu 'spider sp.', morphological reduplication is always involved (ɔlɔlumu can be analyzed as underlying /R− + alu + −mu/, and ɔmɔmu as /R− + amu/).

The result of these two rules is that, when a word is fed into rules (a)–(d) above, the choice of vocalic segments of the penultimate syllable of a word is [i e ɛ a ɔ o u], and the vocalic segment of the last syllable can be one of [i e a o u]. Clusters whose underlying form is /a(C)e/ will be fed into the metathesis rule as [ɛ(C)e], and those of underlying form /a(C)u/ and /a(C)i/, as [ɔ(C)u] and [ɔ(C)i] respectively.

A number of phonological processes apply to the output of metathesis. These rules apply disjunctively according to the types of vowels involved. In what follows, each of these rules is described in detail. The output of metathesis is of the form −VVC#, which does not surface as such; in the following discussion, 'vowel cluster' will refer to the two vowels preceding the word-final consonant at this intermediate stage in the derivation. A summary of the discussion is provided in tables 1 to 3 on pp. 211–212.

Vowel clusters consisting of a high vowel (/i u/) followed by a non-high non-back vowel (/e a/) reduce to a monosyllabic diphthong consisting of a glide that corresponds in roundness to the first underlying vowel, followed by the round vowel [ɔ]:

(10)   tife   tyɔf   'pearl shell'

         pija   pyɔj   'rat'

         huŋe   hwɔŋ   'to breath'

         puka   pwɔk   'creeper sp.'

         kuruŋa   kurwɔŋ   'head-rest'

This process does not affect the vowels of the preceding syllables of the word, if any, as illustrated by the last example in (10).

Vowel clusters consisting of the mid-high vowels /e o/ followed by /a/ or of the high vowels /i u/ followed by /o/ reduce to a monosyllabic diphtong consisting of a glide that corresponds in roundness to the first underlying vowel, followed by the second underlying vowel:

(11)   hepa   hyap   'broad'

         loŋa   lwaŋ   'towards the interior of island'

         rito   ryot   'to glitter'

         ulo   wol   'seabird sp.'

         keleŋa   kelyaŋ   'to appear to'

The word *ulo* 'seabird sp.' has the only word-final /...uCo/ sequence I was able to either elicit from my informant or locate in Churchward (1940). This process does not affect the vowels of the preceding syllables, if any, as illustrated by the last example in (11).

Vowel clusters consisting of an underlying back vowel (/o u/) followed by /i/ or /e/ for /o/, or /i/ alone for /u/ reduce to a single front rounded vowel that corresponds in height to the first vowel of the underlying cluster ([ø ü] respectively):

(12)   toŋi   tøŋ   'to buy'

         soŋe   søŋ   'famine'

         fuli   fül   'deaf'

Unlike the preceding two processes, this process affects all vowels that are part of uninterrupted underlying sequences /...CoCoCi/, /...CoCoCe/, and

/CuCuCi/, as long as they are part of the same morpheme and as long as the sequence is not interrupted by a vowel other than /u/ and /o/:

(13) sukuni   sükün   'to pierce'
      kukulufi   kükülüf   'tree sp.'
      ʔopoti   ʔöpöt   'to follow'

It is important to note that the leftward cyclical application of the umlauting rule makes no reference to intervening consonants, like the rule illustrated in (7a).

Vowel clusters consisting of an underlying low vowel /a/ followed by the high vowel /i/ reduce to [ɛ]. Because of the allophonic change of /a/ to [ɔ] before a syllable that contains the vowel /i/, as discussed earlier and illustrated in (6), /a/ feeds into this rule as [ɔ]. There appears to be free variation between [æ] and [ɛ] in the output of this rule in certain words, which does not appear to have much importance to the analysis of metathesis, and which I shall ignore here:

(14) pɔti   pɛt   'scar'
      hɔʔi   hɛʔ   'to pull'
      pɔni   pɛn   'paint' (from English 'paint')
      ʔanɔsi   ʔanɛs   'small fry'

This process does not affect the vowels of the preceding syllables, if any, as illustrated by the last example in (14).

All other vowel clusters reduce to the first underlying vowel only:

(15) kainaŋa   kainaŋ   'clan, category'
      laʔo   laʔ   'to go'
      hɔsu   hɔs   'gall bladder'
      kɛse   kɛs   'cash' (from English 'cash')
      kamata   kamat   'to begin'

Word with final vocalic clusters in the complete form fall into several patterns. If the second vowel of the cluster is /a/ and the first vowel is a non-low non-high vowel /e o/, or if the second vowel is /o/ and the first vowel is the high vowel /i/, the incomplete form changes the first vowel of this cluster to a diphthong of corresponding rounding. There are no Rotuman words that end in (C)*uo* # :

(16) ?ea   ?ya   'to say'
      foa   fwa   'coconut scraper'
      ?io   ?yo   'to see'
      kelea   kelya   'to look (at something)'

This process does not affect the vowels of the preceding syllables of the word, if any, as illustrated by the last example in (16).

If the second vowel of the underlying cluster is /a/ and the first vowel is a high vowel /i u/, the first vowel becomes a diphtong as in (16) and /a/ becomes [ɔ]:

(17) kia   kyɔ   'neck'
      sua   swɔ   'shoot (of a plant)'
      kiria   kiryɔ   'leper'

This process does not affect the vowels of the preceding syllables of the word, if any, as illustrated by the last example in (17).

If the final vowel of the complete form is a geminate /a/ (i.e. the cluster -*aa*#), the vowel is shortened to a single mora:

(18) ?ā   ?a   'to bite'

Words ending in any other vowel cluster in their underlying representation do not undergo any changes:

(19) hoi   hoi   'flood'
      tɔu   tɔu   'to pluck'
      loloe   loloe   'to continually go to feasts'

Finally, words that consist of a single syllable in underlying form (#CV#) and words that end in −CCV# do not undergo any changes. Words of the shape #CV# are all grammatical morphemes:

(20) ma   ma   'and; just'
      ke   ke   'instead'
      a?su   a?su   'to make (something) wet'

All the above processes are ordered before morphological reduplication. When the partial or full reduplication of an incomplete form takes place, the vowels in the reduplicated element are derived, as illustrated in (21a). Similarly, in the incomplete form of lexical compounds, all elements of the compound are in the incomplete form, as shown by the examples in (21b):

(21)		*Complete form*	*Incomplete form*	*Underlying form*	
	(a)	popore	pöpör	R – + pore	'suddenly'
		mɔmɔmi	mɛmɛm	R – + mami	'disgustingly sweet'
		furfuruki	fürfürük	R – + furuki	'pimple'
	(b)	oʔhoni	öʔhön	oʔi + honi	'classificatory mother'
		kɔlʔɔki	kɔlʔɛk	kalu + – aki	'around'
		sægvɛvene	sægvɛvɛn	sagi + vavane	'female's classificatory brother'

Because vowels with tertiary stress are deleted after both reduplication and compounding, one would be tempted to explain some of the forms in (21) as resulting from the leftward cyclical application of the rules described in this section. In fact, the above forms are simply derived by applying the rules to reduplicated and compounded morphemes.

Table 1 summarizes the changes undergone by vocalic clusters in words ending in – CV # in underlying form. The first vowel of the cluster is shown on the vertical axis of the table:

Table 1
Vowel changes after metathesis.

	i	e	/a/ɔ	o	u
i	i	yɔ	yɔ	yo	i
e	e	e	ya	e	e
ɛ/a/ɔ	ɛ	ɛ	a	a	ɔ
o	ø	ø	wa	o	o
u	ü	wɔ	wɔ	wo	u

Tables 2 and 3 provide illustration of all possible vowel combinations for words that end in – VCV # in their complete form (table 2) and for words that end in – VV # in their complete form (table 3).

Table 2
Illustrations of complete-incomplete pairs for words ending in $-CV\#$.

	i		e		a		o		u	
i	ri i	ri	tife	tyɔf	hi?a	hiɔ?	rito	ryot	ti?u	ti?
	'small'		'pearl shell'		'lie over'		'glitter'		'big'	
e	fesi	fes	he?e	he?	teka	tyak	he?o	he?	fesu	fes
	'tree sp.'		'octopus'		'take'		'call'		'tie'	
ɛ/a/ɔ	hɔ?i	h	vɛve	vɛv	?asa	?as	fa?o	fa?	fɔ?u	fɔ?
	'pull'		'fast'		'day'		'nail'		'back'	
o	rosi	røs	kofe	køf	hosa	hwas	soro	sor	lo?u	lo?
	'deceive'		'coffee'		'flower'		'grate'		'fold'	
u	futi	füt	huŋe	hwɔŋ	puka	pwɔk	ulo	wol	?ulu	?ul
	'banana'		'breathe'		'creeper sp.'		'seabird sp.'		'breadfruit'	

Table 3
Illustrations of complete–incomplete pairs for words ending in $-VV\#$.

	i		e		a		o		u	
i	tī	tī	tie	tie	kia	kyɔ	?io	yo	kiu	kiu
	'tea'		'grave mound'		'neck'		'see'		'plenty'	
e	lelei	lelei	rē	rē	?ea	?ya	leo	leo	feu	feu
	'good'		'do'		'say'		'person'		'tail'	
ɛ/a/ɔ	sɔi	sɔi	vɛe	vɛe	?ā	?a	mao	mao	mɔumɔu	mɔumɔu
	'free'		'divide'		'bite'		'lost'		'wasted'	
o	hoi	hoi	moe	moe	foa	fwa	pō	pō	fo?ou	fo?ou
	'turtle'		'brown'		'scraper'		'catch'		'new'	
u	sui	sui	pue	pue	sua	swɔ	—		lū	lū
	'needle'		'hibiscus'		'shoot				'rope'	
					(of plant'					

The metathesis process and the accompanying umlauting, reduction and diphthongization processes all contribute to give Rotuman a far more complex phonological structure than any language of the area. In a traditional framework, the rules cannot be described simply, in that each cluster type yields different results for which few generalizations can be made. In the following section, I shall show how an autosegmental approach can maximally capture the generalizations involved in deriving the different vowel combinations, the differences between which can be derived in the form of different strategies used to deal with the dispreferred configuration yielded by the rule of metathesis.

3. An autosegmental analysis

In his typological survey of metathesis, Ultan (1978) shows that very few productive metathetic processes can be considered to be the result of a true segmental inversion, and that most 'metathesis-like' processes can be shown to be the result of the combination of a copying process followed by the deletion of the original segment that was copied. This universal tendency prompted Pawley (1982) to reanalyze the Kwara'ae metathesis rules described by Sohn (1980) as a rule of 'vocalic anticipation' from one syllable to the other.

An account of Rotuman phonology that involves the spreading of some feature of the last vowel to the previous vowel (cf. Hyman's (1982) account of nasality in Gokana as a spreading feature) would be very complex. Indeed, I noted in the last section that the number of features that spread from the vowel of the last syllable to that of the penultimate syllable varies according to the nature of the former: while *a* will transfer itself completely onto the vocalic slot of the penultimate syllable if the latter is non-high, only the feature [−back] will spread backwards for clusters of shapes *oCe*, *oCi* and *uCi*. A spreading account of Rotuman metathesis would require two steps, the first step being feature spread and the second step being the dropping of the original word-final vowel. Such an account would involve a complex statement of the mechanisms involved in the first step in terms of the nature of the word-final vowel.

The idea of spreading, however, is not to be completely abandoned. It is intuitively logical to view the metathetic movement of a segment or of a feature across another segment as a particular type of spreading. Crucially for this analysis, the only segments that are phonologically affected by metathesis and its accompanying reduction rules are vowels; the intervening consonant, if there is one, is not affected by metathesis. (I shall ignore for the moment the case where the complete form ends in a vocalic cluster; these cases will be shown to be trivially derivable from the autosegmental analysis.)
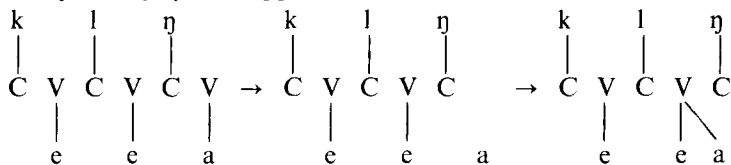
Thus, what is to be captured is the systematic interaction of two vowels, each being part of a different syllable (Rotuman syllable structure is posited for my purpose as any (C)V string, each vowel of a vocalic cluster being treated as an independent syllable); the way these two vowels interact, furthermore, completely disregards the intervening consonant. These considerations thus suggest that, in Rotuman, consonants and vowels occur on two distinct tiers. This analysis was first proposed by McCarthy (1981) to account for the binyan system of Arabic. In Arabic, consonantal segments are linked to the CV-tier independently of vocalic segments. A similar autonomy

between vowels and consonants is precisely the motivation for separating the vocalic melody from the consonantal melody in Rotuman.
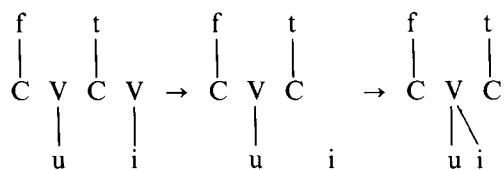
Separate tiers for vowels and consonants have been proposed to account for processes other than binyan-type phenomena in Semitic languages. Reduplication in Temiar (McCarthy (1982: 208–221)), for example, requires a disjunctive melody approach, and so does a variety of phonological processes in Yawelmani (Archangeli (1984)). The approach is thus well established and appears to be cross-linguistically common. More importantly, two processes at play in Rotuman phonology lend independent support to a separate-tier analysis: the allophonic realization of /a/ as [ɛ] illustrated in (6) and (7); and the post-metathesis umlauting of /o/ and /u/ illustrated in (12) and (13). As shown in the previous section, these processes do not make any reference to consonants; they apply to vowel sequences whether or not these sequences are broken by consonants, and the nature of intervening consonants has no effect on the rules. Thus, the separate-tier analysis does not only account for the fact that the vocalic segment involved in the metathesis 'jumps' over the immediately preceding consonant, but also for the fact that intervening consonants are ignored by two other phonological processes, one of which is independent of metathesis.

If the separate-tier analysis is espoused, and if the Universal Association Conventions (McCarthy (1982: 194)) of AP are assumed to be valid, Rotuman metathesis can simply be viewed as a rule by which the final V-slot of the CV-tier is deleted, thus leaving the feature matrix of the final vowel floating. Since this vowel does surface in some form or other in the incomplete form of words, and since, in the AP framework, floating segments are automatically deteled if they surface as unassociated elements, the floating matrix is reassociated to the CV-tier after the application of the final vowel truncation rule. The element to which it is reassociated is the (underlyingly) penultimate V-element, if there is one. Thus, the underlying structures of both the complete and the incomplete forms of words to be fed into the initial, left-to-right association rule is posited to be the same (i.e. the structure of the complete form). To derive the incomplete form, first delete the last V-slot of the CV-tier, and then reassociate the last vowel segment to the penultimate V-slot:
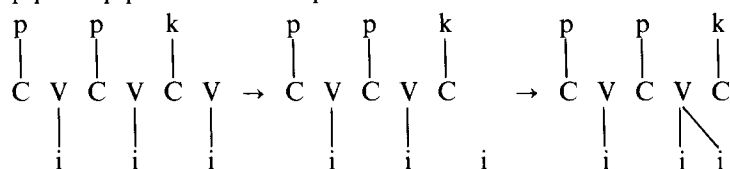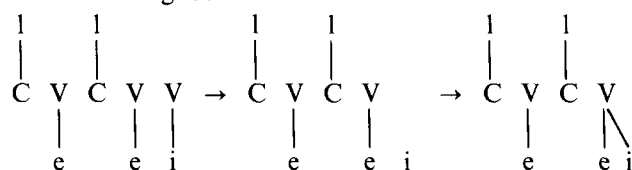
(22a) keleŋa   kelyaŋ   'to appear to'

(22b) futi füt 'banana'

```
  f     t          f     t          f     t
  |     |          |     |          |     |
  C  V  C  V   →   C  V  C      →   C  V  C
     |     |          |               |\
     u     i          u     i         u i
```

(22c) pipiki pipik 'out of shape'

```
  p     p     k          p     p     k          p     p     k
  |     |     |          |     |     |          |     |     |
  C  V  C  V  C  V   →   C  V  C  V  C      →   C  V  C  V  C
     |     |     |          |     |                |     |\
     i     i     i          i     i     i          i     i i
```

(22d) lelei lelei 'good'

```
  l     l                l     l                l     l
  |     |                |     |                |     |
  C  V  C  V  V   →   C  V  C  V      →   C  V  C  V
     |     |  |          |     |             |     |\
     e     e  i          e     e  i          e     e i
```

This deletion rule only applies if the resulting configuration can be sylla-bified. Thus, if the CV-skeleton of the word is limited to # CV # at underlying structure (e.g. *ma* 'and, just', *ke* 'instead'), the rule does not apply because the result cannot be syllabified (cf. McCarthy (1981) for a similar constraint in Semitic languages). Furthermore, the rule cannot take place across a morpheme boundary; the word *aʔsa* 'to make (something) wet' (/aʔ-/ 'causative prefix') for example, has the same complete and incomplete forms. In other words, the deletion and reassociation processes can only take place if there is a V-slot to the left of the deleted V-slot and if this V-slot is part of the same morpheme.

Returning to the discussion of the more general cases, the resulting structure for the penultimate V on the CV-tier is of the form (23) after the reassociation process. Such a structure can be posited as being ruled out on the surface if a consonant follows:

(23) * V C #
       /\
       x y

   where x and y are vocalic segments

After reassociation, a series of alternative rules comes into play, all of which are geared to prevent structures of type (23) from reaching the surface; these

alternative rules bleed each other in terms of their input, and are therefore ordered. It is at this stage that the different vocalic cluster types can diverge to yield one of the surface structures outlined in section 2 above. It is important to notice that all the rules that apply at this level are motivated by the same principle, i.e. the breaking-down of structures of type (23) above.

The environments that form the input to the rules in question, furthermore, can all be defined as subsets of the set of environments created by the reassociation rule, each subset being characterized by a featural conflict between the two segments of the phonemic melody that are associated to the same V on the CV-tier.

Interestingly, these rules do not apply to doubly-associated V-slots that are in word-final position (i.e. in words whose underlying forms end in − VV #), *except* if the second of the doubly-associated vowels is /a/ or if the two doubly-associated segments are /io/. This fact is clearly illustrated in table 3: the only words in this table that have a phonologically distinct incomplete form are *kia* (*kyɔ*) 'neck', *ʔea* (*ʔya*) 'to say', *ʔā* (*ʔa*) 'to bite', *foa* (*fwa*) 'scraper', and *sua* (*swɔ*) 'shoot'; as well as *ʔio* (*ʔyo*) 'to see'. All other words have identical complete and incomplete forms. I do not have an explanation for this unusual state of affairs.[4]
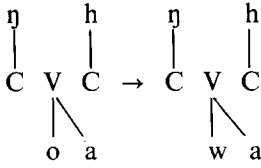
The first rule resolves height conflicts between doubly-associated segments. If the two segments are in conflict with respect to one height feature according to one of the two patterns given in (24a,b), the first segment changes its [+ syllabic] feature to [− syllabic]. In addition, in structures of type (24a), if the second segment is [− back], it changes this feature to [+ back]. The result of this rule is illustrated in (25).

(24a)   V
              ╱   ╲
       [+ high] [− high]
(24b)   V
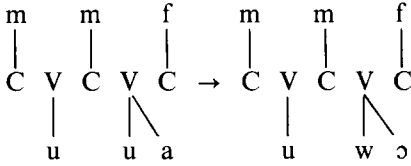   ╱   ╲
       [− low] [+ low]

---
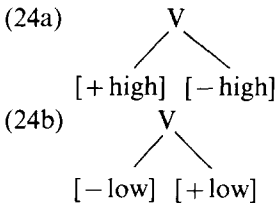
[4] Because Churchward (1940), on which all other accounts of Rotuman phonology have been based, gives no example of the behavior of word-final vowel clusters, this phenomenon has not been previously reported. Since no word ends in a cluster /uo/, we do not know whether the second condition may be extended to any high vowel segment followed by /o/.
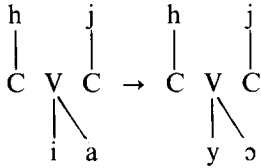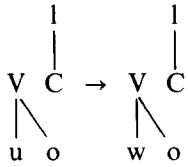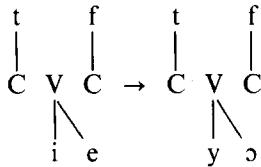
(25a) ŋoha ŋwah 'to peep'

```
    ŋ     h      ŋ     h
    |     |      |     |
    C  V  C  →   C  V  C
        |\            |\
        o  a          w  a
```

(25b) mumufa mumwɔf 'to vomit'

```
    m     m     f      m     m     f
    |     |     |      |     |     |
    C  V  C  V  C  →   C  V  C  V  C
       |     |\           |     |\
       u     u  a         u     w  ɔ
```

(25c) hija hyɔj 'sprained'

```
    h     j      h     j
    |     |      |     |
    C  V  C  →   C  V  C
       |\           |\
       i  a         y  ɔ
```

(25d) ulo wol 'sea-bird sp.'

```
          l            l
          |            |
    V  C  →   V  C
    |\           |\
    u  o         w  o
```

(25e) tife tyɔf 'pearl shell'

```
    t     f      t     f
    |     |      |     |
    C  V  C  →   C· V  C
       |\           |\
       i  e         y  ɔ
```
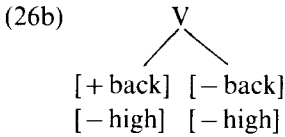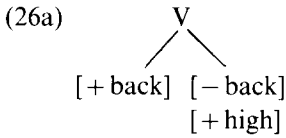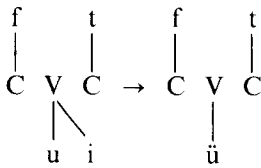
The purpose of this rule is thus to turn the first vocalic segment of a doubly-associated element into a consonantal segment, thus preventing configurations of types (24a,b) from surfacing as (23). The change from /a/ to [ɔ] when preceded by an underlying /i/ or /u/ to which it is doubly associated is reminiscent of the allophonic change of /a/ to [ɔ] when followed by /i/ or /u/ that applies to both metathesized and non-metathesized environments (cf. (8)). The two rules, however, cannot be combined because the former only applies to the output of the reassociation rule.

If the two segments are not in conflict with respect to height according to patterns (24a,b), the feature matrices of the two doubly-associated segments combine according to two distinct patterns.
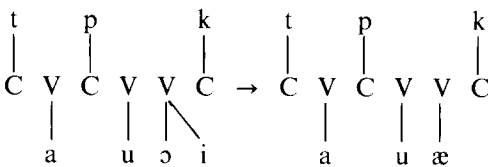
If the backness feature of the second segment is [−back], the first segment acquires the backness feature of the second segment, thus yielding a single segment whose backness feature is that of the original second segment, and whose remaining features are those of the original first segment. Configurations (26a–c) are the configurations that meet this input requirement. (26a,b) undergoes umlauting, while (26c) undergoes the rule vacuously, since the backness feature of both segments is the same. Illustrative derivations are given in (27a-c). Note that the desyllabification rule outlined above outputs clusters of the form [wɔ], [yɔ], and [yo], which do not qualify as input for this rule because they do not match descriptions (26a-c).
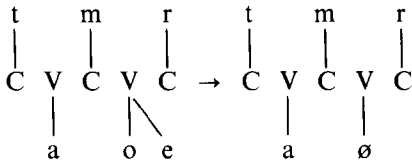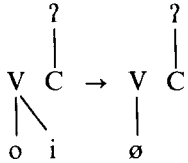
(26a)

$$V$$

[+back] [−back]
          [+high]

(26b)

$$V$$

[+back] [−back]
[−high] [−high]

(26c)

$$V$$

[−back] [−back]

(27a) futi füt 'banana'

f   t   f   t

C V C → C V C

    u i   ü

(27b) tapuɔki   tapuæk 'to bless'

t   p   k   t   p   k

C V C V V C → C V C V V C

    a   u ɔ i   a   u æ
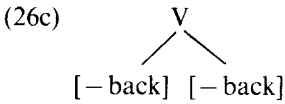
(27c) tamore   tamør   'plant sp.'

```
    t      m      r          t      m      r
    |      |      |          |      |      |
    C  V  C  V  C    →    C  V  C  V  C
       |     /\              |        |
       a    o  e            a        ø
```

(27d) oʔi   øʔ   'classificatory parent'

```
       ʔ          ʔ
       |          |
    V  C    →   V  C
    /\            |
   o   i          ø
```

(27e) fesi   fes   'tree sp.'

```
    f      s          f      s
    |      |          |      |
    C  V  C    →    C  V  ·C
       /\               |
      e   i             e
```
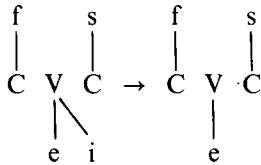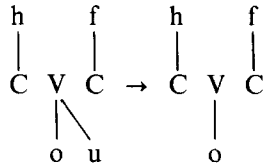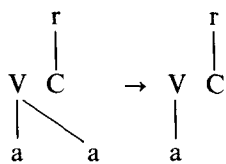
Finally, if the backness feature of the second segment is not [−back], then the two matrices 'combine' by adopting all the features of the first segment; this is illustrated by derivations (28a,b), and generates vocalic combinations in which the second segment is completely deleted without affecting the first doubly-associated segment.

(28a) hofu   hof   'sting of stingray'

```
    h      f          h      f
    |      |          |      |
    C  V  C    →    C  V  C
       /\               |
      o   u             o
```

(28b) ara   ar   'mole'

```
       r                 r
       |                 |
    V  C      →      V  C
    /\                   |
   a    a               a
```

Alternatively, the backness feature of all vocalic segments can be posited to be underspecified (in the sense developed in Kiparsky (1982)). In the merging process that creates the surface umlauting effect, the backness feature of the merged segment is obtained by positing it to be the inverse of the rounding feature of the (original) first doubly-associated segment (rounding and backness being definable in terms of each other by redundancy rule (29) in non-umlauted environments). If a particular segment reaches the surface with an underspecified backness feature, convention (29) applies; such will be the case in all environments that do not satisfy the input description of the umlauting rule. Such an account will thus generate umlauted vowels (i.e. front rounded vowels) only in umlauted environments, which corresponds to their distribution in Rotuman phonology.

(29) [α round] → [α back]

No independent evidence exists, as far as I know, to favour one account (matrix merging) over the other (feature underspecification).

The rules presented in this section yield all and only the surface structures attested for Rotuman. The next section is a recapitulation of the analysis presented here, and an evaluation of its advantages over the analysis that other models would have yielded.

4. Conclusion

The analysis presented in the previous section consists of the following set of rules, all of which are ordered, and which apply after the initial left-to-right association of the CV-tier of words to separate vocalic and consonantal melodies:

(a) Delete the last V of the CV-skeleton of words in the incomplete form and re-associate the orphaned segment to the first V-slot to the left (as illustrated in (22a-d)).

(b) If the resulting doubly-associated configuration presents a height conflict between the two segments (either [+high] [−high] or [−low] [+low]), change the configuration into a diphthong by desyllabifying the first segment (as illustrated in (25a-e)).

(c) If the resulting doubly-associated configuration presents a backness conflict between the two segments ([+back] [−back]) or [−back]

[+ back], merge the doubly-associated matrices by taking the backness feature of the second matrix and the remaining features of the first matrix (as illustrated in (26a-c)).

(d) For all remaining doubly-associated configurations, drop the entire second matrix (as illustrated in (28a,b)).

The most salient feature of this analysis is the fact that the derivation of the incomplete form of all words is essentially accounted for by the same process. Indeed, step (a) is undergone by all entries in the lexicon. The differences in surface forms are captured in the form of strategies used to resolve feature conflicts between pairs of segments associated to the same element of the CV-skeleton (steps (b)–(d)).

Furthermore, step (a) of this analysis reflects the close association of metathetic processes with a two-step process consisting of featural or segmental spread after V-deletion, an association that is supported both by cross-linguistic data (Ultan (1978)) and diachronic analyses (Pawley (1982)). To have stated the first step simply as the spreading of groups of features from the last vowel to the previous syllable, however, would have involved complex statements involving the exact nature of both the metathesizing segment and the environment, since some vowels metathesize completely, others launch only one feature onto the previous syllable, yet others do not undergo metathesis at all. Positing metathesis as being the result of the reassociation of the target segment avoids such an awkward analysis, and elegantly distinguishes between those steps of the process that involve the skeletal representation of the word and those that involve essentially the segmental form of the word, while keeping in mind throughout the close association of these two representational levels.

References

Archangeli, D., 1984. Underspecification in Yawelmani phonology and morphology. Department of Linguistics, Massachusetts Institute of Technology. (Unpublished Ph. D. dissertation.)

Anttila, R., 1972. An introduction to historical and comparative linguistics. New York: Macmillan, London: Collier Macmillan.

Basbøll, H., 1982. Nordic i-umlaut once more: A variational view. Folia Linguistica Historica 3, 59–85.

Biggs, B. G., 1959. Rotuman vowels and their history. Te Reo 2, 24–26.

Biggs, B. G., 1965. Direct and indirect inheritance in Rotuman. Lingua 14, 383–445.

Broselow, E. I. and J. J. McCarthy, 1983. A theory of internal reduplication. (Unpublished typescript.)

Cairns, E., 1976. Universal properties of umlaut and vowel coalescence rules: Implications for Rotuman phonology. In: A. Juilland (ed.), Linguistic studies offered to Joseph Greenberg, Vol. 2 (Phonology), 271–283. (Studia Linguistica et Philologica 4.) Saratoga, CA: Anma Libri.

Churchward, C. M., 1940. Rotuman grammar and dictionary, comprising Rotuman phonetics and grammar and a Rotuman-English dictionary. Sydney: Methodist Church of Australasia.

Churchward, C. M. 1953. Tongan grammar. London: Oxford University Press.

Clark, R., 1974. On the origin of the Tongan definitive accent. Journal of the Polynesian Society 83, 103–109.

Clements, G. N. and E. Sezer, 1983. Vowel and consonant disharmony in Turkish. In: H. van der Hulst and N. Smith (eds.), The structure of phonological representation, Part 2, 213–255. (Linguistic Models Series.) Dordrecht and Cinnaminson: Foris.

Donnellan, K., 1966. Reference and definite description. Philosophical Review 75, 281–304.

Dresher, B. E., 1983. Postlexical phonology in Tiberian Hebrew. In: M. Barlow et al. (eds.), Proceedings of the West Coast Conference of Formal Linguistics, 67–78. Stanford, CA: Stanford Linguistic Association, Stanford University.

Dyen, I., 1965. A lexicostatistical classification of the Austronesian languages. (International Journal of American Linguistics Memoirs 19.) Baltimore, MD: Waverly Press.

Geraghty, P. A., 1983. The history of the Fijian languages. (Oceanic Linguistics Special Publications 19.) Honolulu, HI: University Press of Hawaii.

Goldsmith, J., 1976. An overview of autosegmental phonology. Linguistic Analysis 2, 23–68.

Grace, G. W., 1967. Effect of heterogeneity in the lexicostatistical test list: The case for Rotuman. In: G. A. Highland et al. (eds.), Polynesian culture history: Essays in honor of Kenneth P. Emory, 287–301. Honolulu, HI: Bishop Museum Special Publications 56.

Haraguchi, S., 1977. The tone pattern of Japanese: An autosegmental theory of tonology. Tokyo: Kaitakusha.

Haudricourt, A.-G., 1958a. L'accent d'agencement en mélanésien de Rotuma. Bulletin de la Société de Linguistique de Paris 53, 16–17.

Haudricourt, A.-G., 1958b. La phonologie des voyelles en rotumien (Océanie). Bulletin de la Société de Linguistique de Paris 53, 268–272.

Hyman, L. M., 1982. The representation of nasality in Gokana. In: H. van der Hulst and N. Smith (eds.), The structure of phonological representation, Part 1, 111–130. Dordrecht and Cinnaminson: Foris.

Janda, R. D., 1984. Why morphological metathesis-rules are rare: On the possibility of historical explanation in linguistics. In: C. Brugman and M. Macaulay (eds.), Proceedings of the Tenth Annual Meeting of the Berkeley Linguistics Society, 87–103. Berkeley, CA: Berkeley Linguistics Society.

Kiparsky, P., 1982. Lexical morphology and phonology. In: Linguistic Society of Korea (ed.), Linguistics in the morning calm, 3–91. Seoul: Hanshin Publishing.

Laycock, D., 1982. Metathesis in Austronesian: Ririo and other cases. In: A. Halim, L. Carrington and S. A. Wurm (eds.), Papers from the Third International Conference on Austronesian Linguistics, Vol. 1 (Currents in Oceanic), 269–281. Canberra: Pacific Linguistics C-74.

Leben, W., 1973. Suprasegmental phonology. Bloomington, IN: Indiana University Linguistic Club.

McCarthy, J. J., 1981. A prosodic theory of non-concatenative morphology. Linguistic Inquiry 12, 373–418.

McCarthy, J. J., 1982. Prosodic templates, morphemic templates, and morphemic tiers. In: H. van der Hulst and N. Smith (eds.), The structure of phonological representation, Part 1, 191–223. (Linguistic Models Series.) Dordrecht and Cinnaminson: Foris.

McCarthy, J. J., 1986. OCP effects: Gemination and antigemination. Linguistic Inquiry 17, 207–263.

Marantz, A., 1982. Re reduplication. Linguistic Inquiry 13, 435–482.

Milner, G. B., 1971. Fijian and Rotuman. In: T. A. Sebeok (ed.), Current trends in linguistics, Vol. 8, 397–425. The Hague and Paris: Mouton.

Pawley, A. K., 1979. New evidence on the position of Rotuman. (Working Papers in Anthropology 56.) Auckland: Department of Anthropology, University of Auckland.

Pawley, A. K., 1982. Kwara'ae 'metathesis' as a gradual sound change. Department of Anthropology, University of Auckland. (Unpublished typescript.)

Sohn, H.-M., 1980. Metathesis in Kwara'ae. Lingua 52, 305–323.

Ultan, R., 1978. A typological view of metathesis. In: J. H. Greenberg (ed.), Universals of human language, Vol. 2 (Phonology), 367–402. Stanford, CA: Stanford University Press.