

MORPHOPHONEMIC ALTERNATIONS IN FORMOSAN LANGUAGES

PAUL JEN-KUEI LI

Academia Sinica

1. INTRODUCTION¹

Although morphophonemic alternations vary to a great extent in Formosan languages,² their occurrences are determined by the same two main factors: (1) affixation, i.e. in word or morpheme boundary, and (2) the position of stress. The stressed vowels retain their full vocalic qualities, whereas the unstressed vowels may be weakened or reduced to zero, depending on the individual language. Word-final segments, consonants or vowels, tend to be neutralized, weakened or lost. The alternations mostly involve the processes of neutralization, weakening, deletion, assimilation and occasionally dissimilation and metathesis. Neutralization, devoicing, dele-

1. This paper is one of the reports that grew out of the results obtained from the Project on the Investigation of the Austronesian Languages in Formosa, October 1974–October 1976, supported by a grant from the National Science Council, Republic of China. The author was the principal investigator of the project, assisted by Pang-hsin Ting of the Academia Sinica and Heng-hsiung Jeng of National Taiwan University, as well as by the graduate students Dah-an Ho, Hsiu-fang Yang, Yuan-teh Chu, Samuel Hsi Wang, Ho Sung, and Yü-chen Lo. This paper was presented at the Symposium on Austronesian Linguistics, L. S. A. Summer Institute, University of Hawaii, August 18–20, 1977.

2. The data of various Formosan languages and dialects are based on various source materials: Atayal on Egerod (1965a, b, 1966), Yamada (1974) and Yang (1975), Sediq on Yang (1976), Tsou on Tung (1964), Tsuchida (1976) and Ho (1976a), Kakanabu on Ogawa and Asai (1935) and Tsuchida (1976), Saaroa on Ting (1967) and Tsuchida (1976), Bunun on Jeng (1977), Paiwan on Ho (1975, 1976b, c). As for the other languages, Rukai (including the "dialects" of Tanan, Budai, Maga, Tona and Mantauren), Pazeh-Kahabu, Saisiyat, and Thao are all based on my own field work unless stated otherwise. I wish to thank all the authors for access to their materials, particularly to their unpublished manuscripts. My interpretations of the data are often different from theirs.

tion (truncation) and assimilation are actually different degrees of weakening—reduction of contrast in phonology.

Illustrated in this paper are the following types of morphophonemic alternations in Formosan languages: (1) alternations of labial and velar stops and nasals, (2) alternations of dental stops and affricate, (3) alternation of $l \sim n$, (4) alternations of semivowels (or high vowels) and fricatives or liquids, (5) alternations of $g \sim w$ (or u), $g \sim y$, $aw \sim o$, $ay \sim e$, (6) alternations of voiced and voiceless stops, i. e. devoicing of final consonants, (7) loss of final segments, including consonants and vowels, (8) alternations of full vowels and weakened vowels or zero, (9) assimilation, (10) dissimilation and (11) metathesis.

Of all Formosan languages, the Atayalic group, including Atayal and Sediq, has by far the most complex phonology. There are fewer alternations in the Tsouic group: Tsou, Kanakanabu and Saaroa, particularly in the last two languages. Maga has the most complex phonology of all Rukai dialects/languages: Tanan (Taromak), Budai, Maga, Tona and Mantauran. As for the Paiwanic group, which is said to consist of the rest of all Formosan languages: Ami, Bunun, Kuvalan, Paiwan, Pazeh, Puyuma, Saisiyat, Thao, as well as some extinct languages, it varies to a great extent.

Of most morphophonemic alternations in Formosan languages, those segments that appear in the word-medial position, i. e. in the stem-final followed by suffixes, can be treated as the base (underlying) forms, whereas those segments that appear in the word-final position, i. e. in the stem-final not followed by any suffix, can be treated as derived. There are justifications for such analyses as adopted in this paper. For one thing, we can always predict from the base to the derived forms. For another, we can account for the facts that some segments never appear in the word-final position, e. g., $/b, r, g/$ in Atayal, $/p, b, m, t, d, g, w, y/$ in Sediq, $/b, d/$ in Bunun, $/b, d/$ in Pazeh, $/h/$ in Thao.

2. MORPHOPHONEMIC ALTERNATIONS IN FORMOSAN LANGUAGES

2.1. Alternations of Labial and Velar Stops and Nasals

Sediq (Yang 1976) has the alternations of $p \sim k$ and $b \sim k$ in the stem- and word-final position in the verb paradigm:

(1) Stem	Imperative	
kayak	kiyap-i	'cut (meat)'
atak	tap-i	'cut (with scissors)'
cehak	cehep-i	'lick'
cupecik	cupucip-i	'suck'
(2) Stem	Imperative	
rubeluk	ruburub-i	'broil'
eluk	leb-i	'close'

The labial consonants p and b in the above alternations can be treated as the base forms and the velar k as derived:³

$$(3) \begin{Bmatrix} p \\ b \end{Bmatrix} \rightarrow k / __\#$$

Alternatively, if k should be treated as the base and p and b as derived, then there would be no way of predicting when to derive a p and when to derive a b . Furthermore, k appears in the non-alternating forms in both the stem-final and word-final as (4) below:

(4) Stem	Imperative	
tugeyak	tuguyak-i	'belch'
piyuk	puyuk-i	'blow (breath)'
gemuk	gumuk-i	'cover'

3. In this paper I shall make only simple statements about phonological rules, but not in terms of distinctive features. Because more than a dozen Formosan languages and dialects are covered in this study, to go into a detailed description of the phonology and phonetics of each language and dialect would make this paper unusually long. Interested readers are referred to the Bibliography for further information about the phonology and phonetics of each language and dialect.

Alternation between labial and velar consonants is found also in Sediq nasals:⁴

(5)	<u>Stem</u>	<u>Imperative</u>	
	talaŋ	tulam-i	'run'

Cf. the non-alternating velar nasal in the stem-final position:

(6)	<u>Stem</u>	<u>Imperative</u>	
	kututiŋ	kututiŋ-i	'fall'
	kubahaŋ	kubahaŋ-i	'hear'
	guleiŋ	guliŋ-i	'hide'

Again the labial nasal *m* can be treated as the base and the velar nasal *ŋ* as derived:

(7) $m \rightarrow \eta / __\#$

The solution in (3) and (7) also accounts for the fact that the labials /p, b, m/ do not occur word-finally in Sediq.

In short, the labial and velar oral stops /p, b, k/ are neutralized word-finally in Sediq, and so are the nasals /m, ŋ/.

To my knowledge, this type of alternation is not found in any other Formosan language.

2.2. Alternations of Dental Stops and Affricate

Let us examine the alternations $t \sim c$ in (1) and $d \sim c$ in (2) in the following Sediq examples:

(1)	<u>Stem</u>	<u>Imperative</u>	
	qiyuc	quyut-i	'bite'
	reŋac	ruŋat-i	'chirp, growl'
	sebuc	subet-i	'thresh'

(2)	<u>Stem</u>	<u>Imperative</u>	
	haŋuc	huyed-i	'cook'
	lutuc	lutud-i	'join, connect'
	tugakac	tugukad-i	'kneel'

4. There is only one example for the alternation $m \sim \eta$ in the available data, including 200 verbs. Cf. Pazeh *mi-talam* 'run' whose verb stem final shows up as *-m* rather than *-ŋ*.

In the above alternations *t* and *d* can be treated as the base and *c* as derived:

$$(3) \begin{Bmatrix} t \\ d \end{Bmatrix} \rightarrow c / ___\#$$

Such a treatment also accounts for the fact that the dentals *t* and *d* do not occur word-finally in Sediq.

Some parallelism in morphophonemic alternations can often be found in the same language group among the Formosan languages. For example, the alternation *t*~*c*, though not *d*~*c*, is also found in Atayal, and the condition of Atayal is slightly different from that of Sediq. Atayal *c* appears only before *i* and freely alternates with *t* in the word-final position (Egerod 1966):

$$(4) \begin{Bmatrix} kut \\ kuc \end{Bmatrix} \quad kuc-i \quad kut-an \quad \text{'cut'}$$

In the alternating forms *t* can be treated as the base and *c* as derived:

$$(5) t \rightarrow c / ___\begin{Bmatrix} i \\ \# \end{Bmatrix}$$

As for the non-alternating forms, *t* and *c* contrast before consonants (Egerod 1966).

In summary, *t*, *d* and *c* are neutralized word-finally only in the Atayalic group, although Atayal has no *d*, and neutralization of *t* and *c* takes place also before *i* in Atayal.

2.3. Alternation of *l*~*n*

The alternation of *l*~*n* is found in Sediq as in (1) and (2) below:

(1) Stem	Imperative	
dakin	dukil-i	'grow'
betun	butel-i	'kick'
sukuxun	sukuxel-i	'love'
cikun	cukul-i	'push'

(2) maxan 'ten' ku-muxal-an 'ten times'

Cf. the non-alternating forms:

(3)	<u>Stem</u>	<u>Imperative</u>	
	tekan	tukan-i	'pound (rice)'
	requn	ruqen-i	'swallow'

In the alternating forms *l* can be treated as the base and *n* as derived:

(4) $l \rightarrow n / ___\#$

Although the alternation of $l \sim n$ is not reported for Atayal by Egerod (1965a, b, 1966), yet Yamada (1974: 112-113) reported the free variants $l \sim n$ in the word-final position; *l* is phonetically realized as [l] in formal speech, but as [n] in informal speech. The two scholars have worked on different dialects.

This alternation is found in Kahabu (see note 2), a dialect closely related to Pazeh, a language spoken in Puli, geographically close to Sediq. In Kahabu only the phonetic [n] or [lⁿ], but not [l], occurs in the word-final position, e. g., [bələbən] or [bələbəlⁿ] 'banana', [dukún] or [dukúlⁿ] 'taro'. Examples of the alternation of $l \sim n$ in the Kahabu verb paradigm are as below:

(5)	<u>Present</u>	<u>Imperative</u>	
	ma-xatukun	xatukul-i	'climb'
	m-daxan	daxal-i	'dig'
	mu-xu [?] un	xu [?] ul-i	'pull'
	m-ti [?] in	ti [?] il-i	'hang'

Cf. the non-alternating forms that contain *n* in (6):

(6)	<u>Present</u>	<u>Imperative</u>	
	m-kən	kan-i	'eat'
	ma-hatan	pa-hatan-i	'laugh'

It is clear that the same solution (4) adopted for Sediq applies to Kahabu. This solution accounts for the fact that *l* does not occur word-finally in Kahabu, although it does in Sediq, e. g., *bugihul* 'wind'.

In short, *l* and *n* are neutralized word-finally in Sediq, Atayal (as based on Yamada) and Kahabu.

2.4. Alternations of Semivowels (or High Vowels) and Fricatives (or Liquids)

These alternations were discussed and illustrated in some detail in my earlier paper (Li 1974), so I shall not go into a detailed discussion here. Instead I shall simply list a few examples from various Formosan languages and make a few general remarks.

2.4.1. Alternations of $y \sim \delta$ and $w \sim v$ in Tanan Rukai (Li 1973: 34, 37)

- | | | |
|--------|----------------------------------|---|
| (1)(a) | ay- ² acay 'will die' | ay- ² aca δ -aku 'I will die' |
| | baay 'give' | sa-baa δ -a 'wedding gift' |
| (b) | waDaw 'wait' ⁵ | waDav-ana 'wait a moment' |
| | mabanaw 'bathe' | mabanav-aku 'I bathe' |

2.4.2. Alternations of $y \sim z$ and $w \sim v$ in Tsou (Tung 1964)⁶

- | | | |
|--------|-----------|---------------------------|
| (2)(a) | ahoy | ahoz-a 'begin' |
| | buhfafeoy | huae δ oz-i 'peep' |
| (b) | sifkow | sifkov-a 'flay' |
| | eansow | eansv-i 'breathe' |

2.4.3. Alternation of $y \sim l$ in Kanakanabu

- | | | |
|-----|------------------|---|
| (3) | pai-pacay 'kill' | pai-pacal-au 'Kill!' (imperative) |
| | | (OA 1935: 724) |
| | ŋanay 'name' | ŋanal-aku 'my name' (Tsuchida 1976: 34) |

2.4.4. Alternation of $i \sim a l^7$ (<*ay) in Saaroa (Tsuchida, personal communication)

- | | | |
|-----|----------------------|---------------------------------|
| (4) | pa-pa-paci 'kill' | li-paa-pacal-a 'was killed' |
| | m-u-a-tii 'defecate' | taa-tial-aa 'place to defecate' |

2.4.5. Alternation of $y \sim L^8$ in Mantauran Rukai

- | | | |
|-----|-----------------|--------------------|
| (5) | tupuy 'to burn' | tupuL-a 'Burn it!' |
| | u-luahay 'left' | luahaL-a 'Leave!' |

5. The symbol *D* in the upper case stands for a voiced retroflexed stop; see Li (1973:16).

6. The non-syllabic *i* and *u* in Tung's transcription are reinterpretable as *y* and *w* respectively; see Li (1974) and Ho (1976a).

7. The symbol *l* stands for a voiceless retroflexed lateral fricative [ɬ]; see Ting (1967:921), also cf. Tsuchida (1976:60).

8. The symbol *L* stands for a flap or retroflexed lateral; see Li (1977:7).

2.4.6. Alternations of $ee\sim(a)r$ ($<*ay$) and $oo\sim(a)v$ ($<*aw$) in Maga Rukai

(6)(a)	θine 'to sing'	$\theta inr-aa$ 'Sing!'
	$\theta ible$ 'to float'	$\theta bilar-a$ 'Float!'
(b)	$ibroo$ 'to fall'	$iborv-a$ 'Fall!'
	$li\eta si\eta soo$ 'to wash'	$li\eta si\eta sav-a$ 'Wash it!'

Maga r corresponds to Mantauran L , Saaroa \dot{t} , Kanakanabu l , Tsou z and Tanan δ , all historically derived from the same proto-phoneme, PAN $*y$ as based on Dyen (1971), but $*j$ as based on Dempwolff (1934-38).

2.4.7. Alternation of $w\sim v$ in Paiwan

In addition to Tanan and Tsou, the alternation of $w\sim v$ is reported for the Butanglu dialect of Paiwan (Ho 1976b):

(7)	<u>Present</u>	<u>Imperative</u>	
	$s/\partial m/\partial naw$	$s\partial nav-i$ (or $-u$)	'wash'
	$q/\partial m/awqaw$	$qawqav-i$ (or $-u$)	'shout'
	$ma-DawDaw$	$ma-DawDav-i$ (or $-u$)	'forget'
(8)	$kasiw$ 'tree'	$pu-kasiv-an$ 'container for wood'	

Based on the data above, there are two possible solutions, either to treat w or v as the base form:

(9) $w\rightarrow v/__+V$

(10) $v\rightarrow w/__\#$

Solution (10) is rejected because many Paiwan items end with a phonetic $[v]$, e. g., $tak\partial v$ 'bride', $q\partial mav$ 'rob'. It would involve an undesired conversion of the fricative v to semivowel w in many items. In other words, the correct solution is to treat w as the base and v as derived in the alternating forms.

The same alternation is found in the Stimul dialect of Paiwan (Ho 1975):

(11)	<u>Present</u>	<u>Imperative</u>	
	$s/\partial m/\partial naw$	$s\partial nav-i$ (or $-u$)	'wash'
	$t/\partial m/awtaw$	$tawtav-i$ (or $-u$)	'shout'

The same solution can also be adopted for this dialect. According to Ho (private conversation), the alternation $w \sim v$ occurs in all Paiwan dialects except Makazaya.

An example of the alternation $w \sim \beta$ can be cited from Thao: *makʃnaw*, *pakʃna*: β -in 'breathe'.

Paiwan *v* corresponds to Tsou and Tanan *v* and Thao β , historically derived from the same proto-phoneme, PAN **w* as based on Dyen, but **v* as based on Dempwolff.

I (Li 1974) argued that, because of the uniformity in a vast number of languages including Formosan and Philippine and for the sake of simple statements, it stands to reason to treat *y* and *w* as the base forms for these two types of morphophonemic alternations. These Formosan languages have quite parallel developments for the two proto-phonemes, PAN **y* and **w*. The derivations, both synchronic and diachronic, can be stated by the rules:

- (12)(a) $y \rightarrow \delta, z, l, \text{ɿ}, L, r / ____ + \text{Suffix}$
 (b) $w \rightarrow v, \beta$

2.4.8. Alternation of $r \sim i$ in Atayal

Examples of the alternation $r \sim i$ in Atayal are as below (Egerod 1965b: 261):

(13) Stem	Passive	
bazii	b(z)ir-an	'buy'
kgii	kgir-an	'prepare hemp'
(ma-hii)	hir-an	'to air'
pgiai	piar-an	'run away'

There are non-alternating forms that contain *i* in Atayal (Egerod 1965b: 261):

(14) Stem	Passive	
huiai	hiai-an	'able to'
hului	hlui-an	'pull'
ubui	bui-an	'continue'

The stem-final *r* in (13) can be treated as the base and the word-final *i* as derived:

(15) $r \rightarrow i / __\#$

Alternatively it would be difficult to predict when to derive *i* as *r* in (13) and when to derive *i* as *i* in (14). The solution in (15) also accounts for the fact that *r* does not occur word-finally in Atayal (Egerod 1965a: 204).

At this stage, it is not clear to me whether $r \sim i$ is historically related to the alternations between semivowels and fricatives or liquids, as illustrated from §2.4.1 to §2.4.7. If so, then the solution given in (12) and hence the conclusions reached in Li (1974) may have to be reconsidered.

2.5. Alternations of $g \sim w$ (or u), $g \sim y$, $aw \sim o$, $ay \sim e$

Let us examine the alternation $g \sim u$ in the following examples in Atayal (Egerod 1965b: 261):

(1) Stem	Passive	
bu-iau	iag-an	'wade'
htuu	htg-an	'come out'
htau	htag-an	'fall'
?z-iuu	iug-an	'exchange'

Cf. the forms that do not manifest $g \sim u$ in the same position (Egerod 1965b: 261):

(2) Stem	Passive	
nbuu	p-nbu-an	'drink'
(mnluu)	?lu-an	'discover'

For those forms with the alternation $g \sim u$, *g* can be treated as the base and *u* as derived:

(3) $g \rightarrow u / __\#$

Alternatively, if *u* should be treated as the base, then it would be almost impossible to predict when to derive it as *u*, as in (1), and when to derive it as zero, as in (2) above. Also the solution in (3) accounts for the fact that *g* does not occur word-finally in Atayal.

The alternation of *u* with zero in (2) above is perhaps due to the

vowel sequence restriction in Atayal: a long vowel is shortened when immediately followed by another vowel. This requires further investigation. For a discussion of vowels alternating with zero, see §2.8.2.

Parallel developments are found in Sediq. In fact, there are much more drastic changes in the Paran dialect of Sediq. Let us first examine the following data:

(4)	<u>Stem</u>	<u>Imperative</u>	
	sino	sinaw-i	'wash (utensils)'
	dayo	duyaw-i	'help'
(5)	<u>Stem</u>	<u>Imperative</u>	
	suluhe	sulahay-i	'learn'
	ruŋe	ruŋay-i	'play'

The data above seem to indicate that the diphthongs *aw* and *ay* have monophthongized as *o* and *e* respectively in the word-final position. The process of monophthongization can be stated by the rules:

(6) $aw \rightarrow o / __\#$

(7) $ay \rightarrow e / __\#$

The correctness of this analysis is confirmed by comparison with other dialects of Sediq; that is, *o* and *e* in this dialect corresponds to *aw* and *ay* respectively in the other dialects; Sakura and Taroko:

(8)	<u>Paran</u>	<u>Sakura</u>	<u>Taroko</u>	
	ruseno	sənaw	sənaw	'man'
	hido	hidaw	hidaw	'sun'
	waso	wasaw	wasaw	'leaf'
	pako	pakaw	pakaw	'thorn'
(9)	<u>Paran</u>	<u>Sakura</u>	<u>Taroko</u>	
	ruŋe	ruŋay	ruŋay	'monkey'
	paye	payay	payay	'grains'

In addition to the comparative evidence, there is internal evidence for the monophthongization process in Paran.

Let us further examine the following data in Paran:

(10)	<u>Stem</u>	<u>Imperative</u>	
	tuqaro	tuqurag-i	'burn'
	pihido	puhudag-i	'dry by sun'
	rejo	runag-i	'speak'
(11)	<u>Stem</u>	<u>Imperative</u>	
(a)	kiicu	kucug-i	'fear'
	lihu	luhug-i	'thread a needle'
(b)	heyu	huyeg-i	'stand'
	surebu	surubeg-i	'urinate'
(12)	<u>Stem</u>	<u>Imperative</u>	
	baruy	burig-i	'buy'
	pacuy	pucig-i	'carve'
	rugeruy	rugurig-i	'dance'

The data in (10) and (4) as well as (8) above indicate that there may have been a series of sound changes: $ag > aw > o$. The softening of the voiced velar stop can be stated by the rule below:

(13) $g \rightarrow w/a __\#$

As a matter of fact, there is internal evidence only for the changes $ag > o$ and $aw > o$, but no evidence for the change $ag > aw$ at the intermediate stage, which can only be inferred from comparative evidence, as below:

(14)	<u>Paran</u>	<u>Sakura</u>	
(a)	bagah	bawah	'charcoal'
	pudagic	pədawic	'gaiters, leggings'
(b)	puga	puwa	'navel'
	pugatuk	puwatuk	'woodpecker'

The comparative evidence in (14) above indicates the change $g > w$ not only after a but also after u , i. e. after back vowels, in the word-medial position in the Sakura dialect, though unfortunately not in the Paran dialect of Sediq:

(15) $g \rightarrow u/\left\{ \begin{matrix} a \\ u \end{matrix} \right\} ___$

This seems to confirm the internal evidence to be stated in (17) below.

The data in (12) indicate that the base form *g* is derived as *y* only after the high front vowel *i* word-finally:

$$(16) \quad g \rightarrow y/i ___\#$$

If this observation is correct, then *g* may have been derived as *w* word-finally after the other vowels /a, e, u/ (actually no direct evidence for *e*), as based on the data in (10) and (11) above. Vowel *e* (preceding *g*) is further derived as *u* after a stressed syllable; see discussion in §2.8.1. In other words, *g* may have been derived as *w* only after the back vowels /a, u/ in the word-final position. Rule (13) should, therefore, be revised to Rule (17), which is nearly equivalent to (15).

$$(17) \quad g \rightarrow w / \left\{ \begin{array}{c} a \\ u \end{array} \right\} ___\#$$

Nevertheless, the data in (11) indicate that the hypothetical *w* derived at the intermediate stage is lost after the high back vowel *u* word-finally:

$$(18) \quad w \rightarrow \emptyset / u ___\#$$

Consequently to make more precise synchronic statements, (17) should be revised to:

$$(19)(a) \quad ag \rightarrow o / \quad /$$

$$(b) \quad \left\{ \begin{array}{c} e \\ u \end{array} \right\} g \rightarrow u / ___\#$$

In fact, *w* after the low vowel *a* can also be stated as “lost” after leaving its trace by raising *a* to *o*, as clearly indicated in the data (4). The Paran data examined in this section can be utilized to illustrate the point that a purely synchronic description may not be identical with a diachronic one.

2.6. Alternations of Voiced and Voiceless Stops (Devoicing of Final Stops)

Although Atayal has no alternation of labials and velars like Sediq (see §2.1), it has the alternation between voiced and voiceless labial stops *p*~*b* as below:

(1)	Full Stem	Definite Passive Neutral	
	hgup	hbg-an	'do magic' (Note the metathesis of <i>b</i> and <i>g</i>)
	hop	hab-an	'stab'
	(m-gop)	gob-un	'share one cup'

Cf. the non-alternating forms:

(2)	Stem	Passive	
	kziup	kiop-un	'enter'
	qalup	qlup-an	'hunt'

It is clear that *b* can be treated as the base and *p* as derived in the alternating forms:

(3) $b \rightarrow p / __\#$

This solution also accounts for the fact that *b* does not occur word-finally in Atayal.

That *b* is the base form in Atayal is somewhat similar to Sediq. The case in Atayal simply involves devoicing of the labial stop, while in Sediq it involves the change from labial stops to velar in addition to the devoicing process.

It is interesting to note that in Atayal the devoicing process affects only the labial *b*, but not the dentals *r* and *z*, or the velar *g*. Instead of getting devoiced (like *b*), *r* and *g* become vocalized as *i* and *u* respectively in the word-final position in Atayal; see §2.4.8 and §2.5.

The devoicing process affects both the labial and dental stops, but not the velar in Pazeh-Kahabu.⁹ Given below are some Pazeh examples:

9. Voiced stops do not occur word-finally, as based on my own field notes and Tsuchida's. However, Tsuchida's (1976:115) statement, "Voiced stops do not occur in my [Pazeh] data, but they do in Ferrell's data" should read "Voiced stops do not occur in the final position in my [Pazeh] data, but they do in Ferrell's data". Tsuchida (personal communication) has admitted the omission of "in the final position" as typographical errors. Ferrell (1970) collected his data in four days in 1967 and six days in 1969, Tsuchida collected his in 1969, and I collected mine in fifteen days' field work in four trips to Puli, Central Taiwan, between July 1976 and February 1977. We all worked with the same Pazeh informant Iteh, although we also had different informants.

(4)	<u>Present</u>	<u>Imperative</u>	
	maləp	ʔaləb-i	'close'
	mə-dərəp	dərəb-i	'behead'
	mu-lubulup	lubulub-i	'follow'

(5)	<u>Present</u>	<u>Imperative</u>	
	mu-rahut	rahud-i	'flow'
	maɲit	ʔaɲid-i	'weep'
	mə-kəmət	kəməd-i	'blink'

I have not recorded any item in Pazeh that manifests $g \sim k$ alternation, although Pazeh has both g and k in its inventory. This might be an accidental gap, or more likely the complete lack of alternation in velars is due to physiological reasons.

In fact, for d to be derived as c , discussed in §2.2, is also a type of devoicing process.

The devoicing process in turn can be regarded as a weakening process. Judging from the fact that a few items that manifest the voicing alternation are historically derived from voiceless, e.g., PAN **Cayis* (Dyen) or **tayit'* (Dempwolff) > Pazeh *mayit* 'weep', one might like to argue that the stop has become voiced intervocalically. So it is really a voicing rather than devoicing process that is involved in Pazeh. However, there are also forms that contain a historical final voiced stop, e.g., Proto-Hesperonesian **q₂əNəb* (Tsuchida) > *maləp* 'close'.

2.7. Loss of Final Segments

The maximal weakening of a speech sound is complete deletion of it. Segments (speech sounds) in the word-final position are apt to be weakened or lost.

Let us examine the examples in Thao (Li 1976: 234-35):

(1)	<u>Imperative</u>	<u>Passive</u>	
	ta:la	tala:h-an	'cut (wood)'
	pa:qu	paqu:h-an	'eat or drink with'

Note that the verb stems end with *h*, which is deleted word-finally, but preserved when suffixed. The deletion of the final *h* can be stated:

(2) $h \rightarrow \emptyset / __\#$

In Thao *h* is one of the three consonants that never occur word-finally.

Let us examine the following data in Tanan Rukai (Li 1973: 45-50):

(3) *manɿma* 'thing' *manɿman-li* 'my thing'
 tuma 'do' *tuman-su* 'you (sg.) do'

Apparently *n* is lost in the word-final position after *a*, but preserved when suffixed:

(4) $n \rightarrow \emptyset / a __\#$

The nasal is not lost after other vowels:

(5)(a) *banin* 'board' (c) *takaynin* 'sit'
 kunin 'rabbit' *riɖin* 'back'
 (b) *sukun* 'apron'
 utun 'nipple'

The loss of *n* in the specified environments holds true in four rather divergent dialects of Rukai: Tanan, Labuan, Maga and Mantaوران, but not in the other two: Budai and Tona; see Li (1977).

In Bunun (Jeng, personal communication),¹⁰ *b* and *d* are truncated word-finally:

(6)	<u>Agent-focus</u>	<u>Object-focus</u>	
	(a) <i>laqai</i>	<i>laqaib-an</i>	'pass by'
	(b) <i>qu</i>	<i>qud-an</i>	'drink'
	<i>ma-suku</i>	$\begin{cases} \text{sukud-an} \\ \text{sukud-un} \end{cases}$	'close'

The truncation of the final *b* and *d* in Bunun can be stated by the rule:

(7) $\begin{Bmatrix} b \\ d \end{Bmatrix} \rightarrow \emptyset / __\#$

Since Bunun has no *g*, (7) is really a deletion of final voiced stops.

In Maga (Li 1975), the stem-final syllable *na* gets lost word-finally:

10. I am grateful to Jeng for providing me with these Bunun examples in this section and the ones for metathesis to be discussed in §2.11. He pointed out that there are only a few examples for the deletion of *b* and *d* in the Takbanua dialect of Bunun.

- | | | |
|-----|------------------|-------------------------|
| (8) | tvatlika 'wrist' | tvatlikna-li 'my wrist' |
| | glogava 'finger' | glogavna-li 'my finger' |
| | tbosbosa 'calf' | tbosbosna-li 'my calf' |

The data above show that the stem-final syllable *na* is preserved when followed by a suffix, but lost in the word-final position:

- (9) $na \rightarrow \emptyset / __\#$

Conversely, a stem-final syllable may be preserved word-finally, but get deleted when followed by a suffix, as in the Maga examples below:

- | | | |
|------|----------------|----------------------------|
| (10) | dani 'house' | da-li 'my house' |
| | dadrani 'road' | dadra-ta 'our (inc.) road' |

The fact in (10) can be stated by:

- (11) $ni \rightarrow \emptyset / ___ + \text{Suffix}$

In (8) the suffixed forms preserve better stems, as the general rule goes, whereas in (10) the suffixed forms have got the shortened stems. If we say that (9) is a "natural" rule, then (11) is an "unnatural" rule.

A similar "odd" phonological fact like (10) has also been reported for Saaroa (Ting 1976):

- | | | |
|---------|------------------|--------------------------------|
| (12)(a) | vuŋuʔu 'head' | vuŋu-ku 'my head' |
| | amaʔa 'father' | ama-ku 'my father' |
| (b) | m-aciʔi 'die' | m-aci-cu 'have died' |
| | k/um/aliʔi 'dig' | k/um/ali-a 'Dig!' (imperative) |

In reality, the final syllable ʔV in the non-suffixed forms are optional and dropped out in rapid speech. We can, therefore, treat the syllable ʔV as optionally derived in the surface phonetic realization. If this analysis is correct, then Saaroa does not have any more "unnatural" rule like Maga.

Weakening or loss of the final vowel (indicated by parentheses) in Saaroa is reported by Ting (1976):

- | | | |
|---------|------------------|----------------------|
| (13)(a) | cail(i) 'year' | (b) maŋʊs(a) 'mango' |
| | apul(u) 'fire' | imar(u) 'fat' |
| | tʌnʌm(ʌ) 'sea' | apal(ʌ) 'foot' |
| | siləŋ(a) 'light' | taamu(i) 'rat' |

As Ting pointed out, the weakened or lost vowel is not necessarily identical with the vowel in the preceding syllable, e. g., (13)(b). The

deletion of the final vowel can be stated (note the problem with the form *taamu(i)*):

(14) $V \rightarrow \phi / ___\#$

The rule seems to apply only to polysyllabic forms as far as the available data are concerned, e. g., *mima* 'drink', not **mim*.

As a matter of fact, loss of final segments is not limited to the word-final position. It can take place in the prefix-final position, under the condition that the prefix-final segment (usually vowel) is identical with the following one. This can be illustrated with data from Tanan Rukai (Li 1973: 56-60):

(15)	<u>Noun</u>	<u>Verb</u>
(a)	baLiw 'home'	mu-baLiw 'go home'
	caki 'excrement'	mu-caki 'defecate'
(b)	urua 'hut'	m-urua 'go to a hut'
	umauma 'field'	m-umauma 'go to the field'
(16)	<u>Stem</u>	<u>Present/Past</u>
(a)	Lugu	wa-Lugu 'take up'
	uŋul	wa-uŋul 'drink'
	icib	wa-icib 'bake in stones'
	i-lib	wa-i-lib 'close'
(b)	asi?	w-asi? 'count'
	akam	w-akam 'bake, broil'
(17)(a)	-banaw	ma-banaw 'bathe'
(b)	aLa	m-aLa 'take'

The data above show the alternations of the verbal prefixes mu-~m- 'go' in (15), wa-~w- 'present or past tense' in (16), and ma-~m- 'verbal' in (17). The loss of the prefixal vowels is conditioned by the following identical vowels of the stems. How do we know, of the two identical vowels, that it is a deletion of the vowel of the prefix, rather than that of the stem? Let us examine the following data, in which non-identical vowels are involved:

(18)(a)	Dusa 'two'	ta-Dusa 'two people'
(b)	-ina	t-ina 'mother'
(19)(a)	umas 'person'	la-umas 'persons'
(b)	inia 'him, her, it'	l-inia 'them'

The data above show the alternations of nominal prefixes *ta-~t-* 'personal marker' in (18) and *la-~l-* 'plural marker' in (19). It is clear that the vowels of the prefixes are deleted.

The identical vowel-deletion rule, however, does not operate in Budai or Tona, two related "dialects" of Rukai. See Li 1977.

2.8. Alternations of Full Vowels with Weakened Vowels or Zero

Alternations of vowels can be divided into two main types: (1) full vowels alternating with weakened or reduced vowels, and (2) vowels alternating with zero, both to be discussed in this section. There are, of course, other minor types of vowel alternations, such as assimilation of vowels, to be dealt with in the following section.

Most alternations of vowels are determined by the same factors: (1) the position of stress and (2) affixation (more suffixation than prefixation, even less infixation).

2.8.1. Full Vowels Alternating with Weakened or Reduced Vowels

The best examples for alternations of full vowels with weakened or reduced vowels can be drawn from Sediq. Like many other Formosan languages, stress generally falls on the penultimate syllable in Sediq. Where morphophonemically related forms manifest vowel alternations, the stressed vowels retain full vocalic qualities, whereas the unstressed vowels are weakened to *u*, which is phonetically variant, [ʊ], [v] or [u], as described by Yang, but phonologically reinterpretable as zero in many cases. All Sediq examples in this paper are cited exactly in the same forms as Yang transcribed them, although my present interpretations are often different from hers.¹¹

11. Yang's (1976) paper "The Phonological Structure of the Paran Dialect of Sediq" was an M. A. thesis written under the joint supervision of myself and my colleague Pang-hsin Ting. Yang and I had several lengthy discussions on Sediq phonology. I went over her manuscripts several times and she did several revisions before it was submitted to the Department of Chinese Language and Literature, National Taiwan University, June 1976. In a way I was partially responsible for not noting then the alternative solution as presented in this paper.

(1) Stem	Imperative	
bíki	bukí-i	'bend'
kita	kuta-i	'see'
sukiya	sukuya-i	'fly'
(2) sépe	supí-i	'dream'
bulebin	bulubil-i	'pull'
ruberuk	ruburub-i	'roast'
(3) tálaŋ	tu lám-i	'kneel'
kari	kuri-i	'dig'
lawah	luwah-i	'open'
(4) tudóruy	tuduróy-i	'roll down'
obuh	boh-i	'smoke'
(5) kúlah	kuláh-i	'weed'
tutuc	lutud-i	'join'
tutiŋ	tutiŋ-i	'have a baby'

In the above data, (1) shows the alternation of $i \sim u$, (2) the alternation of $e \sim u$, (3) the alternation of $a \sim u$, (4) the alternation of $o \sim u$, and (5) the alternation (superficially no alternation!) of $u \sim u$.¹² These examples show that all the Sediq full vowels /i, e, a, o, u/ in the stressed syllables are all reduced to /u/ when stress is shifted to the following syllable because of suffixation. This can be stated by the rule, as given by Yang:

(6) $V \rightarrow u / \text{---} C\hat{V}$

Such a rule looks very neat and general. In fact, all but a few vowels in a few forms are *u*'s before stress.¹³ I suspect if they are phonemic. To

12. Phonologically when /u/ is reduced to /u/, even though it does not show any difference in the transcription, it should be discernible phonetically.

13. Let us examine the following exceptions, the italic vowels in the imperative forms:

Stem	Imperative	
ciyuq	ciyúq-i	'answer'
puliyux	puliyúx-i	'change'
kayak	kíyáp-i	'cut (meat)'
pusuciyuk	pusuciyúk-i	'turn (one's direction)'

me they are all phonetically predictable and hence dispensable from phonemic transcription. Consequently, only phonemic consonant clusters may occur before a stressed syllable, e. g. *mupubulebin* 'will pull' in Yang's transcription can be reinterpreted as *mpblebin* in the alternative analysis. If this alternative is adopted, then all the Sediq data discussed so far in this section really show alternations of full vowels with zero rather than weakened vowels:

$$(7) V \rightarrow \emptyset / __ C^i \acute{V}$$

An advantage of this alternative analysis is that we can capture a great generality with Rule (28) below. Rule (28) was treated as a vowel deletion rule unrelated to this one. In this alternative solution, they are both the same rule of vowel deletion before stress. Another advantage of this analysis is that Rule (7) tells all the vowels (no matter how many there are) preceding the stress. All these vowels are phonologically zero but phonetically predictable by a late phonetic realization rule:

$$(8) \emptyset \rightarrow u / C __ C$$

Let us further examine the following vowel alternations in Sediq:

(9)(a) <u>Stem</u>	<u>Imperative</u>	
sérus	surés-i	'wipe'
requn	ruqen-i	'swallow'
bekuy	bukey-i	'tie, fasten'
(b) tudóruy	tuduróy-i	'roll down'
obuh	boh-i	'smoke'

In the above data, (9)(a) shows the alternation of $e \sim u$ and (9)(b) the alternation of $o \sim u$. The two mid vowels /e, o/ are weakened and reduced to /u/ after stress:

Note that *i* turns up instead of the anticipated *u*, as it would be predicted by the rule. The vowel *i* seems to be conditioned by the following *y*. However, *u* appears before *y* in many more forms, e. g., *tuguyak-i* 'Belch!' *sukuya-i* 'Fly!' *tuyu-i* 'Point to!' *puyas-i* 'Sing!' *suyaq-i* 'Spit!' *huyeg-i* 'Stand up!' etc. Other "exceptions", which have in fact a far more general basis, will be handled by a vowel-assimilating rule; see §2.9.1.

$$(10) \begin{Bmatrix} e \\ o \end{Bmatrix} \rightarrow u/\acute{V}(C)___$$

Note that the above rule applies only to mid vowels; it does not apply to high or low vowels, as the ones italicized below:

(11) <u>Stem</u>	<u>Imperative</u>	
biki	buki-i	'bend'
liŋis	luŋis-i	'weep'
taqi	tuqi-i	'sleep'
(12) séxan	suxál-i	'repeat'
seyaq	suyaq-i	'spit'
tara	tura-i	'wait'

As Yang pointed out, there are a few exceptions to Rule (10), e. g., *qoqoq* 'duck', *beyoq* 'juice', *guyoq* 'trap', *turoq* 'sputum'. Also note some irregular verb inflections as below:

(13) <u>Stem</u>	<u>Imperative</u>	
cehak	cehep-i	'taste'
gao	geeg-i	'choose'
kuseaŋ	kuseeŋ-i	'quarrel'
selaq	suliq-i	'kill'
patis	putas-i	'write'
enaq	niq-i	'dwell'

A clear case of vowel weakening in the word-final position can be illustrated with Saaroa examples:¹⁴

(14)(a) <u>Simple Present</u>	<u>Present Perfect</u>	
um-alacɯ	um-alaci-cu	'bite'
m-icɯŋɯɯ	m-icɯŋili-cu	'chase'
m-aŋɯɯɯ	m-aŋɯlivi-cu	'close'
(b) limilavaɯ 'younger sibling'	limilavai-ku 'my younger sibling'	
usumanɯ 'wife'	usumani-ku 'my wife'	

14. My analysis is different from Ting's (1976). He treats *ɯ* as the base and *i* as derived in his unpublished manuscript.

The data above show that the vowel *i* is weakened to *u* when it is not followed by a suffix. This can be stated by the rule:

(15) $i \rightarrow u / __\#$

Maga also has such an example for vowel weakening in the final position, *bkuâsi* 'ribs', *bkuâsi-li* 'my ribs'. The stressed vowel *i* in the stem followed by a suffix is weakened to *i* while occurring in the word-final position. It is probably wrong to treat the stressed vowel *i* as being assimilated to the vowel of the suffix as in my preliminary report on Maga phonology, Li (1975: 23, 27).

2.8.2. Alternations of Vowels with Zero

Maga has numerous alternations of vowels with zero, particularly in verbs and adjectives:¹⁵

(16)	Positive	Negative		Base Form
	tibróo	i t̃buróo	'yellow'	/tiburoo/
	ma-rgíi	i k-r̃agíi	'good'	/maragii/
	ma-pcéé	i k-p̃acée	'dry'	/mapacee/
	ma-ŋtáa	i k-ŋ̃táa	'raw'	/maŋitaa/
	si-ptáa	i s-p̃utáa	'burn'	/siputaa/
(17)	tmacícir̃ŋi	i k-tamcicir̃ŋi	'black'	/tamacicir̃ŋi/
	tmalsiksíki	i k-taml̃iskiskíi	'blue'	/tamaliskiskíi/
	θnavivróo	i k-θanṽivróo	'brown'	/θanaviviroo/
(18)				
(a)	ma-kráci	i k̃orcéə	'bad'	/koraci/
	mo-rgári	i r̃agréə	'climb'	/ragari/
(b)	ma-múdu	i k̃amdúu	'dead'	/mamudu/
(c)	o-dváci	i d̃avcíi	'walk'	/davaci/
(19)				
(a)	i-míci	i āmcíi	'bring'	/amici/
	u-búlu	i āblúu	'bury'	/abulu/
(b)	u-icibi	i ācbíi	'bake'	/icibi/?

15. Beginning of pitch is indicated by \sim , stress by $'$, and morpheme boundary by - (infix by slashes / /).

These vowel alternations are also determined by the two main factors: (1) stress and (2) affixation. When a stem is affixed, the stress position is shifted and thus vowels in the different syllables of the related forms will get deleted. Items with the same morpheme and syllable structures share exactly the same alternation patterns, e. g. (16) above.

Stress is on the penultimate syllable and non-phonemic in Maga. All negative forms always end with long vowels, which are analysable as geminate vowels. So stress may not fall on the same syllable in the positive and negative forms with the same stem. The general rule is that THE VOWELS IN THE EVEN NUMBER OF SYLLABLES FROM THE STRESS GET DELETED. An exception to the general rule is that vowels on high pitch are not deletable. And that complicates the vowel deletion rule in the language.

Both stress and pitch fall on the same (penultimate) syllable in the positive form. In the negative form, however, they do not co-occur, and pitch starts on the syllable immediately preceding the stressed syllable in the surface phonetic forms; that is, pitch starts one syllable earlier than stress, viz. pitch is on the antepenultimate instead of penultimate syllable.¹⁶ And that is one of the reasons why positive and negative forms may have different vowels deleted.

Another exception to the general rule is the final vowel after stress. Obviously deletion of the final vowel would disrupt the regular stress pattern.

There are also some minor preferable restrictions on vowel deletion: (1) generally no deletion of a vowel if it occurs between identical consonants, (2) preferably no deletion of the initial vowel before stress if there is no initial consonant, e. g. *aváyi* 'boat'.

16. I am grateful to Tsuchida (personal communication) for pointing this out to me. Failing to distinguish between pitch and stress resulted in inaccurate transcriptions of a few negative forms in Maga in my preliminary report, Li (1975).

I	II
(20)(a) ɲrée 'saliva'	os-ɲáre 'produce saliva'
ckée 'excrement'	m-cáki 'defecate'
mo-ckée 'defecate'	m-caki-áa 'Defecate!'
(b) bváa 'wine'	k-baváa 'native wine'

The data in (20) I above show that when the first vowel of a dissyllabic stem gets deleted, the second vowel will get lengthened as a compensation. Maga does not permit the form *#CCV#. Comparing columns I and II above, we can see that the position of stress shifts if the stem is affixed. Maga also permits no more than two consonants in the word-initial position. If a single consonant-prefix is added to an item beginning with two consonants, then a vowel will turn up after the second consonant, e. g. (20)(b).

There is not only internal but also external evidence for vowel deletion in Maga. Cf. the following Maga and Budai forms:

(21) Maga	Budai	
kcarsía	kacaLisianə	'aboriginal'
tbalɲáni	tabalaɲa:nə	'arm, shoulder'
bləblə	baləbalə	'bamboo (generic)'
kváðnə	kavaðanə	'type of bamboo'
blɛblɛ	bələbələ	'banana'
rlée	Lolay	'baby, child'
tábɲə	a-ta-tabaɲə	'cockroach'
masrimsími	masaLəməsəmə	'dusk'

Alternation of vowels with zero is also common in Tsou (Tung 1964):¹⁷

17. My interpretation is different from Tung's. While Tung interprets all the following examples as METATHESIS of the vowel and consonant after the prefix (or infix), I interpret them as ALTERNATION of vowels with zero. The morpheme boundary, which may not be the same as given by Tung, is added by me.

- (22) b6-hŋ-u h6ŋ-a 'see clearly' (Tung 1964: 183)
 bo-chfo cohiv-i 'know' (Tung 1964: 183)
 bu-hfaféoi huaféoi 'peep' (Tung 1964: 183)
 mó-chi ciha 'throw away' (Tung 1964: 184)
 t/m/6psu tp6si 'draw, write' (Tung 1964: 184)
 s/m/úhnu skúna 'order' (Tung 1964: 184)

Still the same two factors determine vowel deletion in Tsou. A rule similar to the one for Maga, i.e. deletion of the even number of syllables from stress, seems to hold true of Tsou in many cases. Examples of longer Tsou forms are given below:

- (23) ŋaŋcúŋcú 'full' (p. 186) tousbusbut(ɯ)néni 'discuss' (p. 188)
 nanúhtɯ 'short' (p. 186) toskuf(u)néni 'place above' (p. 188)
 hoŋtúŋtu 'one end of something being burned' (p. 186)

Note that the vowels in parentheses are optional and deletable.

Alternations of vowels with zero are found in several sets of suffixes in Thao: (1) alternation of *-in* (or *-an*) ~ *-n* 'passive', (2) alternation of *-u:wan* ~ *-wan* 'polite request', (3) alternation of *-i:ða* ~ *-yða* ~ *-iða* ~ *-ða* 'complete aspect', as in the following data (24)–(26):

- | | | | |
|------|--------------------|---------------------|---------------------|
| (24) | <u>Active (AF)</u> | <u>Passive (OF)</u> | |
| (a) | k/m/a:n | ka:n-in | 'eat' |
| | θ/m/a:nup | θanu:p-in | 'bury' |
| (b) | ta:la | tala:h-an | 'cut (wood)' |
| | pa:qu | paqu:h-an | 'eat or dring with' |
| (c) | ka:θu | ka:θu-n | 'bring' |
| | minfa:ri | ?infɑ:ri-n | 'blow' |
| | paɲna:ra | paɲna:ra-n | 'burn' |
| (25) | <u>AF</u> | <u>Request</u> | |
| (a) | k/m/a:n | kan-u:wan | 'eat' |
| | q/m/irqir | qirqir-u:wan | 'bite' |
| (b) | munáy | ?unay-wan | 'come' |
| | tma:ða | tmaða:-wan | 'listen' |

(26)	<u>Present</u>	<u>Perfect</u>	
(a)	ma:lus	m/in/alus-i:ða	'sleep'
(b)	mi:lu	m/in/i:lu-yða	'bathe'
(c)	mili:li	m/in/ili:li-i:ða	'stand'
(d)	ma:θay	m/in/a:θay-ða	'die'

These alternations are conditioned by the permissible syllable structure in the language, C(C)V(C). Thao does not allow a vowel sequence to occur,¹⁸ although it may have a phonetically long vowel, which generally coincides with stress (on the penult).

For a detailed discussion of these alternations in Thao and their analyses, see Li 1976.

A simple rule of the initial-vowel deletion operates in Sediq, as reported by Yang (1976):

(27)	<u>Stem</u>	<u>Imperative</u>	
(a)	adis	des-i	'bring'
	atak	tap-i	'cut (with scissors)'
	aŋan	ŋal-i	'take'
(b)	imah	mah-i	'drink'
(c)	eluk	leb-i	'close'
	eyah	yah-i	'come, enter'
(d)	obuh	boh-i	'smoke'
(e)	utaq	taq-i	'vomit'

As based on Yang's (1976) analysis and illustrated in §2.8.1, full vowels are weakened to *u* immediately before stress, so the anticipated forms for the imperatives in (27) would begin with the vowel *u*. However, the actual forms we get do not. Apparently there is such a vowel-deletion rule in Sediq, as given by Yang:

(28)	$u \rightarrow \emptyset / \# ___ C\acute{V}$
------	--

In my present analysis, the alternation in (27) is not different from

18. A diphthong such as *ay* and *aw* is treated as a single vowel in Thao.

the Sediq data discussed in §2.8.1, (1)–(7). They are all the same vowel deletion rule operating in the language; see discussion above.

2.9. Assimilation

When there is a vowel assimilation across morpheme boundary, it is usually the vowel of an affix assimilated to that of a stem. Most data available in various Formosan languages support this claim. There are a few exceptions, e.g., (17) and (22) in §2.9.2 below.

2.9.1. Complete Assimilation

In Sediq, nouns can take the verbal prefixes *mu-* (also 'future tense marker'), *pu-*, *ku-*, etc. and derive as verbs, as in (1) below:

(1) <u>Noun</u>	<u>Verb</u>
quti 'excrement'	mu-quti 'will defecate'
huliŋ 'dog'	pu-huliŋ 'hunt with a dog'
muhiŋ 'nose'	mu-nu-muhiŋ 'have snored'

Note that the vowels of the verbal prefixes are all the same *u*, as expected; see §2.8.1. However, the vowels of the verbal prefixes in (2) below are not *u*; instead they are all identical with the stressed vowels in the stems:

(2) <u>Noun</u>	<u>Verb</u>
hido 'sun'	mi-hido 'expose to the sun'
hebin 'a split'	ke-hébin 'to split'
heŋak 'breath'	se-heŋak 'breathe'

Also cf.

(3) —	ma-háŋuc 'will cook'
-------	----------------------

(4) <u>Stem</u>	<u>Imperative</u>
dehuk	dehé-k-i 'arrive'
pahu	pehé-i 'wash (clothes)'
suluhe	sulaháy-i 'learn'

The data in (2)–(4) indicate that the vowels preceding the stressed syllables which begin with *h* are identical with the stressed vowels. Since the combination **ho* never occurs in Sediq, we can state the complete

vowel-assimilating rule (The subscript x stands for vowel identity):

$$(5) V \rightarrow V_x / ___ h \acute{V}_x$$

The vowel-assimilating rule also applies in a vowel sequence without an intervening *h*, as in (6)–(8) below:

(6) Stem Imperative

reus reés-i 'bury'

guleiŋ gulifiŋ-i 'hide'

sais siís-i 'sew'

(7) Stem Future

eyah me-éyah 'come'

adis ma-ádis 'bring'

imah mi-ímah 'drink'

ekan me-ékan 'eat'

aŋan ma-áŋan 'take'

(8) uyas mu-úyas 'sing'

The data (6)–(8) show that all vowels in Sediq except *o* are involved in the assimilating rule. Since *o* never occurs in a vowel sequence, Rule (5) above can be extended to Rule (9) below:

$$(9) V \rightarrow V_x / ___ (h) \acute{V}_x$$

Let it be noted that the vowel assimilation will hold on the condition that there is an *h* or no consonant in between; otherwise the vowels preceding the stress will be reduced; see §2.8.1.

In light of the fact stated by Rule (9) above, Rule (7) in §2.8.1 should be narrowed down to:

$$(10) V \rightarrow \phi / ___ C^i V$$

Condition: C does not contain *h*.

The rule can be simplified if stated in terms of distinctive features.

Vowel assimilation has also been observed in Saaroa (Ting 1976:)

(10)(a) um-ala 'take' (b) ɯm-ɯmɯɯ 'touch'

um-ilavɯ 'chew' ɯm-ɯraɯ 'plant'

um-usal(ɯ) 'rain'

- (11)(a) t/um/aŋi 'weep' (b) l/um/umukʉ 'plant'
 k/um/aliʔi 'dig'
 s/um/avʉŋu 'make cake'

Concerning the alternation of the prefix *um-~um-* in (10) and the alternation of the infix *-um-~um-*, it is clearly simpler to treat *u* as the base and *ʉ* as derived, conditioned by the following vowel:

- (12) u→ʉ/___Cʉ

The vowel of the passive (or Object Focus) suffix *-ən* in Saisiyat can be assimilated to the vowel of the stem:

- | (13) <u>Active (AF)</u> | <u>Passive (OF)</u> | |
|-------------------------|---------------------|--------------------|
| k/om/aLas | kaLas-ən | 'bite' |
| kəmpəL | kəpəL-ən | 'squeeze' |
| Lasəŋ | Lasəŋ-ən | 'sting' |
| k/om/olol | kolol-ən | 'bury' |
| (14) ʃæʔhōro | ʃæʔhōro-on | 'see accidentally' |
| (15) mo-lobLih | lobLih-in | 'return' |

The passive suffix *-ən* appears after both the stem vowels *a* and *ə*, and even after *o*. If *ə* is treated as the base, then it is assimilated to the preceding vowel *o* or *i*:

- (16) ə→ $\begin{cases} o/o \\ i/i \end{cases}$ ___

The conditions are not very clear because of inadequate data for passive forms. It requires further investigation. Rule (16) is highly tentative.

2.9.2. Partial Assimilation

Maga shows partial assimilation of the stem vowel to the suffix as in the following examples:

- (17) kvaa 'hoe' kve-li 'my hoe'
 arima 'hand' arime-li 'my hand'
 cɟira 'ear' cɟire-li 'my ear'
 bvaa 'wine' bve-li 'my wine'

The low vowel *a* is raised to the mid *e* by the high vowel *i* of the

suffix. In this case the vowel in the word-final position is the base, whereas the vowel in the word-medial position is derived:¹⁹

(18) $a \rightarrow e / ___\text{Ci}$

This vowel-raising rule, however, applies only to a handful of words. It does not apply to the following items:

(19)(a) pcecera 'flesh between thighs' pcecena-li 'my flesh between thighs'

tkəikəira 'armpit' tkəikəina-li 'my armpit'

(b) nu-tmaraa 'how (future)' tumanì 'how (non-future)'

(20) (see §2.7 (8) for examples)

(21) dani 'house' da-li 'my house'

Furthermore, there is an example for vowel-raising not because of the high vowel of the suffix:

(22) obaa 'carry on back' nu-obe-ta 'we shall carry on back'

Partial assimilation in nasal consonants is observed in the Stimul dialect of Paiwan (Ho 1975):

(23) (a)

man-ìlima 'five people'

man-inim 'six people'

man-alu 'eight people'

man-ta-pulu? 'ten people'

man-kuzuł '1,000 people'

man-Dusa-kuzuł '2,000 people'

(b)

mam-pitu 'seven people'

mam-pitu-a-kuzuł '7,000 people'

mam-pitu-a-kuDaw '70,000 people'

The above data show the alternation of the prefix *man-~mam-* 'people'. Since *m* appears only before *p*, and *n* elsewhere, *n* can be treated as the base and *m* as derived:

(24) $n \rightarrow m / ___\text{Labial}$

2.10. Dissimilation

Dissimilation is diachronically a sporadic change, and synchronically it is a relatively rare process found operating in language.

19. Cf. the historical derivations, PAN **lima* > Maga *a-ri-ma* 'five, hand', **Calija* > *crija* 'ear'.

This is one reason for treating the non-suffixed forms in (17) as the base.

Examples of dissimilation in consonants can be drawn from Tsou (Tung 1964, Starosta 1969, Ho 1976a). Let us examine the alternation $h \sim k$ in the following examples (Tung 1964: 210-213):

- | | | | |
|-----|-------------------------------|-----------------------------|--------------------------|
| (1) | I | II | III |
| | eúso 'two' | m-pús-ku 'twenty' | o-psó-hu 'go twice' |
| | túeu 'three' | m-túe-hu 'thirty' | o-téu-hu 'go thrice' |
| | eímo 'five' | m-eemó-hu 'fifty' | |
| | | más-ku 'ten' | oh-más-ku 'go ten times' |
| (2) | no-pús-ku 'stay for 2 days' | na-téu-hu 'stay for 3 days' | |
| | no-suptú-hu 'stay for 4 days' | | |
| | to-iemó-ha 'five years' | to-más-ka 'ten years' | |
| (3) | s/m/úhnu | skúna | 'order' (Tung 1964: 184) |

The data above show the alternation $k \sim h$ in addition to the alternation of $u \sim \text{u}$, which is not our concern here. For the alternation of the consonants, h can be treated as the base and k as derived:

- (4) $h \rightarrow k/s$ _____

The statement above is supported by the fact that Tsou does not permit the sequence $*sh$ (Tung 1964: 14). There is also historical evidence for the change $h > k$ when preceded by a voiceless fricative in Tsou, e.g., Proto-Tsou $*saNuzu >$ Tsou $skúzu$ 'stone' instead of the anticipated $*shuzu$ *; Proto-Tsou $vuNai >$ Tsou $fkói$ 'snake' instead of the anticipated form $*fhói$ *; see Li (1972).

As Ho (1976a: 266) pointed out quite correctly, (4) is more economical than the alternative statement (5) below:

- (5) $k \rightarrow h / \left\{ \begin{array}{c} e \\ o \\ \text{u} \end{array} \right\}$ _____

Also the environment in (5) includes vowels /e, o, u/ that do not belong to a natural class. So (4) is preferred to (5).

Tsou has the morphophonemic alternation $s \sim h$ manifested in the two grammatical particles *mos-o* and *moh-cu* (-to, -ta) 'aspect marker' with the

same grammatical function (Tung 1964: 92-97, 196, Ho 1976a: 267-268). Since *s* and *h* are in complementary distribution and *h* is phonologically conditioned, *s* can be treated as the base and *h* as derived:

$$(6) \quad s \rightarrow h / ___ \left\{ \begin{array}{c} c \\ t \end{array} \right\}$$

The rule above accounts for the fact stated by Tung (1964:14), "Except the laryngeals, a stop and a spirant of the same position do not go together", viz, no combinations like **sc* and **st* occur in Tsou. Alternatively, if the rule should be stated

$$(7) \quad h \rightarrow s / ___ o$$

then there is counter-evidence in many Tsou forms such as *hochia* 'few', *hoci* 'if', *hahocyu* 'man, the male', in which the combination *ho* does occur.²⁰

Dissimilation of nasals is observed by Tung (1964: 183) as in the following example:

$$(8) \quad msimo : sinvi \text{ 'to chew'}$$

According to Tung's (1964: 183) analysis, this is a case of "the dissimilation of the /m/ to /n/ before /v/ ...". To state this by rule is:

$$(9) \quad m \rightarrow n / ___ v$$

This is to avoid a combination of two labial consonants. A similar process of the dissimilation of labials is attested in the Stimul dialect of Paiwan (Ho 1975):

$$(10) \quad \begin{array}{ll} (a) & (b) \\ k/im/ac \text{ 'bite'} & v/in/ali \text{ 'blow (wind)'} \\ d/im/apis \text{ 'blow (breath)'} & v/in/ili \text{ 'buy'} \\ r/im/ala \text{ 'boil water'} & p/in/ili? \text{ 'choose'} \\ ?/im/ici \text{ 'kill'} & \\ c/im/agicag \text{ 'knock'} & \\ t/im/intin \text{ 'weigh'} & \end{array}$$

Cf. (10)(a) and (b) above. It is clearly simpler to treat *m* as the base

20. The analyses of the alternations *h*~*k* and *s*~*h* are generally based on Ho's (1976a) paper.

and *n* as derived for the alternating infix forms *-im-* and *-in-*:

(11) $m \rightarrow n$ /Labial V_____

Dissimilation of vowels is at doubt, if not totally lacking, in Formosan languages. The following Maga forms seem to be a case of vowel dissimilation:

(12)	(a)	(b)
	mamaa 'father'	mami-nmaa 'my father'
	kakaa 'elder sibling'	kaki-nmaa 'my elder sibling'

There are only a few such examples. If (12)(b) is interpreted as vowel dissimilation, then is (13) a case of vowel dissimilation or assimilation?

(13) ninaa 'mother' nini-nmaa 'my mother'

2.11. Metathesis

Metathesis is a very sporadic change and process in language. Some instances of the so-called metathesis can actually be better explained as a much more general process such as vowel alternation, for example, see §2.8.2 (22) and Note 17.

There is, however, an example in Tsou, for which I have no better explanation than metathesis for the time being:

(1) *eimo* 'five' to-*ie*mo-ha 'five years' (Tung 1964: 212)

Note the metathesis of *i* and *e* in the stem meaning 'five' above. Both combinations *oe* and *oi* occur in Tsou (Tung 1964: 23). Perhaps the change from *ei* to *ie* is to give a sequence of the preferred syllable structure CVCVCVCV in the form *toiemoha*, in which *i* is probably a non-syllabic *y*.

Jeng (personal communication) has kindly provided me with the following examples for the metathesis of *ua~au* and *ia~ai* in Bunun:²¹

21. The morpheme boundary - is added by me. The mark ' stands for syllable division. The abbreviations are: AF, Agent-focus (*ma-*); OF, Object-focus (*-an*, *-un*); LF, Locative-focus (*-an*); DF, Dative-focus (*-un*).

- (2)(a) *ma-tua* sak hilav. *tau'-an* ku hilav.
 AF open I door *tau'-un* me
 OF
 I opened the door. The door was opened by me.
- (b) *ma-suað* sak hutan. *sauð-an* ku hutan ?iti?.
 AF plant sweet here
 potato
 I planted sweet potatoes. The sweet potatoes were
 planted here by me.
- (3)(a) *ø'ikma'-ia* sak sui. *'ikma'ai'-un* ku sui.
 AF use money
 I spent the money. The money was spent by me.
- (b) *øpakasia* *pakasai'-un*
 AF request DF

Metathesis of consonants can occasionally be found. For example, Thao has the variant forms *sma:puk* and *sma:kup* 'catch (fish)'. This is clearly a case of metathesis of *p* and *k*, although the occurrence has nothing to do with affixation. It does when compared with the imperative form, *sakp-i*.

Atayal has the metathesis of *g* and *b* (derived as *p* word-finally) in the forms below:

- (4) Stem Passive
hgup *hbg-an* 'do magic' (Egerod 1965a: 260)

REFERENCES

- Bender, Byron W. 1973. Parallelisms in the Morphophonemics of Several Micronesian Languages. *Oceanic Linguistics* 12: 455-477.
- Dempwolff, Otto. 1934-38. *Vergleichende Lautlehre des austronesischen Wortschatzes*. Berlin. [Reprinted in 1969, Nendeln, Liechtenstein: Kraus Reprint]
- Dyen, Isidore. 1971. The Austronesian Languages and Proto-Austronesian. In *Current Trends in Linguistics*, ed. by Thomas Sebeok, 8: 5-54.

- Egerod, Søren. 1965a. Verb Inflection in Atayal. *Lingua* 15: 251-282.
- _____. 1965b. An English-Atayal Vocabulary. *Acta Orientalia* 19: 203-220.
- _____. 1966. A Statement on Atayal Phonology. *Artibus Asiae Supplementum* XXIII (Felicitation Volume for the Seventy-fifth Birthday of Prof. G. H. Luce) 1: 120-130.
- Ferrell, Raleigh. 1969. Taiwan Aboriginal Groups: Problems in Cultural and Linguistic Classification. Taipei: Institute of Ethnology, Academia Sinica Monograph, No. 17.
- _____. 1970. The Pazeh-Kahabu Language. *Bulletin of the Department of Archaeology and Anthropology, National Taiwan University*, 31/32: 73-97.
- Ho, Dah-an. 1975. A Preliminary Report on the Stimul Phonology. Unpublished MS. (In Chinese)
- _____. 1976a. Tsou Phonology. *Bulletin of the Institute of History and Philology, Academia Sinica*, 47: 245-274. (In Chinese)
- _____. 1976b. The Phonology of the Butanglu Dialect of Paiwan. To appear in the *Bulletin of the Institute of History and Philology, Academia Sinica*, 48 (December 1977). (In Chinese)
- _____. 1976c. A Comparative Study of Paiwan Dialects. Unpublished MS. (In Chinese)
- Jeng, Heng-hsiung. 1977. Topic and Focus in Bunun. Taipei: Institute of History and Philology, Academia Sinica Special Publication, No. 72.
- Li, Paul Jen-kuei. 1972. On Comparative Tsou. *Bulletin of the Institute of the History and Philology, Academia Sinica*, 44: 311-337.
- _____. 1973. Rukai Structure. Taipei: Institute of History and Philology, Academia Sinica Special Publications, No. 64.
- _____. 1974. Alternations between Semiconsonants and Fricatives or Liquids. *Oceanic Linguistics* 13: 163-186.
- _____. 1975. Maga Phonology: Preliminary Report. *Bulletin of the Department of Archaeology and Anthropology, National Taiwan University*, 37/38: 16-28.
- _____. 1976. Thao Phonology. *Bulletin of the Institute of History and*

- Philology, Academia Sinica, 47: 219-244.
- _____. 1977. The Internal Relationships of Rukai. Bulletin of the Institute of History and Philology, Academia Sinica, 48: 1-92.
- Ogawa, Naoyoshi and Erin Asai. 1935. Myths and Traditions of the Formosan Native Tribes. Taihoku. (In Japanese)
- Stanley, Patricia. 1974. Syntax of Tsou Verbs (Formosa). Paper Presented at the First International Conference on Comparative Austro-nesian Linguistics.
- Starosta, Stanley. 1969. Review of A Descriptive Study of Tsou, Formosa, by T'ung-ho Tung. Language 45: 439-444.
- Ting, Pang-hsin. 1967. A Descriptive Study of the La'alua Language, Formosa—Phonetic Systems. In Symposium in Honor of Dr. Li Chi on his Seventieth Birthday, Part II, 917-932. Taipei (In Chinese)
- _____. 1976. A Study of the La'alua Language, Formosa—Grammar. Unpublished MS. (In Chinese)
- Tsuchida, Shigeru. 1976. Reconstruction of Proto-Tsouic Phonology. Tokyo: Study of Languages & Cultures of Asia & Africa, Monograph Series No. 5.
- Tung, T'ung-ho. 1964. A Descriptive Study of the Tsou Language, Formosa. Taipei: Institute of History and Philology, Academia Sinica Special Publications, No. 48.
- Yamada, Yukihiro. 1974. A Phonology of Tayal. Research Reports of the Kochi University 23: 109-117.
- Yang, Hsiu-fang. 1975. The Phonological Rules of Atayal. Unpublished MS. (In Chinese)
- _____. 1976a. The Phonological Structure of the Paran Dialect of Sediq. M. A. thesis submitted to the Department of Chinese Language and Literature, National Taiwan University, June 1976. Bulletin of the History and Philology, Academia Sinica, 47: 611-706. (In Chinese)
- _____. 1976b. A Comparative Study of the Paran, Taroko, and Sakura Dialects of Sediq. Unpublished MS. (In Chinese)

臺灣土著語言的詞音位轉換

(摘 要)

李 壬 癸

本文把現象紛雜的各種臺灣土著語言的詞音位轉換(morphophonemic alternations)，理出幾條通則來。希望所得的結果不僅有助於通盤瞭解臺灣土著語言的音韻系統，而且對一般音韻學理論也有一些貢獻，提供許多有趣的實例。

雖然各種臺灣土著語言的詞音位轉換現象並不相同，但它們的出現却都取決於兩個相同的基本因素：（一）出現在字界或語位界限，（二）重音的位置。重音節的元音保持完整的元音性，而非重音節的元音則可能弱化或完全刪除，視個別語言而定。字尾的音段（輔音或元音）傾向於中化(neutralized)、弱化、或消失。大多數的轉換涉及以下的變化過程：中化、弱化、清化、刪除、同化，偶爾也有異化與換位(metathesis)的變化過程。中化、清化、刪除以及同化等事實上都是不同程度的弱化現象，是降低了音韻的對比程度。刪除是極度弱化的結果，而字尾語音清化則是一種輕度的弱化現象。

本文把臺灣土著語言的詞音位轉換歸納為以下十一種類型：（一）唇音與舌根音（包括塞音與鼻音）的轉換 $p \sim k$, $b \sim k$, $m \sim \eta$ ，（二）舌尖塞音與塞擦音的轉換 $t \sim c$, $d \sim c$ ，（三）舌尖鼻音與邊音的轉換 $l \sim n$ ，（四）半元音（或高元音）與濁擦音（或流音）的轉換。（五） $g \sim w$ （或 u ）， $g \sim y$ ， $aw \sim o$ ， $ay \sim e$ 等一類的轉換，（六）濁塞音與清塞音的轉換 $b \sim p$, $d \sim t$ ，也就是字尾塞音的清化，（七）字尾或語尾音段（包括元音與輔音）的消失，（八）完整元音與弱化元音或零的轉換，（九）同化，（十）異化，十（一）換位。具有第一類轉換的只有賽德語。第二類的有賽德語與泰雅語。第三類的有賽德語、泰雅語、巴則海語。第四類的有魯凱語、鄒語、卡那卡那富語、沙阿魯阿語、泰雅語、排灣語。第五類的有泰雅語、賽德語、魯凱語馬加方言。第六類的有泰雅語、巴則海語。第七類的有邵語、魯凱語（大南、大武、馬加、萬山各方言）、布農語、沙阿魯阿語。第八類的有泰雅語、賽德語、魯凱語馬加

方言、鄒語、邵語。第九類的有賽德語、沙阿魯阿語、魯凱語馬加方言。第十類的有鄒語、排灣語三地門方言。第十一類的有鄒語、布農語、邵語、泰雅語。以上第十及十一類的例子很少。沒有一種語言同時具有以上十一類的各種轉換現象。有的語言轉換現象多，如賽德語霧社方言，有的語言轉換現象少，如阿美語。

在所有的臺灣土著語言當中，以泰雅語羣的音韻最爲複雜，轉換的現象最多，也最爲有趣。鄒語羣的轉換現象較少，尤其是卡語與沙語。魯凱語當中以馬加方言的音韻最爲複雜，其元音有無的轉換最爲特殊。至於所謂的排灣語羣包括十多種不同的語言，音韻之繁簡頗不一致。

臺灣土著語言的各種詞音位轉換，大都以出現在字中接後加成分的音段爲基式(bass form)，而以出現在字尾不接後加成分的音段爲導式(derived forms)。本文採取這種分析方式有幾個理由。其中一個理由是，我們一定可以從基式預測導式。另外一個理由是，我們可以解釋一些語音分佈的限制，例如泰雅語的 b, r, g，賽德語的 p, b, m, t, d, g, w, y，布農語的 b, d，邵語的 h 等在字尾都不出現。

相近的語言常有相似或平行的轉換現象，例如泰雅語與賽德語都有上述第二、三、五、八類的現象。魯凱語與鄒語羣都有第四類的現象。

本文是在中央研究院歷史語言研究所「臺灣南島語言調查研究」計劃下完成的研究報告之一，由行政院國家科學委員會資助，特此誌謝。本文曾在美國語言學會與夏威夷大學聯合主辦的「南島語言學座談會」上發表，於1977年8月18~20日在檀香山舉行。文中所用的各種山地語言資料凡是魯凱語、邵語、賽夏語、巴則海語都是根據作者所收集的田野資料整理分析而成，泰雅語是根據易家樂先生的報告，賽德語是根據楊秀芳小姐的報告，鄒語是根據董同龢先生、土田滋先生、及何大安先生的報告，沙阿魯阿語是根據丁邦新先生及土田滋先生的報告，布農語是根據鄭恒雄先生的報告，排灣語是根據何大安先生的報告。作者特別感謝提供語言資料的各位先生，尤其他們未發表的稿件都非常寶貴。作者對於語言資料的解釋與原作者常有不同的地方，可以說是見仁見智的差異。本文在付印之前，承丁邦新與龔煌城兩位先生各看過一遍並提出一些改進意見，排印時何大安先生與陳秀雲小姐都協助校對，作者在此一併申謝。