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A Comparative Study on Formosan Phonology: Paiwan and Budai Rukai

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A Comparative Study on Formosan Phonology:

Paiwan and Budai Rukai

by

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Dissertation

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To my grandmother,

with loving memory

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A Comparative Study on Formosan Phonology:

Paiwan and Budai Rukai

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Chun-Mei Chen, Ph.D.

The University of Texas at Austin, 2006

Supervisor: Anthony C. Woodbury

This study provides a detailed description and analysis of phonology of two Formosan languages and further compares the phonological constraints and prosodic structures in the languages. Formosan languages, nearly half of which have become extinct in the past two centuries, are the aboriginal languages of Taiwan. They belong to the Austronesian language family. Paiwan and Budai Rukai were selected for their geographical distribution and genetic classification. None of the existing field reports bear on both systemic phonetics and phonology of Formosan languages. Accentual patterns from Formosan languages have become essential for the reconstruction of Proto-Austronesian stress. In this

study, segmental phonology, phonetic representations of consonants and vowels, sound change, and prosodic structures such as word stress, phrasal stress, word-level pitch accent, and sentence-level intonation of Paiwan and Budai Rukai were documented, analyzed, constructed and compared.

The distribution of pitch accent in imperative construction and face-to-face interaction has shown the significance of prosody in Paiwan. Boundary tones are important indices for the syntactic types of sentences in Paiwan. On the other hand, vowel length is phonemic, and syllable weight does affect the assignment of stress in Budai Rukai. The interaction between vowel length at penult and stress patterns in Budai Rukai has provided evidence for the argument of contrastive stress in the Proto-Austronesian language. The dissertation has provided two more indicators in Formosan languages that reflect the contrastive stress in Proto-Austronesian roots: syllable extrametricality in Budai Rukai and final stress subject to schwa penult in Central Paiwan. The documentation of prosodic patterns has become a prerequisite for the preservation of ancestral accent of the indigenous languages. Historical reconstruction of cognates and synchronic phonological features have provided evidence for the proposal that the innovations shared by Paiwan and Budai Rukai are due to recent contact.

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CHAPTER ONE
INTRODUCTION

Who cares when a language dies? Why are our languages important to you? Our kids are not saying these words, and why do you want to learn? I was being inquired about these questions over and over again on my fieldwork trips. Language endangerment is a serious concern to which more and more linguists have paid their attention. Because of the very rich linguistic diversity, and because of the enormous social and cultural variation, the concern about language endangerment is centered. Formosan languages, nearly half of which have become extinct in the past two centuries, are the aboriginal languages of Taiwan. They belong to the Austronesian language family.

This study provides a detailed description and analysis of phonology of Formosan languages, and further compares the phonological constraints and prosodic structures in the languages. Two languages, Paiwan and Budai Rukai, are selected for their geographical distribution and classification within the Austronesian language family. From the perspective of Proto-Austonesian (PAN) reconstruction, Paiwan (66,000 speakers) and Rukai (10,000 speakers) represent one or two subgroups under the Austronesian genetic trees proposed by Blust (1977, 1999) and Ross (2002). Their genetic trees (Blust 1977, 1999; Ross 2002) give the Formosan languages considerable significance in the reconstruction of Proto-Austonesian language. Under the nodes represented in their trees, as shown in Figure 1.1 and Figure 1.2, the Formosan languages represent a number of primary Austronesian subgroups (up to nine), whereas other Austronesian languages outside Taiwan belong to a single subgroup. This implies Taiwan may be the oldest area where the Proto-Austronesian forms are preserved. The study of Formosan languages may have contributions to the reconstruction of Proto-Austronesian (PAN) language.

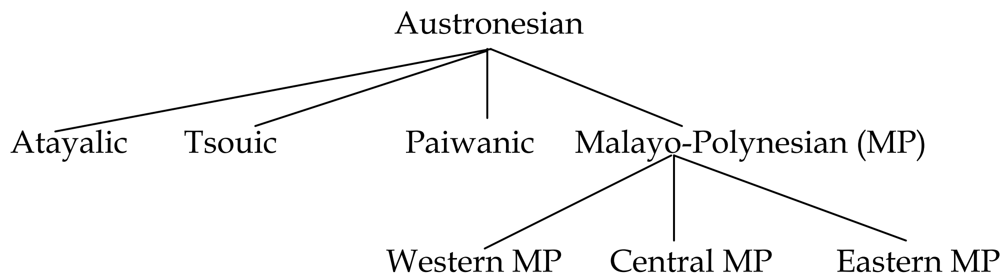


Figure 1.1: The Austronesian Family Tree Proposed by Blust (1977)

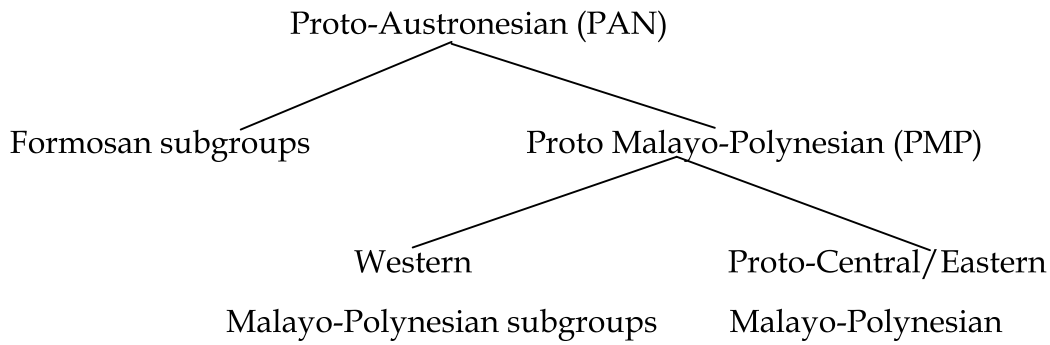


Figure 1.2: The Uppermost Nodes of the Austronesian Genealogical Tree (Ross 2002; after Blust 1977)

While the hypotheses of Austronesian subgrouping are still under dispute, accentual patterns from Formosan languages have become essential for the reconstruction of PAN stress (cf. Wolff 1993; Zorc 1993). Although government textbooks of Formosan languages with segmental charts and texts, and preliminary grammar books of these languages have been published (cf. Series of Formosan Languages 2000), none of the existing field reports bear on both systematic phonetics and phonology of the diverse aboriginal languages. Maddieson (2001) has pointed out that the majority of field reports on languages give rather minimal details on their phonetic properties, sometimes nothing more than a list of symbols. Though the phonological inventories of Paiwan and Budai Rukai have been constructed in recent work (Li 1977a, 1977b; Ho 1976, 1977; Chang 2000; Zeitoun 2000; Hsin 2001, 2003; Pulaluyan 2002), it varies from one fieldwork documentation to another. Furthermore, most of the existing documentation provides little empirical phonetic evidence for the phonological patterns, not to mention stress and sentence-level prosody or above.

According to the Ethnologue report[1], Austronesian tribal people are less than 2% of the population in Taiwan. In other words, only 2% (or less) of the population in Taiwan speaks Austronesian languages, though 14 Austronesian languages are still spoken on this island. It has been reported on the Ethnologue website that some Austronesian languages in Taiwan are nearly extinct. Alhough the languages such as Paiwan and Rukai in the current project are not extinct, they are threatened. The Paiwan and Rukai languages are the minority languages in Taiwan and currently losing their younger speaker population. It is clear that the documentation of Formosan languages has become an urgent issue. This dissertation aims to document and preserve both segmental and prosodic components of the two Formosan languages: Paiwan and Budai Rukai. Synchronic phonological distinctiveness and constraints have a bearing on the reconstruction of Proto-Paiwan and Proto-Rukai, and the relationship between the two languages has implications for the reconstruction of the Proto-Austronesian language.

Section 1.1 is the background information of the two languages, Paiwan and Budai Rukai. Section 1.2 addresses the importance of including prosodic components in linguistic documentation. Section 1.3 reviews theoretical

[1] See http://www.ethnologue.com.

frameworks of phonology that are proper and adopted for the description of Paiwan and Budai Rukai phonology in later chapters. Section 1.4 presents the organization of the dissertation.

1.1 Background Information of Paiwan and Budai Rukai

Among the aboriginal tribes in Taiwan, the Paiwan tribe has a comparatively large population, only outnumbered by the Amis and Atayal tribes. The Paiwan people live in the mountain areas 500-1200 meters above sea level, which cover Pingtung County and several small villages of Taitung County. Ho (1978) prefers to divide the Paiwan dialects into two: 't' vs. 'tj' dialects, and phonetic or phonemic variation has been found even in areas where the merger between t/tj and d/dj was reported. Within the Pinigtung County, Budai Rukai is right adjacent to the Paiwan aborigines. Dialectal features were not only found in Paiwan but also in Rukai. The Rukai language is divided into six dialects: Tanan, Budai, Labuan, Tona, Maga, and Mantauran. Linguistically, Tanan, Budai, and Labuan form one subgroup, while Tona and Maga form another (cf. Li 1977a; Hsin 2003). These two subgroups are to some extent mutually unintelligible (cf. Li 1977a). Mantauran differs from both groups though Zeitoun (1997) contends that it is more related to the Tanan-Labuan subgroup. Li (1977a, 1995) proposes the internal relationship of these dialects, as shown in Figure 1.3.

The works done by Li (1973, 1975, 1977a, 1977b) has had tremendous influence on subsequent investigations. His studies cover cognates in individual dialects and comprise dialectal comparison. Hsin (2003) conducts fieldwork in Maga Rukai and finds that Maga Rukai dialect shows a number of phonological characteristics that are unique among the Rukai dialects. This indicates dialectal features play an important role in the analysis of Rukai phonology.

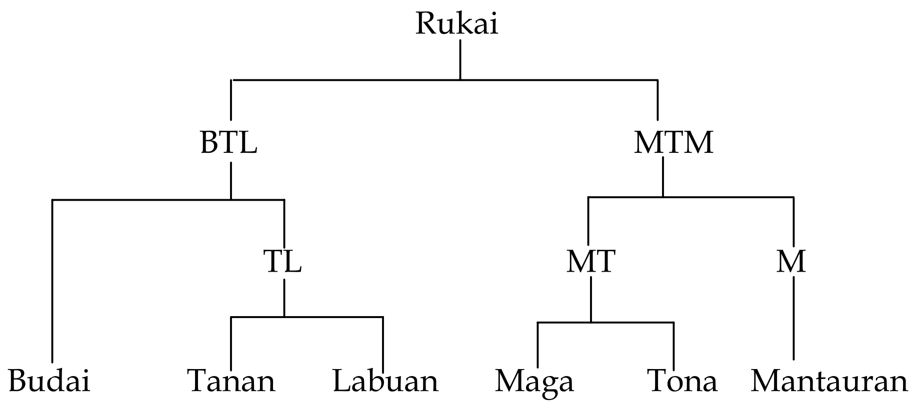


Figure 1.3: Internal Relationship of the Rukai Dialects (Li 1977a, 1995)

In terms of phonological change, Li (1995) claims that Budai Rukai is the most conservative. Drastic sound changes have taken place in Mantauran, and to a lesser extent in Mega. The position of Rukai in the Formosan language family is still controversial. Under the classification of Dyen (1965) and Ferrell (1969), Rukai is considered a division of the Paiwanic branch, mainly based on the evidence from lexical comparison. Ho (1983) and Li (1995) hold the traditional view that it is one of the Paiwanic languages, while the other scholar Tsuchida (1976) believes that Rukai is closer to Tsou. As echo vowels are developed in Rukai as well as the Tsouic dialects but not attested in any other Formosan languages, Tsou was chosen in Hsin's (2000) Maga Rukai study for comparison. Hsin (2000) argues that some similarities shared by Tsou and Maga Rukai are not commonly found in the other Formosan languages, such as the wide array of consonant clusters and the prosodic structure. However, as Li (1995) points out that the dialects of Rukai differ not only geographically, but also, to a certain extent, culturally and linguistically, one dialect of Rukai may be closer to the Tsouic while the other dialect of Rukai is closer to the Paiwanic.

Language contact in Formosan languages has gradually aroused interest of Austronesian specialists. Blust (2002) argues that Formosan languages such as Thao or Saisiyat have been subjected to very heavy contact influence from SVO Taiwanese. As a result, some Formosan languages have begun to favor SVO order. However, Blust (2002) also notes that even in these languages verb-initial constructions continue to be offered as a more native-like alternate to their historically recent calqued equivalents. Unlike Li's (1977a) diachronic account, Hsin (2003) has proposed a synchronic approach in which mid vowels in Rukai are generated in the dialect by phonological processes such as Vowel Coalescence and Nucleus Incorporation. The results of the synchronic approach show that mid vowels are the surface variants of high vowels, and the distribution of /ɨ/ and /ə/ become predictable. Both diachronic and synchronic accounts have made attempt to clarify the internal relationships of the languages, and it is apparent that phonological features have become prominent indices for the development of each dialect and the reconstruction of the proto-languages.

The geographical distribution of the two Formosan languages is shown in Figure 1.4, in which the letters 'g' and 'f' represent Paiwan and Rukai respectively. The fieldwork data presented in the current project are based on the following dialects: Paiwan (Northern, Central and Southern) and Budai Rukai. The critical review of the relevant literature and the previous documentation is drawn along with the description and analysis of the fieldwork data.

Figure 1.4: Distribution of the Formosan Languages[2]

[2] Source: http://www.ocac.net/newocac/taiwan/taiw an_6-3.htm#

1.2 Importance of Documentation of Prosody

Empirical study of Austronesian prosodic structure is relatively rare. Zorc (1993) has claimed that in the synchronic description of any language, word accent and intonation must be distinguished and accounted for. Nevertheless, before accent and intonation can be distinguished, more empirical studies on stress and accent patterns are needed. Several dimensions of factors have involved in the documentation and preservation of Formosan prosody: the diachronic change, synchronic linguistic alternation and the paralinguistic language contact. The younger generation in tribes has relatively less chance to speak their mother tongue. The factor of paralinguistic language contact will probably more greatly influence the prosodic patterns of Formosan languages in next generation. It has been observed in my fieldwork that younger informants of Paiwan may have different prosodic patterns from their parents or grandparents in their utterances.

The present study draws evidence from synchronic data of the prosodic patterns found in Paiwan and Budai Rukai and proposes an account for the distinction between the two languages. Not only stress patterns but also other types of prosodic patterns such as accent and intonation play important roles in word meanings and syntactic phrases in Formosan languages. The examples in (1)-(4) are the pairs of prosodic contrast found in my fieldwork.

(1)	Paiwan	Pitch Accent	Gloss
	a. paisu	páisu H	'money'
	b. paisu (<paisu-u)	**paisu** H	'(excl. imperative) Pestle!

(2) a. katsu (<kats-u) kátsu ‘(excl. imperative) Bite!’

H

b. katsu (<katsu-u) **<u>katsu</u>** ‘(excl. imperative) Bring (it)!’

H

(3)

Paiwan	Intonation	Gloss
a. timaɟu mamazɑŋiʎan	Low boundary tone	‘He is a chieftain.’
b. timaɟu mamazɑŋiʎan	High boundary tone	‘Is he a chieftain?’

(4)

Budai Rukai	Intonation	Gloss
a. ka-la-su talialaalaj	Downstepped tone	‘He is a chieftain.’
b. ka-la-su talialaalaj	Upstepped tone	‘Is he a chieftain?’

Examples of (1)-(3) are prosodic patterns in Paiwan, while examples of (4) are drawn from the field data of Budai Rukai. The distinction between (a) and (b) is based on prosodic components. A high or low boundary tone in Paiwan is aligned with the right edge of an intonational phrase. A downstepped or up-stepped peak prominence in Budai Rukai is aligned with the second-right or third-right edge of an intonational phrase, depending on the quantity of the penults. The stress patterns in Paiwan are syllabic trochees (Chen, 2004). In-depth investigation in different Paiwan tribes has revealed the prosodic variation among Northern, Central and Southern Paiwan. On the other hand, stress patterns in Budai Rukai are not well studied yet. According to Zeitoun’s (2000) preliminary description of Rukai phonology, stress falls on the penultimate but sometimes antepenultimate syllable in Budai Rukai. However, long vowels at penultimate position were mistaken as short vowels at antepenultimate position. As a result, stress patterns in Budai Rukai are unclear under her description.

Fieldwork conducted in the current project has shown the quantity-sensitive property of Budai Rukai stress and its syllable extrametricality.

The examples drawn from Paiwan and Budai Rukai illustrate the diversity of prosody in Formosan languages, and they also reflect the development of accent patterns in each subgroup. Furthermore, some cross-linguistic prosodic patterns or meaningful phonological processes were found or preserved in myth narrative, natural discourse or conversation (cf. Woodbury 1987). The documentation of prosody in the grammar of an unknown language has become an urgent issue for fieldworkers. None of the verbal arts of aboriginal languages can be completely preserved without the documentation of prosody, at both word and sentence levels, given the facts that the younger generations of the aboriginal tribes have relatively less chance to speak their mother tongue, and that language contact affects the prosodic patterns of the aboriginal languages.

1.3 Theoretical Frameworks Adopted for Paiwan and Budai Rukai Phonology

This section is a briefly review of the theoretical frameworks adopted for the linguistic description in this project. It also explains the pros and cons of theoretical frameworks for the field phonology of Paiwan and Budai Rukai. The purpose for using various phonological theories is to elucidate the description of Paiwan and Budai Rukai phonology, as clearly as possible. Theoretical frameworks adopted for later description comprise autosegmental phonology, metrical theory, prosodic theory and Optimality Theory.

Autosegmental Phonology

Autosegmental Phonology (cf. Goldsmith 1976) is an attempt to provide an adequate understanding of the phonetic side of the linguistic representation.

It constitutes a particular claim about the geometry of phonetic representation. The theory suggests that phonetic representation is composed of a set of several sequences of segments, with constraints on the association of various levels of sequences. It is a theory of how the various components of the articulatory apparatus, such as lips (close, open), tongue body (high, front), velum (raise, lower), and larynx (high pitch, low pitch), are coordinated.

The treatments of autosegmental phonology capture the existence of contour-valued features, melody levels in the grammar, and processes of automatic spreading of features, both to the left and right. In autosegmental phonology, there is no longer a one-to-one relation between segments of the string and features, which is an inherently non-linear character to phonological representation. It becomes possible to represent the tonal features and the segmental features on separate levels.

Autosegmental phonology has been adopted in a wide diversity of language description, especially in tone languages. Like most of the fieldworkers, I do not begin the current project with an understanding of the nature of the linguistic observables in the unknown languages. Autosegmental analysis provides wider range of possibility for the representation of the unknown languages, and it is therefore the proper for the description and analysis of segmental and suprasegmental elements of Paiwan and Budai Rukai. Particularly, the current project captures the phonological patterns of the two languages with an emphasis on the representations of prosody.

Metrical Stress Theory

Stress patterns in Paiwan and Budai Rukai will be described and analyzed under the framework of metrical theory (cf. Hayes 1995). Metrical stress theory is a branch of generative phonology that deals with stress patterns. Hayes (1995) incorporates the trochaic and iambic opposition into a general theory of word stressed assignment. In his view, stress is the linguistic manifestation of rhythmic structure, and the phonological properties of stress can be explicated on this basis. According to Hayes (1995), the smallest constituent in metrical structure is the foot. The Iambic/Trochaic Law, illustrated in (5), determines the set of possible feet and motivates a large number of segmental rules that adjust metrical structure.

(5) Iambic/Trochaic Law (Hayes 1995)

a. Elements contrasting in intensity naturally form groupings with initial prominence.
b. Elements contrasting in duration naturally form groupings with final prominence.

Following Hayes (1995), metrical structure is not just a means of deriving stress but serves as a general organizing principle for the phonology of a language. The foot structure of a language can govern the prosodic morphology and cause readjustments of stress in response to segmental changes. While languages distinguish syllable quantity and syllable prominence, only quantity may be referred to by rules of foot construction. Hayes (1981) proposes two parameters that play the most important role in the metrical theory: quantity-sensitive and left/right dominance. By setting up all the relevant parameters, stress rules of a language can be derived, which is the idea of *parametric metrical theory*. A proposed parametric theory is well defined, maximally restrictive, and is capable of describing all the stress systems of the world's languages. It is therefore more constrained and capable of stronger predictions.

Metrical stress theory is applicable to the description of an unknown language, because it captures the basis of the rhythmic structure of the language, relevant segmental adjustments, and the organization of the phonology of the language. It not only shows the derivation of the rhythmic structure but also generalizes grouping structure in metrical representations and foot templates.

Typology of Stress

As far as typology of stress is concerned, quantity-sensitive is a well-known parameter. In quantity-sensitive languages, the weight of the syllable must be concerned, with heavy syllables characteristically attracting stress and light syllables receiving stress only in the absence of an eligible heavy syllable. In quantity-insensitive languages, stress is typically determined by the odd or even location of a syllable with respect to the left or right edge of the word. Hayes (1981) proposes foot construction algorithms as follows: Quantity-Sensitive (Left or Right Dominant) and Quantity-Insensitive (Left or Right Dominant).

On the other hand, Kenstowicz (1996) proposes the hierarchy of the optimal vowels for stress in several diverse languages, so-called Quality-Sensitive stress. In Quality-Sensitive stress system, vowel quality plays a role in determining the location of stress, and stress seeks out the most optimal vowels as determined by the hierarchies of (a) a, ä > e, o > i, u; (b) a, ä, e, o, i, u > ə. Phonetic basis of a language has a bearing on the prominence hierarchy. A phoneme’s inherent feature may influence the distribution of prosodic categories.

Prosodic Theory

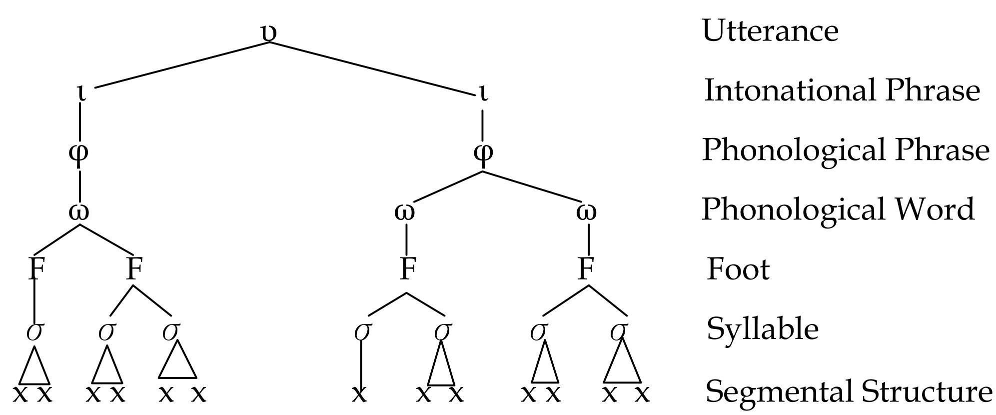
Hayes (1989) and the other prosodic theorists (cf. Selkirk 1980a, 1980b; McCarthy and Prince 1986) assume a set of universal prosodic categories in a hierarchical relation. In the prosodic hierarchy, as illustrated in (6), moras are organized into syllables, syllables into feet, and feet into prosodic words. Every prosodic word (PrWd) contains a foot, and every foot contains a syllable, and every syllable contains a mora. Prosodic units in the hierarchy are assumed to be authentic. Prosodic theory predicts that stress feet are necessarily composed of syllables and all metrical paring.

(6) Prosodic Hierarchy

PrWd — Prosodic Word
Ft — Foot
σ — Syllable
μ — Mora

Mora is a unit of quantity, and the mora unit may be ignored in the prosodic representation of a quantity-insensitive language. The components of a prosodic hierarchy in Selkirk's (1995) proposal comprise syllable, foot, phonological word, phonological phrase, intonational phrase, and phonological utterance. Given that the prosodic categories are universal and authentic (cf. Selkirk 1984, 1986, 1995), the prosodic representation of an unknown language X can be constructed, as shown in (7).

(7) Prosodic Representation of Language X



The assumptions of the prosodic representations in the unknown languages are examined, verified or revised in this dissertation.

Optimality Theory

Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1993a, b) turns markedness statements into the actual substance of grammars, in the form of universal constraints. The definition of constraints, under the framework of Optimality Theory (Kager 1999), is a structural requirement that may be either satisfied or violated by an output form. Phonological constraints are intrinsically in conflict, and every logically possible output of any grammar will necessarily violate at least some constraint. The grammar in Optimality Theory selects output representation for every input representation.

Optimality Theory recognizes two types of constraints, faithfulness and markedness. Each individual constraint evaluates one specific aspect of output markedness or faithfulness. Description of an unknown language, however, usually starts with a preliminary sketch of segmental distribution and then its prosodic patterns. Pitch accent and sentence-level prosody in Formosan languages, for instance, comprise phonological and morphological or syntactic processes. For this reason, the analysis of pitch accent or sentence-level prosody is difficult to recapitulate in Optimality Theory, which does not include solid word and sentence levels in its model. On the other hand, there are some principles built in Optimality Theory good for the generalization in a comparative study, such as markedness, constraints, and ranking. Optimality Theory allows us to relate the patterns in a particular language to patterns across languages. It assumes that all the languages have the same set of ranking, and the difference among languages lies in the ranking of the constraints.

The current work aims to provide both a description and an analysis of the phonology in the two Formosan languages. The constraints are adopted for comparison, only after a comprehensive grammar of Paiwan and Budai Rukai phonology is accomplished.

1.4 Organization of the Dissertation

The current project investigates sound patterns, syllable structure, stress, accent, and intonation of the two Formosan languages, Paiwan and Budai Rukai, particularly, the possible roles of word-level and sentence-level prosodic structures and whether the prosody in the languages has special expressive or other pragmatic meanings.

The documentation of phonology and prosodic patterns of the two languages is based on my fieldwork data, consisting of elicitation, phrases, sentences, narrative, and natural discourse. Data drawn from other corpus or archive are given a clear source. Phonetic and phonological patterns are documented and analyzed. Instrumental studies are also conducted to verify the phonological description and show the phonetic representations of the sound patters. In other words, both descriptive characteristics and empirical evidence are found in this dissertation. The dissertation will be organized as follows.

Chapter 2 captures the major features of Paiwan phonology and the salient features in the sub-dialects of Paiwan, i.e., phonological variation among *Northern*, *Central* and *Southern* Paiwan. Stress patterns in Paiwan are cautiously examined, with a categorization of individual stems, affixed forms, and phrases. I begin with a thumbnail sketch of Paiwan morphology, followed by the syllable structure, the inventory of consonants and vowels, and a detailed description of word stress is provided. Next, I deal with a variety of morphophonemics and the prosodic patterns in phonological phrases. The chapter ends with the transcription and orthography issues of the Paiwan language.

Chapter 3 captures the phonetic representations of Paiwan. It provides a detailed phonetic description and empirical evidence for the phonetic varieties of Paiwan. Sound change attested in the speech community is the motivation for the empirical examination. VOTs of Paiwan consonants and the example spectrogram are illustrated. Next, I examine intrinsic and extrinsic vowel durations of Paiwan. An attempt is made to figure out the phonetic correlates of Paiwan stress. Issues on synchronic varieties and diachronic sound change are addressed. The chapter ends with a list of phonetic varieties, and their implications for the reconstruction of Proto-Paiwan.

Chapter 4 is the prosodic structure of Paiwan. I deal with the prosodic properties of the Paiwan language. Prosody plays an important role in many aspects of Paiwan phonology, such as prosodic words, phonological phrases, intonation, and beyond sentence level. The chapter aims to draw a clear picture on how prosody works in the speech of Paiwan. Word-level pitch accent, sentence-level intonation, and prosody beyond sentence are described and analyzed. The chapter begins with a review of critical prosody issues, along with which the prosodic structure of Paiwan is temporarily proposed. Next, all types of word-level pitch accent in Paiwan, including imperative accent and pragmatic accent in different types of discourse are clarified. A sketch of intonational phonology of Paiwan is illustrated, and tone or intonational variation is modeled in terms of the f0 realization. Prosody in Paiwan oral narrative and discourse is also described and analyzed. The chapter ends with a discussion of prosody in linguistic documentation and the contradiction of the prosodic hierarchy.

Chapter 5 is a sketch of the major features of Budai Rukai phonology. I also provide phonetic representations and variation of Budai Rukai, along with the description. This chapter focuses on distinctive phonemes, syllable structure, segmental phonetics and word stress of Budai Rukai. Given that affixation is also an important process for the formation of prosodic words in Budai Rukai, the chapter starts with a thumbnail sketch of Budai Rukai morphology. Next, canonical syllable structure is provided, followed by both consonant and vowel inventories. Acoustic measurements of segments and the phonetic representations of allophones are illustrated. The distribution of stress is described, and the stress patterns are analyzed with metrical parameters in Budai Rukai. Orthography issues are addressed at the end.

Chapter 6 is a brief sketch of the prosodic patterns in Budai Rukai, particularly, word-level pitch accent and sentence-level intonation. First, both phonological variation of word stress and the phonetic representations of word stress in Budai Rukai are presented. A list of prosodic words with stress variation is compiled for the generalization and the argument for contact stress patterns. Phonetic correlates of Budai stress are also investigated. Next, two types of pitch accent in Budai Rukai, regional and imperative, are clarified. Finally, intonational phonology of Budai Rukai is drawn in terms of tones, the f0 realization. Phonetic representations of intonation are illustrated with pitch tracks of minimal pairs.

Chapter 7 is a discussion on the relationship between Paiwan and Budai Rukai. An attempt is made to support the idea that the common innovations shared by Paiwan and Budai Rukai are due to recent contact. Earlier proposals of family tree classification are reviewed. First, characteristics of consonants, vowels and syllable structure of Paiwan and Budai Rukai are presented and compared. The segmental characteristics of the two languages have a bearing on the historical reconstruction of Proto-Austronesian (PAN) language. Next, the prosodic representations of Paiwan and Budai Rukai, including word stress and pitch accent, are compared. The historical development of stress from PAN to modern Paiwan and Budai Rukai is reconstructed, and the indicators in the Formosan languages that reflect the contrastive stress in PAN are found. In addition, cognates and loans are presented to verify the independent development of Paiwan and Budai Rukai from PAN, and the innovations shared by the two languages are due to recent contact. The issues of language contact in the Paiwan and Budai Rukai tribes are drawn with a summary of the attested contact phonological features at the end.

Chapter 8, the final chapter, concludes the dissertation with the significance of the current project. A brief summary of the important findings is refreshed. Language Continuum has been proposed for Paiwan and Budai Rukai, and it may apply to the other Formosan languages, to draw out the growing trend of language contact in the tribal communities. Remaining issues for further studies are addressed to end the dissertation.

CHAPTER TWO
PHONOLOGY OF PAIWAN

This chapter deals with the major features of Paiwan phonology and also includes an account of the salient features in the sub-dialects of Paiwan. Phonological phonemes of Paiwan have been briefly introduced in earlier field reports (Ho 1977, 1978; Ferrell 1982; Chang 2000; Pulaluyan 2000), but none of the existing documentation has drawn a clear picture on segmental phonology, word stress, and phrasal prosodic formation. It has been taken for granted that Paiwan has a penultimate stress in earlier studies (Chang 2000; Tseng 2003) without a cautious examination into individual stems, affixed forms, and phrases. The chapter focuses on Paiwan phonemes and segmental phonology, but a detailed description of word stress and phrasal phonology is also found here.

Section 2.1 is a thumbnail sketch of Paiwan morphology. Syllable structure is presented in section 2.2. Section 2.3 provides consonant inventory of Paiwan, including the major segmental varieties within the Paiwan community and the segmental alternation. Vowel inventory is given in section 2.4. Stress is described and analyzed in section 2.5, in which two types of stress patterns in Paiwan are illustrated. A theoretical orientation from metrical theory (Hayes 1995) will be adopted in the description of stress. Section 2.6 deals with a variety of morphophonemics, and section 2.7 describes the structure of a phonological phrase. Finally, the IPA transcription used for the current study is addressed in section 2.8, and the other types of transcription and the orthography issue are briefly discussed.

Paiwan is notable for its large number of consonantal phonemes, compared with the other Formosan languages. The importance of Paiwan has been mentioned in Ferrell's (1982) dictionary. Paiwan does not show extensive mergers and splits among Proto-Austronesian (PAN) stops. The significance of Paiwan lies in its phoneme inventory directly comparable to the PAN inventory proposed in Dempwolff's (1934-38) and Dahl's (1973) reconstruction studies. Paiwan language has parallel palatal stops which are rarely attested in the other Formosan languages, and the merger of palatal stops also occurs in some varieties of Paiwan. An attempt has been made in Ho's (1978) comparative study to reconstruct Proto-Paiwan. Yet, a comprehensive description on Paiwan phonology, drawn from fieldwork data and empirical evidence, is still needed. This chapter provides the description of Paiwan phonology, and the empirical evidence from acoustic phonetic studies is found in the next chapter, Chapter 3.

The Paiwan aborigines occupy the mountain and foothill areas of Pingtung and Taitung Counties, Taiwan. The population of Paiwan is centered at Da-Wu Mountain areas, 500-1200 meters above sea level, and where the hills extend down to the sea. In the southern territory of the Paiwan aborigines, Paiwan tribes have been found on the coast as well as along the narrow interior valleys of the numerous streams. According to Ferrell's (1982) report, the high interior mountains in the northern part of Pingtung County are considered by many Paiwan aborigines to represent their place of origin, and villages found in the interior mountainous area are the ones which commonly figure in origin myths and oral literature. Nevertheless, the central mountain chain and Japanese regional aboriginal offices used for tribal classification in Ogawa and Asai's (1935) study have lost their index function today for dialectology, ever since the withdrawal of Japanese governance.

The investigation of Paiwan villages in the current study follows the geographical coordinates within Pingtung County, from the Northern, Central, to the Southern tribes. Six Paiwan tribes were investigated. The informants are four male and six female Paiwan speakers, ages 48-70. All of them speak very fluent Paiwan language. Although the study assesses linguistic varieties in several Northern, Central and Southern Paiwan tribes, including villages in Sandimen, Majia, Piuma, Gulou, Shimen and Mudan, data collected in Central Piuma Paiwan village are the base for this chapter, in which certain historical merger was prohibited and more consonantal phonemes have been preserved. All the villages investigated in the current study are illustrated in Figure 2.1. However, data collected in Northern and Southern Paiwan villages will be roughly discussed when salient regional distinction occurs.

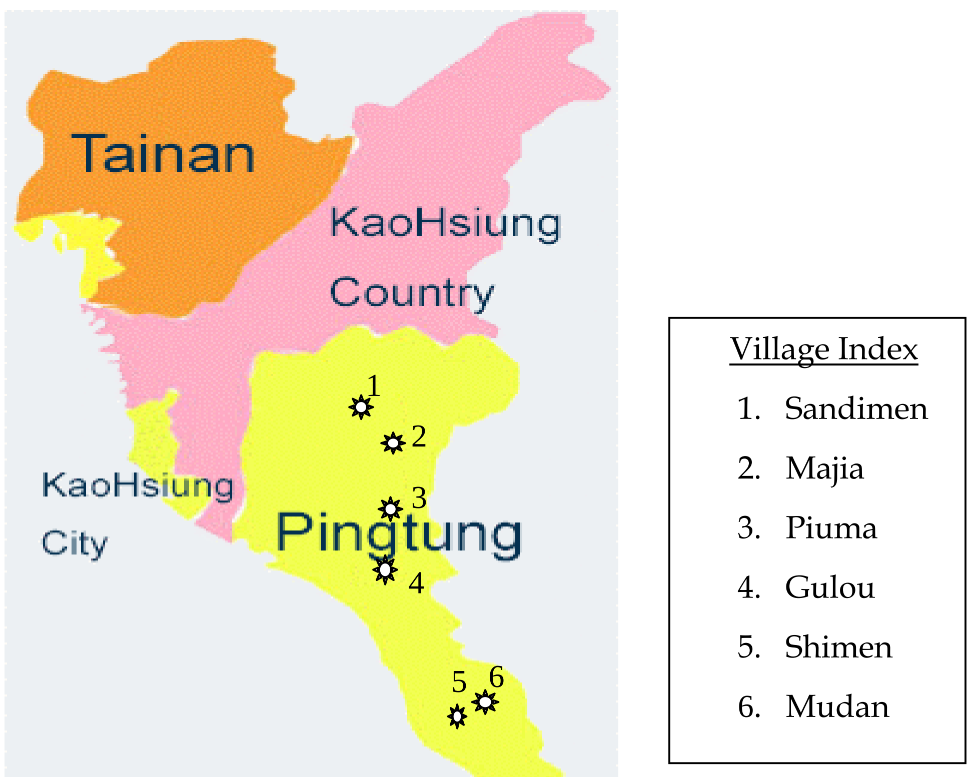


Figure 2.1[1]: The Paiwan Villages Investigated in the Current Study

[1] The background of the figure is drawn from the official website of Kaohsiung International Airport: http://www.kia.gov.tw/english/e_content/e_customer/e_tour-1.asp

Central Piuma village is one of the oldest villages among the Paiwan tribes in Pingtung County, located at the central eastern of Pingtung County. The tribe is surrounded with mountains. More than 95% of the residents in the community are the Paiwan aborigines. Non-Paiwan residents in the community are mainly spouses of the Paiwan people. Paiwan is the primary communication language in the tribe. Social affairs were announced in Paiwan within the village. The younger generation speaks Mandarin in public educational institutions and Taiwanese outside of the tribe. All the oral data were collected from natural speech, including elicitation, narrative, and conversation.

As far as isogloss is concerned, it is difficult to draw a borderline between one dialect domain and another in the Paiwan territory. It has been found that certain features are not distinctive between northern and central geographical regions, while some Paiwan speakers who live around central southern regions may acquire both Central and Southern Paiwan dialect features. Due to the frequent immigration and intertribal marriage, relatively convenient transportation and the communication with outsiders, it is rather difficult to mark the boundary between dialect domains. The terms of *Northern, Central,* and *Southern* are not only conventionally referred to the Paiwan dialects according to the geographical distribution but also indices for self-identity when the middle-aged Paiwan people need to distinguish themselves from the other tribal groups. For instance, in an intertribal-marriage family living in Central Piuma village, the husband was from Northern Paiwan, whereas the wife was born and raised in Central Piuma. Every Paiwan speaker in the Central Piuma village is aware of the 'Northern' pronunciation of the husband, even though the husband has moved to Central Piuma from the North early as at the age of ten. It is clear that the existence of dialectal variants should be described and accounted for, especially when the phonological variants distinguish one dialect form another, though the task of concrete classification may be unreachable at this stage. It has been mentioned in Hua and Zeitoun (2005) that most scholars conveniently refer to Paiwan dialects according to their geographic distribution, and that Ho (1978) has warned against the feasibility of such a classification. On the other hand, Ferrell (1982) has also reported that phonologically Central and Southern Paiwan villages tend to form a loose grouping, opposed to an even more heterogeneous grouping of northern and eastern villages. This indicates that the phonological distinction among the Paiwan aborigines does exist. The preliminary classification of *Northern, Central,* and *Southern* in this chapter is built on the attested phonological varieties. Fieldwork traces the relative locus of the villages within the Paiwan territory, centered from the Da-Wu Mountain in Pingtung County. Shown in Figure 2.1, the numerals '1' and '2' represent *Northern Paiwan*, whereas '3' and '4' represent *Central Paiwan*, and '5' and '6' represent *Southern Paiwan*. The focus of the classification is a sketch of phonological distinction. This chapter deals with the phonology of Paiwan only. Detailed phonetic variation of Paiwan is discussed in the next chapter, Chapter 3.

2.1 Thumbnail Sketch of Paiwan Morphology

To better facilitate our understanding of Paiwan phonology and phonetics, I wish to first offer a thumbnail description of Paiwan morphology. Paiwan morphemes can be classified into roots and bound forms. Roots are independent free morphemes that can be used independently as complete words or utterances. Roots include primary nouns, verb stems, stative verb stems and particles. Bound forms must be used in combination with other morphemes. At least four classes of bound forms were attested: ligatures (as construction markers), intensifiers, personal pronouns, and derivational morphemes (as affixes). Derivational morphemes in Paiwan include bound prefixes, suffixes, infixes, and circumfixes. Derivational processes are usually productive, and by adding derivational morphemes the transformation from nouns into verbs occur. On the other hand, inflectional affixes are usually attached to verb stems, and the processes of inflection and derivation are sometimes undistinguishable. Words in Paiwan are independent forms comprised of independent morphemes or the combination of free stems and bound morphemes. Compounds are very restricted in Paiwan, and they are usually formed with the connection of ligatures as lexemes.

2.1.1 Independent Morphemes

Roots in Paiwan are generally in the shapes of CVC, CVCV(C), and CVCVCV(C). Roots longer than three syllables are rather restricted. Roots are the independent morphemes as affix targets. Affixes may prefix, infix or suffix to a minimal independent word. Paiwan word minimality is shown in (1).

(1) Paiwan Word Minimality

	Shapes	Roots	GLOSS
a.	CVC	sis	'meat containing a bone'
b.	CVCV	ḽima	'hand'
c.	CVCVC	vuqaʎ	'to be white'
d.	CVCVCV	qaraba	'flat worm'
e.	CVCVCVC	kadikad	'a stirrer'

The affixation to the independent words is exemplified in (2).

(2) a. Roots as Prefix Targets : prefixes attach to the left edge of roots

Roots	Prefixation	GLOSS
kuɭa	pi$_{prefix}$-kuɭa	'to wash feet'
ɭima	mi$_{prefix}$-ɭima	'to wash hands'
ɭikuz	i$_{prefix}$-ɭikuz	'behind'
aʎak	marə$_{prefix}$-aʎak	'parent and child'

b. Roots as Suffix Targets: suffixes attach to the right edge of roots

Roots	Suffixation	GLOSS
vaik	vaik-an$_{suffix}$	'take it and go!'
kan	kan-ən$_{suffix}$	'eat'; 'food'
tsautsau	tsautsau-aŋata$_{suffix}$	'it is definitely a person'

c. Roots as Infix Targets: infixes attach to neither the right edge nor the left edge of roots, usually right after the first consonant of roots

Roots	Infixation	GLOSS
kan	k-əm$_{infix}$-an	'to eat'
matsa	m-ən$_{infix}$-atsa	'to see'
ɭakup	ɭ-in$_{infix}$-akup	'vine-covered'

d. Roots as Circumfix Targets: circumfixes attach to both right edges and left edges of roots; circumfixes are the combination of prefixes and suffixes.

Roots	Circumfixation	GLOSS
kan	ka-kan-an	'dining room'
vaik	ku-vaik-aj	'I will leave'
kəɖi	caʎa-kəɖi-an	'the smallest'
quɟaʎ	kaʎa-quɟaʎ-an	'rainy season'

e. Roots as Multi-Affix Targets: multiple prefixes and suffixes may attach to the right edge or the left edge of roots; infixes may be embedded in prefix sequences right after the first consonant of the prefix morphemes; the combination of prefixes, infixes or suffixes may attach to roots to form independent words. In the following examples, prefixes are underlined.

Roots	Multi-Affixation	GLOSS
kan	$\underline{\text{pa}}_{\text{prefix}}$-$\underline{\text{pu}}_{\text{prefix}}$-kan	'to call someone to eat'
qumaq	$\underline{\text{ta}}_{\text{prefix}}$-qumaq-an$_{\text{suffix}}$-an$_{\text{suffix}}$	'entire household'
ʎaməŋ	$\underline{\text{pa}}_{\text{prefix}}$-$\underline{\text{ka}}_{\text{prefix}}$-ʎaməŋ-ən$_{\text{suffix}}$	'to do thoroughly'
quɭid	$\underline{\text{p}}_{\text{prefix}}$-ən$_{\text{infix}}$-$\underline{\text{a}}$-quɭid-an$_{\text{suffix}}$	'to really do'
pəʎuq	$\underline{\text{k}}_{\text{prefix}}$-in$_{\text{infix}}$-$\underline{\text{a}}$-pəʎuq-an$_{\text{suffix}}$	'filled'

To summarize, shapes of affixation are predictable, usually in the form of V, CV, VC, VCV or CVCV. None of the attested affixes are in the form of CVC, which is a common shape of roots. Roots in Paiwan carry the main components of meanings in a word. More examples of prefixing, suffixing, infixing, and circumfixing are found in section 2.1.2.3, section 2.1.2.4, section 2.1.2.5, and section 2.1.2.6 respectively. In the following sections, fours types of independent morphemes are exemplified: primary nouns, verb stems, stative verb stems as adjectives, and particles.

2.1.1.1 Primary Nouns

Primary nouns in Paiwan are simple morphemes that cannot be segmented into simper components. Nouns in Paiwan can be used as verb stems as well, as shown (3). Examples illustrated in (3) are Agent Focus forms, in which the infixation of **əm** occurs right after the first consonant of the noun roots. For instance, the infixation of **əm** to the CVC roots becomes C-**əm**-VC.

(3)

Nouns	Gloss	Verbs	Gloss
sis	'meat containing a bone'	s-əm-is	'to gnaw bone'
ḽima	'hand'	ḽ-əm-ima	'to use hands'
kasuj	'trousers'	k-əm-asuj	'wear trousers'
kadikad	'a stirrer'	k-əm-adikad	'to stir'

2.1.1.2 Verb Stems

Verb stems generally cannot be used as independent complete words or utterances without proper inflectional affixation. In the following examples, verbs can stand alone as a word, whereas stem morphemes cannot. Examples of verbs at the right column are Agent Focus forms. Again, VC-infixation occurs right after the first consonant of the stems, i.e., C-**əm**-VC(V)(C).

(4)

Stems	Gloss	Verbs	Gloss
kats	'to bite'	k-əm-ats	'to bite'
rava	'to prepare'	r-əm-ava	'to prepare things'
ʎisuk	'to pull out'	ʎ-əm-isuk	'to extract'
rawraw	'to rinse'	r-əm-awraw	'to rinse (clothing)'
ʎaʎiak	'to scatter'	ʎ-əm-aʎiak	'to put in disarray'

Stems not only carry the main components of meanings in a word but also serve as the bases for the other independent words. A stem in Paiwan may consist only of a single root morpheme or of two root morphemes, or of a root morpheme plus a derivation affix or affixes. Examples are given in (5).

(5) Root: ɟavats$_{root}$ ‘to walk’

Stem: pa$_{prefix}$- ɟavats$_{stem}$ ‘to cause to walk’

Derivation: pa$_{prefix}$-[ɟa-ɟava-ɟavats$_{base}$]$_{stem}$ ‘to do a run around’

Roots, stems, and derivation forms in Paiwan can form a prosodic word to which stress can apply. Further description and discussion on Paiwan stress is found in section 2.5.

2.1.1.3 Stative Verb Stems as Adjectives

The number of independent stative verb stems is restricted. Stative verb stems in Paiwan serve as modifiers or adjectives[2] without inflection. Stative verb stems can be used as independent complete words. Examples are given in (6).

(6)

Stems	Gloss	Stems	Gloss
qatsi	‘to be brave’	kəɖi	‘to be small’
ɭuməʎak	‘to be soft’	ɭum	‘to be ripe’
vuqaʎ	‘to be white’	qətsəŋəɭ	‘to be black’

2.1.1.4 Particles

Particles are generally interjections used independently in utterances. Interjections are often in the form of vowel sequences without consonantal onsets. Examples are given in (7).

(7)

Stems	Gloss	Stems	Gloss
ui	‘yes’	ini	‘no; do not’
nəka	‘not exist’	ai	‘oh! (exclamation)’
ua	‘oh! (exclamation of pain)		

[2] Most of the current studies on Formosan languages do not admit the existence of adjectives.

2.1.2 Bound Forms

Bound forms are non-independent morphemes that must be in combination with either independent roots or other non-independent morphemes to form words. In this section, ligatures, pronouns, prefixing, suffixing, infixing, circumfixing, focus, and reduplication are illustrated.

2.1.2.1 Ligatures[3]

Paiwan does not allow Noun + Noun compounding without ligatures. Ligatures are construction markers that introduce relational phrases such as noun phrases or verb phrases. Ligatures are syntactic markers in noun phrases, rather than agreement markers. On the other hand, the relationship between verb phrases and noun phrases can be equal, genitive or unequal. Unequal relationship is usually accusative. Three ligatures with their functions are given in (8), and examples are illustrated in (9).

(8)

Ligatures	Function
a	equal relationship (Lig)
nua	genitive relationship (Gen)
tua	neither equal nor genitive relationship (Acc)

(9) a. vuvu a vavajan
grandparent Lig woman
'female grandparents'; 'grandmother'; 'the grandparent is female'; 'the woman is a grandparent'; the female who is a grandparent';

[3] The term 'ligature' was adopted from Li (1996a, 1996b, 1997, 2004). A ligature links two nouns, verbs or phrases. There is not always a clear distinction between nominative case markers and ligatures. Li (2004) has noted that the marker *a* in Basay, another Formosan language, can function as the nominative and as a ligature, just as *a* in Paiwan and *a* in Kavalan. The ligature *a* may have diferet syntactic uses from the nominative *a*.

'the grandparent who is a female'

b. vuvu nua vavajan

grandparent Gen woman

'the woman's grandparent'='the grandparent belongs to the woman'

c. nua vavajan a vuvu

Gen woman Lig grandparent

'the woman's grandparent'; 'the grandparent belongs to the woman'; 'the grandparent who belongs to the woman'

d. təməkəɭ tua vava ti vuvu

drink Acc wine Nom grandparent

'Grandparent drinks wine'

Note the construction marker 'ti' shown in the example of (9d) indicates Nominative singular case. A separate set of construction markers are used with names of individuals or subjects, with personal pronouns, or with kinship terms. The paradigm of the construction markers is given in (10).

(10)	Nominative	Genitive	Accusative
Singular	ti	ni	cai
Plural	tia	nia	caia

2.1.2.2 Pronouns

Pronouns in Paiwan are either bound morphemes or the combination of bound morphemes as independent pronouns. Bound morphemes behave like construction markers, whereas independent personal pronouns are the combinations of both construction markers and bound pronoun morphemes. A complete paradigm of Paiwan personal pronouns is illustrated in (11).

(11)

	Nominative	Genitive	Accusative
1st person singular	-akən; ti-akən	ku-; ni-akən	canu-akən
1st person plural (incl.)	-icən; ti-cən	ca-; ni-cən	canu-icən
1st person plural (excl.)	-amən; ti-amən	nia-; ni-amən	canu-amən
2nd person singular	-sun; ti-sun	su-; ni-sun	canu-sun
2nd person plural	-mun; ti-mun	nu-; ni-mun	canu-mun
3rd person singular	ti-maɟu	ni-maɟu	cai-maɟu
3rd person plural	ti-a-maɟu	ni-a-maɟu	cai-a-maɟu

2.1.2.3 Prefixing

Generally speaking, prefixes are productive derivational morphemes in Paiwan that they can attach to the left edges of different roots or stems. The number of prefixes is the largest among the affixes. One single prefix form may have different grammatical functions and meanings, whereas allomorphs are also attested. Prefixing always occurs at the left edge of roots or stems, shown as follows: PREFIX-$[\ldots]_{stem}$. A few examples of prefixes are illustrated in (12).

(12)

Prefixes	Functions	Examples	Gloss
ca-	more; further	ca-kəḍi	'smaller'
cə-	from; to do at	cə-maza	'to stay here'
cu-	at certain place	cu-a-qatsiʎaj	'a place characterized by stones'
i-	at; in	i-gadu	'in the mountains'
ka_1-	Inchoative Marker	ka_1-ɟaʎav-u	'do it quickly!'
ka_2-	time in past	ka_2-tiaw	'yesterday'
ki-	get; obtain	ki-paisu	'to get money'

ʎa-	belong to a category	ʎa-Taihuk	‘the people who lives in Taipei’
ʎə-	go in direction of	ʎə-təku	‘to go downward’
ma-	in the condition of; be affected by	ma-ɟuŋats	‘to be sticky’
maʎə-	number of persons	maʎə-ɭima	‘five persons’
marə-	reciprocal relationship	marə-aʎak	‘parent and child’
mə-	Agent Marker for Verbs (change of status)	mə-qatsa	‘to become big’
mərə-	super-; gigantic	mərə-aʎak	‘to be an overgrown child’
mi-	Agent Marker (intransitive)	mi-gatsaʎ	‘to stand’
na-	already; definitely	na-vaik-aŋa	‘to have already left’
nu-	if; when	nu-vaik-akən	‘if I go’
pa-	occur; to cause	pa-patsaj	‘to kill; to cause death’
pə-	to come into view; emerge	pə-zaʎum	‘water comes out’
pi-	put in/on	pi-tsəkuj	‘to put it on the table’
pu-	have; produce; acquire	pu-aʎak	‘to give birth to child’
sa_1-	wish to	sa_1-vaik-akən	‘I wish to leave’
sa_2-	go to; in the direction of	sa_2-zua-u	‘go there!’
sa_3-	have quality/flavor of	sa_3-guŋ	‘to smell like a cow’
$sə_1$-	people of	$sə_1$-Taihuk	‘a person from Taipei’
$sə_2$-	have quality of	$sə_2$-kuja	‘bad’
$sə_3$-	occur unexpectedly	$sə_3$-ɟuŋats	‘to adhere to

			accidently'
si_1-	Instrumental Focus Marker	si_1-kan	'eating utensil'
si_2-	belong to certain time in the past	si_2-tiav-an	'belong to yesterday'
ta-	in past; =ka	ta-ŋida	'when (in past)'
uri	definite future	uri-vaik	'shall go/leave'

2.1.2.4 Suffixing

Suffixing always occurs at the right edge of roots or stems, shown as follows: $[\ldots]_{stem}$-SUFFIX. The suffixes in Paiwan are either non-derivational or derivational morphemes. Non-independent and non-derivational suffixes usually qualify the morphemes to which they are attached. They come with specific roots or stems. Non-derivational suffixing is exemplified in (13).

(13)

Suffixes	Gloss	Examples	Gloss
-aŋa	'certainly'	vaik-aŋa	'certainly going'
-aŋata	'(emphatic) definitely'	vavajan-aŋata	'it is definitely a woman'
		ui-aŋata	'definitely yes'
-anan	'still, yet'	kəma-kan-anan	'still eating'
ʎa	(emphasis)	ui-ʎa	'yes'

Derivational suffixes are usually productive morphemes that attached to roots or stems. Diverse grammatical functions of derivational suffixes have been attested in Paiwan, such as focus markers, imperative voice, and groupings. Examples of derivational suffix morphemes are illustrated in (14).

(14)

Suffixes	Functions	Examples	Gloss
-an	Specifier; Locative Focus	vaik-an	'take it and go!'

-ən	Goal of Action; Object Focus	kan-ən	'eat'; 'food'
-aj	Intended; Object Focus	ku-vaik-aj	'I will leave (sb.)'
-aw	Intended; Locative Focus	ku-vaik-aw	'I will go'
-u	Agent Focus; Imperative	vaik-u	'Go! Leave!'
-i	Object Focus; Imperative	vaik-i	'Let's Go!'
-ʎ	Groupings; Duration	maka-ɭima-ʎ	'five (days, times)'

2.1.2.5 Infixing

Infixes in Paiwan are generally in the form of VC and occur at the second-left edge of /CVC…/ roots or stems, or prefixes, right after the first consonant of stems, shown as follows: $C]_{stem}$-INFIX-$[VC\ldots]_{stem}$. Infixes attested in Paiwan are all bound morphemes attached to roots, stems or words. Some of the infixes are allomorphs. Examples are given in (15).

(15)

Infixes	Functions	Examples	Gloss
-aʎ-	have sound or quality of	k-aʎ-əŋkəŋ	'have ringing in ears'
-aɭ-	have sound or quality of	c-aɭ-əqcəq	'making clicking noise'
-ar₁-	have sound or quality of	ts-ar₁-abtsab	'to clap hands'
-ar₂-	on all sides	k-ar₂-a-kim	'to search everywhere'
-əm-	Agent or Actor; Agent Focus Marker	k-əm-an	'to eat'
-in-	perfective markers; action has already begun	k-in-an	'have already eaten; have started eating'

2.1.2.6 Circumfixing

Circumfixing components are generally derivational morphemes that are productive and usually attached to stems to form independent words. Circumfixes are usually the combination of prefixes and suffixes, but the combination of prefixes, infixes, and suffixes are also attested. Roots or stems are surrounded by circumfixes. Paiwan is notable for its richness of highly productive derivational morphemes. A wide diversity of derivational morphemes was attested. In addition to prefixes, suffixes and infixes shown in section 2.1.2.3, 2.1.2.4 and 2.1.2.5, circumfixes can produce limitless derivation processes in Paiwan. Circumfixing occurs at the left edge and the right edge of roots or stems. A few examples of derivational circumfixing morphemes are illustrated in (16).

(16)

Morphemes	Functions	Examples	GLOSS
mi- + -an	pretend	mi-taqəd-an	'pretend to be asleep'
caʎa- + -an	most; -est	caʎa-kəɖi-an	'the smallest'
ka-cə-+-an	containing	ka-cə-zaʎum-an	'containing water'
ka-na- + -aŋa	every	ka-na-tsautsau-aŋa	'every person'
pu- + -an	container of	pu-zaʎum-an	'water container'
ka- +-an	principal; main	ka-kan-an	'dining room'
kaʎa- +-an	characterized time/place	kaʎa-quɟaʎ-an	'rainy season'
r-əm-a-+an	do at/in	r-əm-a-zaʎum-an	'to do in water'

2.1.2.7 Focus

Focus is a syntactic marking of the verb in a sentence upon a specific facet of the action or situation. It is an important grammatical feature not only in Paiwan but also in western Austronesian languages (cf. Ferrell, 1982). Four categories of focus markers were attested in Paiwan. Focus markers can be prefixes, infixes or suffixes. The focus maker morphemes are illustrated in (17).

(17) Focus Markers

a. Agent / Actor Focus (AF): infix -əm-

b. Object/ Patient Focus (OF): suffix -ən

c. Locative, spatial or temporal locus, beneficiary Focus (LF): suffix -an

d. Instrumental Focus (IF): prefix si-

The minimal pairs for focus system are given in (18).

(18) a. inu a k-əm-an a vavajan 'where is the woman eating?'

where Lig eat (AF) Lig woman

b. inu a kan-ən nua vavajan 'where is the woman's food?'

where Lig eat (OF) Gen woman

c. inu a kan-an nua vavajan 'where is the woman's eating place?

where Lig eat (LF) Gen woman

d. inu a si-kan nua vavajan 'where is the woman's eating-utensil?'

where Lig eat (IF) Gen woman

2.1.2.8 Reduplication

Reduplication is a process of repetition of root morphemes without adding ligatures between bases and prefixes or suffixes. Reduplication is rather productive in Paiwan, as it occurs not only in roots, nouns, and other stems, but also in verbs. Full reduplication generally occurs in nouns or stative verbs, whereas partial reduplication commonly occurs in verbs. At least two types of partial reduplication are attested in Paiwan: Ca-reduplication in which C is the first consonant of the bases, and the reduplication of roots less final consonant (CV or CVCV). A few examples of Paiwan reduplication are illustrated in (19).

(19) a. Full Reduplication: reduplicants copy the complete syllables of the base to form another new word

Roots	Gloss	Reduplication	Gloss
aʎu	'honey'	aʎu-aʎu	'sweets'
qatsa	'big'	qatsa-qatsa	'tall'
kəɖi	'small'	kəɖi-kəɖi	'very small'

b. Reduplication in verbs: reduplicants copy the partial syllable(s) of the base to form another new word. While the bases in Paiwan are in the form of CVC or CVCV(C), reduplicants usually do not copy the final coda of the bases. The following examples illustrate partial reduplication in Paiwan: RED + BASE.

BASE	Gloss	Reduplication	Gloss
qəvət	'to embrace'	ma-qa-qəvət	'to embrace each other'
ɭaiŋ	'to chase'	ma-ɭa-ɭaiŋ	'to chase each other'
-ŋuaq	'to be good'	ŋua-ŋuaq	'beautiful'
ɟəɭi	'to laugh'	pa-ɟa-ɟəɭi-ɟəɭi	'to laugh together'

More discussion on Paiwan reduplication is found in section 2.6.4.

2.1.3 Word Classes

Words are defined as independent forms carrying meanings. They are either single independent morphemes such as roots or the combination of independent and bound form morphemes. Words in Paiwan can be classified into nouns, verbs, stative verbs /adjectives, adverbials and particles. Examples of word classes are shown in (20). Stems are in bold and underlined.

(20) a. Nouns: the combination of noun stems and affixes (prefixes, infixes, suffixes, or circumfixes)

Stems	Gloss	Words	Gloss
tagiʎ	'mountain fields'	p-in-a-**tagiʎ**-an	'beginning place'
qajaw	'the front'	qaja-**qajav**-an	'frontmost'
siaw	'soup'	pa-pu-**siav**-an	'a wooden soup-bowl'
kəsa	'food'	ka-**kəsa**-an	'kitchen, cooking area'
kasiw	'tree'	pu-kasi-**kasiv**-an	'place for storing firewood'

b. Verbs: the combination of verb stems and affixes (prefixes or/and infixes)

Stems	Gloss	Words	Gloss
gutsaɭ	'to break open'	ma-**gutsaɭ**	'become broken open'
gatsaʎ	'to stand'	p-ar-a-**gatsaʎ**	'to do in standing position'
gatsəɭ	'to itch'	pa-pə-**gatsəɭ**	'to cause itching'
ɟavats	'to walk'	pa-ɟa-ɟava-**ɟavats**	'to do a rough run around'
patsaj	'to die'	ki-caʎu-**patsaj**	'to endure'

c. Stative Verbs /Adjectives: the combination of stative verb stems and affixes (prefixes or/and infixes)

Stems	Gloss	Words	Gloss
kuja	'a defect'	na-pə-sa-**kuja**	'be unpleasant'
ɭaits	'dried grass'	ma-ɭai-**ɭaits**	'be similar to dried grass'
ɭauʎ	'an unfinished portion'	na-ma-**ɭauʎ**	'be left out'
ɭaɖuq	'be long'	maʎə-**ɭaɖuq**	'be too long'

d. Adverbials: the combination of adverbial morphemes and affixes (prefixes or/and suffixes)

Stems	Gloss	Words	Gloss
sauni	'a short while'	nu-**sauni**	'soon; later today'
		ka-**sauni**	'earlier today'
		ta-**sauni**	'earlier today'
tiaw	'day before or'	nu-**tiaw**	'tomorrow'
	'after today'	ka-**tiaw**	'yesterday'
		ta-**tiaw**	'yesterday'
		si-**tiav**-an	'yesterday'
-ŋida	'when'	nu-**ŋida**	'when (in future)?'
		ka-**ŋida**	'when (in past)?'
		ta-**ŋida**	'when (in past)?'
		si-**ŋida**-an	'at what time?'

e. Particles: in addition to the independent interjections shown in section 2.1.1.4, quite a few clause-linking particles or conjunctions are attested in Paiwan. Conjunctions must be used in clauses or sentence contexts in combination with the other morphemes or independent words. In the following examples, particles are in bold.

Particles	Gloss	Word Classes	
sa	'and'	sa-u **sa** kan	'go and eat!'
ma-nu	'but, however, then'	**ma-nu** t-ima	'well, who is it then?'
uʎa	'because'	**uʎa** avan	'precisely because'
u-ka	'if…'	**u-ka**-kən a kəman	'if I were to eat it...'
nu	'when, if'	**nu** i-ka-sun a vaik	'if you don't go'

ʎaki 'also' **ʎaki** nu-ŋida 'whenever'

2.1.4 Compounds

Compounds are rather restricted in Paiwan and usually formed by adding ligatures between the morphemes or words. Compounds are apparently ligature constructions that are lexemes. Compounding is productive in numerals and nouns. A few examples are shown in (21).

(21)

Compounding	Words	Gloss
a. ɖusa-a-puɭuq two- Lig -ten	ɖusapuɭuq	'twenty'
b. unəm-a-puɭuq six-Lig-ten	unəmapuɭuq	'sixty'
c. pitu-a-puɭuq seven-Lig-ten	pituapuɭuq	'seventy'
d. siva-a-idaj nine-Lig-ten	sivaidaj	'nine hundred'
e. kanavat-a-lima right-Lig-hand	kanavatalima	'right hand'
f. kuɖaɭ-a-vali strong-Lig-wind	kuɖaɭavali	'strong wind'
g. kakavits-a-vavajan grand-grand parents-Lig-woman	kakavitsavavajan	'great grandmother'

2.2 Syllable Structure

The minimal Paiwan syllable consists of just a vowel, while the maximal syllable structure is CVVC, in which VV is a diphthong.

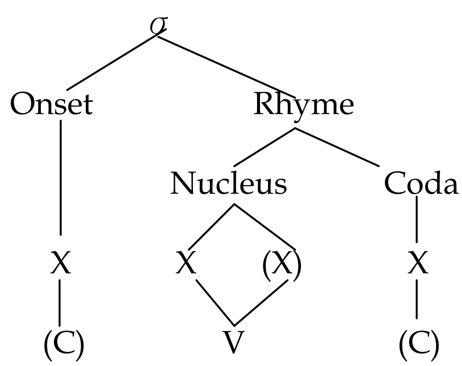
The types of Paiwan syllables are exemplified in (22).

(22)

Syllable Type	Paiwan	Gloss
V	i	'at / in'
VV	ui	'yes'
CV	va	'lung'
CVC	vat	'husked rice'
CVVC	vaik	'to go'

No CC onset cluster was found. VV- and VC-syllables are very restricted in Paiwan; they are either exclamations or colloquial expressions, and no more than five words were found in each type. The metrical syllable structure of Paiwan is illustrated in (23), in which 'σ' represents a syllable unit. Rhyme is independent, because both V and VV-syllables were found.

(23)



Any of the five Paiwan vowels may occur at the nucleus position, and any of the aboriginal consonants may occur in both onset and coda position. Each single vowel or diphthong forms a syllable nucleus.

All of the possible consonant and vowel arrangements for monosyllabic words are illustrated in (24).

(24) Monosyllabic words

σ

(C) V (V) (C)

V		i		'at/in/
VC		i	s	'exclamation (of disgust)'
CV	s	a		'and'
CVC	p	u	k	'tree bean'
VV		ui		'yes'
CVV	v	au		'feminine name'
CVVC	ʎ	ua	ŋ	'cattle'

Polysyllabic words occur with a maximum of two consonants appearing in medial clusters. Such clusters always syllabify so that the initial consonant occurs as the coda of one syllable, and the second consonant occurs as the onset of the next syllable. The combination of syllable types in Paiwan disyllabic words is given in (25).

(25) Disyllabic words

		σ			σ		
	(C)	V (V)	(C)	(C)	V (V)	(C)	
V.CV		u		t	a		'also'
V.CVC		i		ɟ	u	m	'point'
CV.V	k	a			i		'language'
CV.CV	k	ə		ɖ	i		'few'
CV.VV	ɭ	i			au		'many'
CV.CVV	p	a		d	ai		'uncooked rice'
CV.CVC	v	ə		n	a	n	'deer'
CV.CVVC	m	a		s	au	ŋ	'to be bent down'
CVC.CVC	ʎ	u	s	p	i	t	'thin'
CVC.CVV	q	u	ŋ	ts	ui		'tobacco pipe'

CVV.CV	ts	au	b	u		‘straw hat’
CVV.CVC	c	ai	n	a	n	‘honeybee’
CVV.CVV	ts	au	ts	au		‘person’
CVV.CVVC	t	ai	t	ai	ʎ	‘one of the pair’

Diphthongs **au**, **ai**, **ui** are phonetically realized as **aw**, **aj**, and **uj** at syllable-final position, in which case glides **w** and **j** serve as the codas of the syllables. Thus, surface syllable form of CVG is allowed. On the other hand, **ui** is realized as **wi** at syllable-initial position, in which case surface GVC syllable is allowed.

Blust (1988) proposes Austronesian Root Theory and argues that roots have the phonemic shape CV(C), where the last consonant is rarely absent and occurs only morpheme-finally, while meaning-associated segments consist of a single consonant or, less typically of a pattern of consonants in successive syllable. His proposal of root shape seems to apply to some of the Paiwan data. In Paiwan, the CV(C) shape of roots is widely found. Yet, the final consonant of the CVC shape of roots can be absent, and the number of cases contradictory to Blust’s proposal is not small. Moreover, medial CVC morpheme shape is also found, such as onomatopoeia *qubqub* ‘frog’, *zuŋzuŋ* ‘thunder’, *tsiptsip* ‘clicking noise’, *qaʎqaʎ* ‘dog’s bark’, and *kiskis* ‘scraping’. The syllabification of these words is CVC.CVC. Morpheme-medial $C_1.C_2$ clusters occur across syllable boundaries, and consonant clusters within the same syllable do not occur. Many roots in Paiwan are longer than the shape of CV(C).

2.3 Consonants

2.3.1 Consonant Inventory

The consonant inventory of Central Paiwan is shown in Table 2.1. Loan phoneme is shown in parentheses. Central Paiwan has twenty-three consonant phonemes and one loan consonant phoneme /h/. The glottal stop is somewhat marginal. As far as synchronic phonology is concerned, the glottal stop phoneme exists, though the number of words with glottal stop phoneme has been somehow decreasing in Central and Southern Paiwan villages.

Table 2.1: Central Paiwan Consonants

	Labial[4]	Alveolar	Retroflex	Palatal[5]	Velar	Uvular	Glottal
Plosive	p b	t d	ɖ	c ɟ	k g	q	ʔ
Fricative	v	s z					(h)
Affricate		ts					
Trill		r[6]					
Nasal	m	n			ŋ		
Lateral			ɭ	ʎ			
Approximant	w			j[7]			

Phoneme /ts/ is the only affricate found in Paiwan, and it is often realized as palatalized [tʃ] among the older speakers in Central Piuma Paiwan, even without the phonetic condition of a following high front vowel /i/. In other

4 The labial category here includes two places of articulation: bilabial and labiodental. Phonemes /p/, /b/ and /m/ are bilabial consonants, whereas /v/ and /w/ are labiodental phonemes.

5 Palatal [c], [ɟ] and [ʎ] are transcribed as [tj], [dj] and [lj] respectively in earlier literature of Paiwan and the majority of the language teaching materials.

6 Central Paiwan /r/ has the allophonic alternation of voiced velar fricative [ɣ].

7 The phoneme /j/ is often conventionally transcribed as /y/.

words, palatalized allophone [tʃ] may occur word-initially, medially, and finally in Central Paiwan. However, both [ts] and its allophone [tʃ] were attested in the same village, among different ages of speakers. The distribution of [ts] and [tʃ] is not always predictable in one single informant's speech, and in most cases the two sounds are free variation[8]. Given that minimal pairs between [**ts**] and the other phonemes were found, **ts** is treated as the phoneme.

Wolff (1988) has claimed that in the languages outside Formosa *t[9] and *C merged. In the languages which show different reflexes for *t and *C, the differences between the reflexes of *t and *C are of two kinds: in most of the languages which retain the distinction *t is reflected with phonemes that have apical stop articulations and *C is reflected with phonemes which have affricate or spirant articulation. However, *C was merged into /t/ in many Austronesian languages. Although whether *C was a stop or affricate in PAN is not clear, the fact that the affricate phoneme has been preserved in Formosan languages indicates the significant status of Formosan languages in the reconstruction of PAN. While many other Austronesian languages such as Fijian, Javanese, Malay and Tagalog do not have this affricate phoneme, phoneme /ts/ has been attested in many other Formosan languages such as Atayal, Amis, Bunun, Rukai, Tsou, Pazih, Seedik, and Saaroa (cf. Dyen 1965; Li 2004). It is a phoneme in all the varieties of Paiwan.

The consonant inventory of Northern Sandimen Paiwan is shown in Table 2.2. Northern Paiwan has twenty consonant phonemes, in which palatal sounds /c/, /ɟ/, and /ʎ/ are absent, and one loan phoneme /h/ is attested. Uvular /q/

[8] The author's fieldwork observation has revealed that an older male speaker in the village used the [tʃ] sound more often than the other middle-aged male and female speakers. A responsible account for the odd distribution requires further quantitative or sociolinguistic data and studies, which are out of the scope of this study.

[9] The symbol '*' in *t represents Proto-Austronesian (PAN) phonemes.

is also absent, compared with the consonant inventory of Central Paiwan. In Northern Paiwan villages, the glottal stop phoneme /ʔ/ is the reflex of /q/, derived from historical sound change. The phoneme status of glottal stop is ascertained in Northern Paiwan but not assured in Central and Southern Paiwan.

Table 2.2: Northern Paiwan Consonants

	Labial	Alveolar	Retroflex	Palatal	Velar	Uvular	Glottal
Plosive	p b	t d	ɖ		k g		ʔ
Fricative	v	s z					(h)
Affricate		ts					
Trill		r					
Nasal	m	n			ŋ		
Lateral		l[10]	ɭ				
Approximant	w			j			

Conservative Northern Paiwan speakers or those who have frequent or intensive contact with Central or Southern Paiwan speakers may retain the phoneme features of the other regions. Phoneme merger occurs in Northern Paiwan, and the minimal pairs between /c/ versus /t/and /ɟ/ versus /d/ were not attested in the Northern villages. Therefore, the merger does not cause the confusion of the pair sounds. The sound system of Northern Paiwan speakers has become notable among the local Paiwan aborigines.

It has been reported in Wolff's (1988) study that *q was a velar stop rather than a glottal stop in PAN, and the glottal stop /ʔ/ is the reflex of *q or *k. In fact, /ʔ/ has developed in some Austronesian languages such as Tagalog, Javanese, Malay, Saisiyat and Tsou. While the phoneme status of the glottal stop is

[10] The proto-phoneme */l/ was sometimes realized as palatal [ʎ] among older speakers in Northern Sandimen but not middle-aged or younger speakers.

marginal in Central Paiwan, it is a solid phoneme in Northern Paiwan, as it is the reflex of /q/. Among the data collected in Northern Paiwan, quite a few glottal stops /ʔ/ occur not only at word-initial position, but also at word-medial or final position. Words in Northern Paiwan with a glottal stop at medial and final position are shown in (26).

(26) Glottal stop /ʔ/ at word-medial or word-final position

Northern Paiwan	Central Paiwan	Gloss
vituʔan	vituqan	'star'
tsaʔi	tsaqi	'excrement'
maʔusaw	maqusav	'thirsty'
tsuʔəɭal	tsuqəɭal	'bone'
ɭəsəʔ	ɭəsəq	'tear'
maipuʔ	maipuq	'to fall'
mapəluʔ	mapəluq	'house'
punuʔ	punuq	'brain'

On the other hand, the consonant inventory of Southern Paiwan is shown in Table 2.3. Southern Paiwan has twenty-three consonant phonemes and one loan phoneme /h/. The status of the phoneme /r/ is controversial[11] in earlier historical reconstruction. The majority of the speakers in Mudan Southern Paiwan prefer the sound [ɣ], though the other Southern villages adopt the sound

[11] Dahl (1973) and Ho (1977) gave the voiced velar fricative /ɣ/ a higher ranking than the trill /r/ in the reconstruction of PAN, i.e., the historical derivation is from /ɣ/ to /r/. According to Ho (1977), the phoneme /ɣ/ is rather old, and /ɣ/ has become /r/ in the majority of Paiwan dialects. Yet, given that the phoneme /r/ has become essential among the Paiwan aborigines, and that the phonological description in the current study is synchronic, the phoneme /r/ is adopted in the Southern Paiwan inventory here.

[r] in the same phonological environments. Interestingly, the sound [ɣ] is usually preserved in more conservative or isolated villages.

Table 2.3: Southern Paiwan Consonants

	Labial	Alveolar	Retroflex	Palatal	Velar	Uvular	Glottal
Plosive	p b	t d	ɖ	c ɟ	k g	q	ʔ
Fricative	v	s z					(h)
Affricate		ts					
Trill		r[12]					
Nasal	m	n			ŋ		
Lateral			ɭ	ʎ[13]			
Approximant	w			j			

The merger of Paiwan consonantal phonemes is shown in Table 2.4. Although sound change does occur among those Paiwan villages, it is rather difficult either to identify the origin of this historical change, or to single out one specific reason for the synchronic variation within the Paiwan territory.

Table 2.4: The Correspondence of Paiwan Phonemes

Consonant	Northern	**Central**	Southern	GLOSS
*c[14] > t	tula	**cuʎa**	cuʎa	‘eel’
*ɟ > d	damuʔ	**ɟamuq**	ɟamuq	‘blood’
*ʎ > l	ləɭət	**ʎəɭət**	ʎəɭət	‘lip’
*q > ʔ	isiʔ	**isiq**	isiq	‘urine’
*k > ʔ	kivaŋvaŋ	**kivaŋvaŋ**	ʔivaŋvaŋ	‘to play’

[12] Southern Paiwan /r/ has the allophonic alternation of velar voiced fricative [ɣ], uvular voice fricative [ʁ], and glottal fricative [h]. Velar [ɣ] has become an important phonetic feature for Mudan Southern Paiwan speakers to identify themselves as Mudan residents. The speech community in Mudan is rather isolated in the mountainous area.

[13] /ʎ/ is pronounced as [l] by many younger speakers in the Southern villages.

[14] The symbol ‘*’ here represents the Proto-Paiwan phonemes reconstructed by Ho (1978).

Shown in Table 2.4, the merger between alveolar and palatal stops occurs in Northern Paiwan, but it does not mean that all the Paiwan speakers living in the Northern region cannot articulate palatal stops. The merger reported here is more a tendency than a formal classification. For instance, the merger *c > t also occurs in another Central Paiwan village reported in Ho's (1978) study[15]. The dialectal variation between /q/ and /ʔ/ in Paiwan has been reported in a lot of earlier field studies (Ho 1977, 1978; Chang 2000; Governmental Teaching Material 1993; Pulaluyan 2000). For instance, *qiḽas* 'moon' is pronounced as *ʔiḽas* or *iḽas* 'moon' in Northern Paiwan villages. Nevertheless, the sound change has been treated as sporadic variation in earlier studies. Although a dialectological study of Paiwan is not the main concern of this study, an attempt has made here to roughly classify the various sound groups of the Paiwan aborigines. Consequently, a full dialectology of Paiwan remains to be done in the future.

Words illustrating Paiwan consonants are listed in Table 2.5.

Table 2.5: Words illustrating the consonants of Paiwan

CONSONANTS	**PAIWAN**	**GLOSS**
p	pana	'river'
b	babuŋ	'blister'
t	tata	'ring'
d	daqis	'wrinkle'
c	cakit	'hunting knife'
ɟ	ɟapaʎ	'thigh'
k	kaka	'siblings'
g	gadu	'mountain'

[15] See Ho (1978), pp604-677.

q	qadaw	'sun'
ʔ	ʔuqaʎaj	'man'
v	va	'lung'
s	sapuj	'fire'
z	zaʎum	'water'
ts	tsaqi	'excrement'
(h)	hana	'flower'
n	nakuja	'bad'
m	maɭap	'to take'
ŋ	ŋabu	'toad'
r	raɟaj	'sharp'
ʎ	ʎabac	'guava'
ɖ	ɖaʎi	'sparrow'
ɭ	ɭaɟap	'lightning'
w	uwats	'vessel'
j	jaja	'to pick'

Minimal pairs exhibiting contrasts between the consonant phonemes are given in (27). In a few cases where no minimal pairs exist in the corpus, sub-minimal pairs are given.

(27) /p/ vs /b/ **p**uk 'tree bean'
buku 'wart'
/m/ **p**aɭaʎ 'feather'
maɭap 'to take'

/t/	**p**uʎu	‘kidney’
	tutu	‘breast’
/v/	cuka**p**	‘shoes’
	cuka**v**	‘turtle’
/b/ vs /d/	**b**uqu	‘tumor’
	dudu	‘coconut’
/m/ vs /n/	**m**akuja	‘to tear’
	nakuja	‘bad’
/ɭ/	ca**m**a	‘your father’
	ca**ɭ**a	‘the most’
/t/ vs /s/	cəvu**t**	‘trousers’
	cəvu**s**	‘sugarcane’
/ts/	tu**t**u	‘breast’
	tu**ts**u	‘now’
/n/	kəma**ts**	‘to bite’
	kəma**n**	‘to eat’
/k/	pi**t**u	‘seven’
	pi**k**u	‘elbow’
/r/	**t**utu	‘breast’
	ruvu	‘bird’s nest’
/d/ vs /t/	**d**u**d**u	‘coconut’
	tu**t**u	‘breast’
/ɟ/	**d**aqis	‘wrinkle’
	ɟaqis	‘forehead’
/ɖ/	qa**d**av	‘sun’

	qa**ɖ**av	‘mother-of-pearl’
/r/ vs /ɭ/	ca**r**a	‘golden ring’
	ca**ɭ**a	‘the most’
/ɖ/ vs /t/	**ɖ**əmakuŋ	‘to bend’
	təmaku	‘cigarette’
/z/	**ɖ**aʎik	‘spleen’
	zakiʎ	‘hemp’
/ɭ/	**ɖ**ava	‘female friend’
	ɭava	‘flying squirrel’
/n/ vs /ts/	kia**n**	‘to follow’
	kia**ts**	‘lightning’
/ɭ/	ki**n**a	‘mother’
	ki**ɭ**a	‘wax apple’
/r/	kaka**n**an	‘dining table’
	kaka**r**an	‘awl’
/ɭ/	ɟa**n**av	‘shoal’
	ɟa**ɭ**av	‘fast’
/ŋ/ vs /ɭ/	**ŋ**iav	‘cat’
	ɭiav	‘many’
/q/	vuɭu**ŋ**	‘old’
	vuɭu**q**	‘javelin’
/c/ vs /ɟ/	**c**əmapəs	‘to sieve’
	ɟəmapəs	‘to blow’

	/ts/	**c**əḽu	‘three’
		tsəḽu	‘to extract tooth’
	/t/[16]	**c**u**c**u	‘butterfly’
		tu**t**u	‘breast’
		cikajkaj	‘Formosan blue magpie’
		tikaj	‘maggot’
	/d/	pi**c**a	‘in; at’
		pi**d**a	‘how many’
	/k/	**c**aḽa	‘the most’
		kaḽa	‘thread’
/ɟ/ vs	/d/	**ɟ**a**ɟ**asan	‘grasp in hand’
		da**d**asan	‘turban ornament’
		ɟi**ɟ**i	‘buttocks’
		dip**d**ip	‘to cut into small pieces’
	/g/	**ɟ**umaʎun	‘to arrive’
		gumaʎu	‘slow’
/k/ vs	/g/	**k**uaŋ	‘gun’
		guŋ	‘cattle’
	/ŋ/	ʎacə**k**	‘dew’
		ʎacə**ŋ**	‘vegetables’
	/q/	bu**k**u	‘wart’
		bu**q**u	‘tumor’
	/ʔ/	**k**uḽa	‘foot’

[16] The minimal pair presented here was collected in Mudan Southern Paiwan. Yet, it is assured that /c/ and /t/ are contrastive before /i/.

	ʔuɭu	'head'
/ʎ/	ku**k**a	'chicken'
	ku**ʎ**a	'foot'
/g/ vs /q/	punu**g**	'corn'
	punu**q**	'brains'
/q/ vs /ɭ/	pəntə**q**	'to break'
	pəntə**ɭ**	'to twist'
/r/	cə**q**uq	'cute; lovely'
	cə**r**uq	'egret'
/ʔ/	uma**q**	'pus'
	uma**ʔ**	'house'
/s/ vs /z/	**s**uman	'to be engaged in'
	zumaŋ	'to guard'
/ts/	ʔaʎi**s**	'tooth'
	ʔaʎi**ts**	'skin'
/v/	**s**a	'and'
	va	'lung'
/r/	**s**umanav	'deliberately'
	rumənav	'to wash'
/ʔ/	cuvu**s**	'elm'
	cuvu**ʔ**	'bamboo sprout'
/z/ vs /ts/	ku**z**u	'thousand'
	ku**ts**u	'head louse'
/ʎ/	**z**aqu	'soap'

		ʎaqu	‘owl’
	/ɭ/	**z**umaŋ	‘to guard’
		ɭumaiŋ	‘to follow’
	/r/	**z**aman	‘torch’
		ramaŋ	‘conger eel’
/ʎ/ vs	/r/	**ʎ**uni	‘earthquake’
		runi	‘sponge cucumber’
	/ɭ/	a**ʎ**u	‘honey’
		a**ɭ**u	‘eight’

The distinctive features presented here follow modified versions of *Sound Pattern of English* (*SPE*) (cf. Chomsky and Halle, 1968; Halle and Clements, 1983; Sagey 1986), encoding major classes, types of construction, manners of articulation, and places of articulation. The distinctive features of the Paiwan consonants are illustrated in Table 2.6.

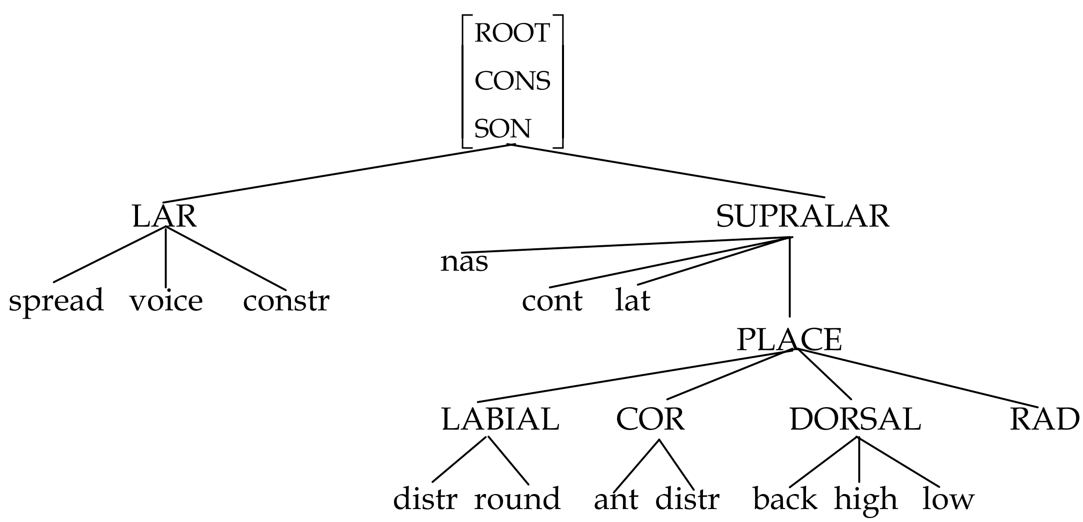
Table 2.6: Distinctive Features of Paiwan Consonants

PLACE	LABIAL					CORONAL													DORSAL			
Feature	p	b	m	v	w	t	d	n	ts	s	l	ɭ	r	ɖ	c	ɟ	ʎ	j	k	g	ŋ	q
cons	+	+	+	+	–	+	+	+	+	+	+	+	+	+	+	+	+	–	+	+	+	+
cont	–	–	–	+	+	–	–	–	±	+	+	+	+	–	–	–	+	+	–	–	–	–
son	–	–	+	–	+	–	–	+	–	–	+	+	+	–	–	–	+	+	–	–	+	–
ant						+	+	+	+	+	+	–	–	–	–	–	–	–				
dist						–	–	–	±	–	–	–	–	–	–	–	–	–				
strid	–	–	–	–	–	–	–	–	±	+	–	–	–	–	–	–	–	–	–	–	–	–

voiced	–	+	+	+	+	–	+	+	–	–	+	+	+	+	–	+	+	+	–	+	+	–
nasal	–	–	+	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	+	–

Feature geometry (Clement 1985; Sagey 1986; McCarthy 1988) is a model in which the non-linear relationship between features and the way features can be grouped into a hierarchy array of functional classes. In non-linear phonology, features are organized in phonological representation. Feature may or may not have values. The feature [LABIAL] refers to the group of labial segments, in which any generalization involving non-labial segments cannot be expressed. In a feature tree, features or particular groups of features can spread to neighboring segments. The root node refers to the dominating node. McCarthy (1988) proposes that the laryngeal and the supralaryngeal constituents make up the root node. Following McCarthy (1988) and Broe (1992), the structure of feature geometry is represented in (28).

(28)



Generally speaking, the distribution of Paiwan consonants is rather free. The distribution of the loan phoneme and allophones, on the other hand, is more restricted. Palatalized allophones [tʃ], [ʃ], and [ʒ] are not always predictable in Central Piuma Paiwan, among older speakers only. The surface distribution of the consonants is given in Table 2.7. More discussion on consonantal allophones is found in section 2.3.2.

Table 2.7: Paiwan Consonant Distribution[17]

Consonants	Word-Initial				Word-Internal	Word-Final
	#___i	#___u	#___a	#___ə	V__V	___#
p	**pitsuɭ** 'muscle of arm'	**puɖu** 'kidney'	**padaj** 'rice'	**pədi** 'portion'	**sapuj** 'fire'	**kurap** 'skin disease'
b	**bibi** 'duck'	**buniq** 'mud'	**bakits** 'bucket'	**bəruŋ** 'hole'	**bubuŋ** 'bubble'	**qubqub** 'frog'
t	**titsa** 'rake'	**tutu** 'breasts'	**taqəd** 'to sleep'	**təquŋ** 'horn'	**putut** 'drill'	**parut** 'true'
d	**dimpuŋ** 'flour'	**duku** 'poison'	**daɭiʎ** 'bottle'	**dəməs** 'glutton'	**gadu** 'mountain'	**taqəd** 'to sleep'
c	**cimiz** 'chin'	**cuʎur** 'angle'	**cababaŋ** 'blister'	**cəbək** 'lake'	**pacəz** 'wood-chisel'	**səmuc** 'choking'
ɟ	**ɟiɟi** 'buttocks'	**ɟurits** 'paste'	**ɟaɭan** 'road'	**ɟəkap** 'footprint'	**suɟu** 'lover'	**qaʎuɟ** 'to lost'
k	**kiɭiʎ** 'cricket'	**kupu** 'cup'	**kasuj** 'trousers'	**kəʎa** 'torso'	**səkəz** 'to stop'	**vaik** 'to go'
g	**gidi** 'side'	**gusam** 'weed'	**gaŋ** 'crab'	**gəmgəm** 'fist'	**sagi** 'file'	**səgsəg** 'tabu field'
q	**qipu** 'earth'	**quzu** 'leaf'	**qaʎup** 'to hunt'	**qətsəv** 'counter part'	**biqu** 'curve'	**tidəq** 'interval'
ʔ[18]	**ʔiʎa** 'to hide'	**ʔuqaʎaj** 'man'	**ʔaʔa** 'crow'	**ʔəɭuz** 'pillar'	**vituʔan** 'star'	**umaʔ** 'house'

[17] Words in parentheses were attested in Central Piuma Paiwan only.

v	**vikiŋ** ‘curve’	**vukid** ‘forest’	**vasa** ‘taro’	**vəku** ‘wart’	**kuvaʎ** ‘blanket’	**qətsəv** ‘counterpart’
s		**suʎa** ‘ice’	**saŋas** ‘first’	**sənaj** ‘song’	**sasaw** ‘outdoors’	**qurəpus** ‘cloud’
z		**zuma** ‘other’	**zaman** ‘torch’	**zəḽət** ‘bow-string’	**imaza** ‘here’	**kuraz** ‘rake’
ts		**tsuvuq** ‘bamboo sprout’	**tsaḽa** ‘to fry’	**tsədas** ‘sunlight’	**patsaj** ‘to die’	**kurits** ‘millet’
(h)	**hikuki** ‘airplane’	**huni** ‘ship’	**haku** ‘box’		**kuhugan** ‘five minutes’	
tʃ	**tʃima** ‘nail’	**(tʃuru)** ‘tip’	**(tʃaviʎ)** ‘year’		**(matʃa)** ‘eye’	**(qaʎitʃ)** ‘skin’
ʃ	**ʃiḽi** ‘pillow’				**ḽiʃi** ‘bride price’	
ʒ	**ʒitsu** ‘this’				**ʃiʒi** ‘goat’	
n	**niqaj** ‘newly-born monkey’	**nuḽi** ‘glue’	**namaqar** ‘weak’	**nəka** ‘not exist’	**nana** ‘sweet potato’	**pakan** ‘to feed’
m	**mimi** ‘calf’	**muka** ‘papaya’	**matsam** ‘piquant’	**məkuj** ‘cucum-ber’	**qimi** ‘cheeks’	**səḽəm** ‘the dark’
ŋ	**ŋiḽu** ‘pain’	**ŋuɟus** ‘nose’	**ŋadan** ‘name’	**ŋəḍuq** ‘segment’	**kuŋaj** ‘dirt’	**qiʎaŋ** ‘dirt’
r	**rigi** ‘horse’	**rugus** ‘twig’	**ragəd** ‘pebble’	**rəŋeəŋ** ‘obstacle’	**parut** ‘true’	**maqipər** ‘unlucky’
ʎ	**ʎisuk** ‘to pull out’	**ʎunaj** ‘small knife’	**ʎatu** ‘to boil (meat)’	**ʎəḽət** ‘lip’	**riʎaj** ‘skinny person’	**kuriʎ** ‘dried food’
ḍ	**ḍimuḽ** ‘fist’	**ḍukuŋ** ‘bend’	**ḍaqa** ‘branch’	**ḍəkan** ‘tumpline’	**ḍaḍaj** ‘toy’	**piaḍ** ‘dish’

[18] Words presented in this row were collected from Northern Paiwan.

ɭ	**ɭigu** ‘glory’	**ɭuqəm** ‘luck’	**ɭaɭaja** ‘flag’	**ɭədəp** ‘to dive’	**ʃiɭi** ‘pillow’	**ɖaquɭ** ‘goiter’
w	**wi** ‘yes’	**wuvaj** ‘feminine name’	**wara** ‘dried rice-straw’		**sawni** ‘short while’	**ʃiaw** ‘soup’
j	**yisu** ‘Jesus’	**jui** ‘feminine name’	**jaʃi** ‘coconot’		**vavajan** ‘woman’	**quzəmaj** ‘dim’

As shown in Table 2.7, the palatalized /tʃ/ is occasionally not conditional and occurs word-initially, medially and finally in Central Piuma Paiwan. In Northern Paiwan, the palatalized occur before a high front vowel only, i.e., the occurrence of palatalized allophonic series is conditional. In Southern Paiwan, however, the condition of a following high front vowel does not always cause palatalization in all the attested words.

2.3.2 Allophones of Consonants

Paiwan consonantal segments are relatively crucial for the historical reconstruction in that they demonstrate quite a few distinctive features which are not attested in the other Formosan languages. All Formosan languages except Paiwan have made extensive mergers and splits among obstruent segments. According to Ferrell (1980), Paiwan is unique in being the only Formosan language which does not merge any of the segments *t and *d[19] under his examination. On the other hand, there have been disputes over whether retroflexion or palatalization is a distinctive feature in Proto-Austronesian. Wolff (1988) proposes the hypothesis that the feature of palatalization characterized the

[19] The southern Formosan segments under Ferrell’s (1980) examination are S, t_2, d_2, d_3, t^y, t_1, d_1, and g^y.

proto-system, and that the feature of retroflexion developed in the daughter languages. The uniqueness of Paiwan has been supported by the facts that both of the retroflexion or palatalization features are attested in the Paiwan language, and that a series of palatal segments are found in Paiwan dialects.

In this section, synchronic consonantal allophones of Paiwan and their distribution are elaborated and exemplified. Data presented in this section, unless specified, were drawn from Central Paiwan.

2.3.2.1 Stops

Paiwan has a set of eleven stops, a voiced, and a voiceless series, at bilabial, alveolar, palatal and velar place of articulation, plus a retroflex plosive, a uvular and a glottal stop. Stops in Paiwan are usually unreleased in word-final position. Alveolar stops are often palatalized before the high front vowel /i/.

/b/, /d/, /ɟ/, /g/: The voiced stops, [+consonantal, +voiced, -sonorant, -continuant]. Examples of allophones are given in (29).

(29) /ɟ/ [ɟ] voiced palatal stop. There are no restrictions on the distribution of the sound. It occurs before and after any vowels.

/ɟaqis/	[ɟaqis]	'forehead'
/suɟu/	[suɟu]	'lover'
/qəmiɭaɟ/	[qəmiɭaɟ]	'to sit'
/ɟiʎ/	[ɟiʎ]	'buttocks'

[dʲ] voiced palatalized alveolar stop. It occurs before the high front vowel /i/ in younger speaker's speech only; [ɟ] and [dʲ] are in free variation before [i] in younger speaker's speech.

/ɟiʎ/	[dʲiʎ]	'buttocks'

/p/, /t/, /c/, /k/, /q/: The voiceless stops, [+consonantal, -voiced, -sonorant, -continuant]. Examples of allophones are given in (30).

(30) /c/ [c] voiceless palatal stop. There are no restrictions on the distribution of the sound. It occurs before and after any vowels.

/cuʎa/	[cuʎa]	'eel'
/kəməcab/	[kəməcab]	'to reap (with knife)'
/vuc/	[vuc]	'squirrel'
/ciaʎ/	[ciaʎ]	'abdomen'

[tʲ] voiceless palatalized alveolar stop. It occurs before the high front vowel /i/ in younger speaker's speech only; [c] and [tʲ] are in free variation before [i] in younger speaker's speech.

/ciaʎ/	[tʲiaʎ]	'abdomen'

/ɖ/: voiced retroflex stop, [+consonantal, +voiced, -sonorant, -continuant].

(31) /ɖ/ [ɖ] retroflex stop. There are no restrictions on the distribution of the sound. It occurs in any word position, before and after any vowels.

/ɖava/	[ɖava]	'female friend'
/kuɖaɭ/	[kuɖaɭ]	'thick'
/kəɖi/	[kəɖi]	'small'
/piaɖ/	[piaɖ]	'dish'

/ʔ/: voiceless glottal stop, [-voiced, -sonorant, +constricted], a clear phoneme in Northern Paiwan but somewhat marginal in Central and Southern Paiwan.

2.3.2.2 Nasals

Paiwan has three nasal segments: /m/, /n/, and /ŋ/, with the distinctive features of [+consonantal, +voiced, +sonorant, -continuant, +nasal].

/m/, /n/, /ŋ/: nasal stops. Nasal stops are assimilated with the articulation place of its following consonant. Neutralization occurs among the three nasal segments. The contrast among [n], [m], and [ŋ] is neutralized in the position before another consonant. Each nasal phoneme has to precede a homorganic consonant. Examples are given in (32)-(34).

(32) /m/ [m] bilabial nasal. It occurs before LABIAL consonants, before and after any vowels. It does not occur as a syllable peak.

/matsa/	[matsa]	'eye'
/umuq/	[umuq]	'pus'
/pakim /	[pakim]	'to grope for'
/ba**m**ban/	[ba<u>**m**</u>ban]	'corrugated iron'

(33) /n/ [n] alveolar nasal. It occurs before CORONAL consonants, before and after any vowels, and in utterance-final position. It does not occur as a syllable peak.

/nasi/	[nasi]	'breath'
/kanən/	[kanən]	'food'
/avan/	[avan]	'exactly'
/ɟə<u>**n**</u>ɟəm/	[ɟə<u>**n**</u>ɟəm]	'to push down'

(34) /ŋ/ [ŋ] velar nasal. It occurs before VELAR consonants, before and after any vowels, and in utterance-final position. It does not occur as a syllable peak.

/ŋabu/	[ŋabu]	'toad'

/maŋuaq/	[maŋuaq]	'fortunate'
/ʎatsəŋ/	[ʎatsəŋ]	'vegetable'
/sasiŋki/[20]	[sasiŋki]	'camera'

2.3.2.3 Fricatives

Paiwan has three aboriginal fricatives /v/, /s/ and /z/, and one loan fricative segment /h/. The feature [+continuant] distinguishes fricatives from stop segments. /h/ is more productive in Central Piuma Paiwan and was found not only in loan words but also in second-person singular affixation as an alternation with the voiceless alveolar fricative /s/.

/v/: voiced labiodental fricative, [LABIAL, +consonantal, +voiced, -sonorant, +continuant]. The features [-consonantal, +sonorant] distinguish [w] from [v]. Allophonic segment [w] only alternates with [v] at word-final position when its preceding segment is also a vowel. The elaboration of morphophonemic alternation between [w] and [v] is found in section 2.6.3.

(35) /v/ [v] voiced labiodental fricative. There are no restrictions on the distribution of the sound [v].

/vaʎi/	[vaʎi]	'board'
/saviki/	[saviki]	'betel nut'
/ratsəv/	[ratsəv]	'medicinal herbs'

/s/, /z/: alveolar fricatives, [CORONAL, +consonantal, -sonorant, +continuant, +strident, +anterior]. Segments /s/ and /z/ have the palatalized allophonic variants /ʃ/ and /ʒ/ respectively in Paiwan. The palatalized allophones occur before a high front vowel /i/. In other words, the allophonic variation is usually

[20] This is a Japanese borrowing compound, adopted from *sasin* 'photo' (<Japanese *shashi* 'photography') and -*ki* 'machine'

conditional. However, the palatalized allophones are sometimes not conditional in Central Piuma Paiwan (see § 2.3.1 above); it can appear in any phonological environments. The features of [-anterior] and [+distributed] distinguishes [ʃ] and [ʒ] from [s] and [z] respectively. Given that the distribution of the palatalized sounds is more restricted, the alveolar sounds are treated as the phonemes. Examples of allophones are shown in (36) and (37).

(36) /s/ [s] voiceless alveolar fricative. The distribution of the sound is free except before the high front vowel /i/. It does not occur before /i/.

/saɭaɟ/	[saɭaɟ]	'companion'
/qasaʎ/	[qasaʎ]	'chaff'
/qudas/	[qudas]	'white hair'

[ʃ] voiceless post-alveolar fricative, and it occurs before the high front vowel /i/ only. [ʃ] and [s] are allophones in complementary distribution.

/siɭi/	[ʃiɭi]	'pillow'
/sasiq/	[saʃiq]	'ant'

(37) /z/ [z] voiced alveolar fricative. The distribution of the sound is free except before the high front vowel /i/. It does not occur before /i/.

/zaɭuzu/	[zaɭuzu]	'twilight'
/pazaŋaɭ/	[pazaŋaɭ]	'price'
/rəməŋəz/	[rəməŋəz]	'to ambush'
/rizariz/	[rizariz]	'saw'

[ʒ] voiceless post-alveolar fricative, and it occurs before the high front vowel /i/ only. [ʒ] and [z] are allophones in complementary distribution categorically.

/zian/	[ʒian]	'men's dance'
/sizi/	[ʃiʒi]	'goat'

2.3.2.4 Affricates

The segment /ts/ is the only affricate found in Paiwan, with the features of [CORONAL, +consonantal, -sonorant, +anterior]. It has a palatalized allophone [tʃ]. The feature [-anterior] distinguishes the allophone [tʃ] from [ts]. Some examples of allophones are shown in (38).

(38) /ts/ [ts] voiceless alveolar affricate. The distribution of the sound is free except before the high front vowel /i/. It does not occur before /i/.

/tsaviʎ/	[tsaviʎ]	'year'
/kutsu/	[kutsu]	'head louse'
/qaʎits/	[qaʎits]	'skin'

[tʃ] voiceless post-alveolar affricate, and it occurs before the high front vowel /i/ only. [tʃ] and [ts] are allophones in complementary distribution categorically in Northern and Southern Paiwan.

/tsiqaw/	[tʃiqaw]	'fish'
/qatsiʎaj/	[qatʃiʎaj]	'stone'

Note that the [tʃ] allophone can occur anywhere in older speaker's speech in Central Piuma Paiwan. The sound [ts] is more restricted than [tʃ] in the older generation of that dialect. Yet, there are restrictions on the distribution of the palatalized sounds [ʃ] and [ʒ] in Central Piuma Paiwan. The unpredictable occurrence of the sound [tʃ] may be due to paralinguistic factors.

Thus far, we have seen the palatalized allophones of [ʃ], [ʒ], and [tʃ] in Paiwan. Phonological palatalization applies to both fricatives and the affricate.

2.3.2.5 Liquids

Paiwan has three liquids, two laterals /ʎ/, /ɭ/ and one trill /r/. The three liquid segments share the features of [CORONAL, +consonantal, +sonorant, +continuant, -nasal]. The feature [-nasal] distinguishes liquids from nasals, and the feature [+sonorant] distinguishes liquids from fricatives. Laterals /ʎ/ and /ɭ/ are two distinct phonemes in that *aʎu* 'honey' and *aɭu* 'eight' are two separate words, and that *vaɭi* 'wind' differs from *vaʎi* 'board'. In addition to the different places of articulation, the feature [+retroflex] also distinguishes /ɭ/ from /ʎ/. In Central and Southern Paiwan, the segment /r/ has a voiced velar fricative allophone [ɣ], while flap or tap allophone was also found in speech flow. Some examples of allophones are illustrated in (39)-(40).

(39) /ʎ/ [ʎ] palatal lateral. There are no restrictions on the distribution of the sound. It occurs before and after any vowels.

/ʎupəc/	[ʎupəc]	'plug'
/qaʎa/	[qaʎa]	'enemy'
/aŋaʎ/	[aŋaʎ]	'mouth'
/ʎiku/	[ʎiku]	'bellows'

[lʲ] palatalized alveolar lateral, and it occurs before the high front vowel /i/ only. It was attested in younger speaker's speech. [ʎ] and [lʲ] are allophones in free variation before [i] in younger speaker's speech.

/ʎiku/	[lʲiku]	'bellows'
/maʎisuk/	[malʲisuk]	'to come out'

(40) /r/ [r] alveolar trill. There are no restrictions on the distribution of the sound. It occurs before and after any vowels.

/ragəd/	[ragəd]	'pepper'
/mirava/	[mirava]	'to prepare oneself'
/ʎaʎukur/	[ʎaʎukur]	'plant'
/qarut/	[qarut]	'portion'
/qərəŋan/	[qərəŋan]	'bed'

[ɾ] alveolar flap, and it occurs in intervocalic position; [r] and [ɾ] are allophones in free variation in non-stressed syllable.

/qarut/	[qáɾut]	'portion'

[ɭ] retroflex lateral, and it occurs in syllable-initial position only. [ɭ] and [r] are allophones in free variation in syllable-initial position.

/qərəŋan/	[qəɭəŋan]	'bed'

[ɣ] voiced velar fricative. It was attested in Central and Southern Paiwan only. There are no restrictions on the distribution of the sound. [ɣ] and [r] are allophones in free variation in Central and Southern Paiwan.

/rusuŋ/	[ɣusuŋ]	'animal cage'

/garuts/	[gaɣuts]	'comb'
/marəvur/	[maɣəvuɣ]	'damaged'

One important observation on the Paiwan allophones is the free variation even for an individual speaker, more for younger speakers than older speakers. Typically, younger speakers would sometimes use an alternative allophone, and sometimes not.

2.4 Vowels

2.4.1 Vowel Inventory

The vowel inventory of Paiwan is shown in (41).

(41) i u

ə (o)

a

Vowel characteristics of Paiwan vowels are given in Table 2.8.

Table 2.8: Summary of Paiwan Vowel Characteristics

Vowel	Characteristics
i	high front unrounded
u	high back rounded
ə	central unrounded
a	low central unrounded
(o)	mid-high back rounded

Paiwan has four aboriginal vowels, and the back mid-high vowel /o/ is a loan vowel, with relatively lower frequency of occurrence. Blust (1988) has noted that almost all Austronesian specialists admit just four Proto-Austronesian vowels: a, ə, i, and u. Many of the words with the phoneme /o/ are associated with Japanese, Taiwanese, or Mandarin loanwords. Therefore, /o/ is included in the vowel inventory as a loan vowel here.

Words illustrating Paiwan vowels are listed in Table 2.9.

Table 2.9: Words illustrating the vowels of Paiwan

VOWEL	**PAIWAN**	**GLOSS**
i	ɭ**i**ʎ**i**ŋ	'shadow'
u	ɭ**u**k**u**ts	'campanula'
ə	ɭ**ə**s**ə**q	'tear'
a	ɭ**a**v**a**	'flying squirrel'
(o)	ɭip**o**n	'Japan'

On the other hand, I did not find any vowel length as a linguistic distinctive feature in the corpus.

Among the aboriginal vowels, only /a/, /i/ and /u/ can occur word-initially. Schwa never appears word-initially as a single syllable or in diphthongs.

Minimal pairs exhibiting contrasts between the vowel phonemes are given in (42).

(42) /i/ vs /u/	**i**ta	'one'
	uta	'also'
/a/	ʎav**i**	'seed of millet'
	ʎav**a**	'flying squirrel'
/ə/	mal**i**mu	'to be covered'
	mal**ə**mu	'sudden'
/a/ vs /i/	ɟaq**a**s	'material for charcoal'

		ɟaq**i**s	'forehead'
/u/		g**a**ŋ	'crab'
		g**u**ŋ	'cattle'
/ə/		kakan**a**n	'dining table'
		kakan**ə**n	'food'
/u/ vs /ə/		quʎ**u**ŋ	'color'
		quʎ**ə**ŋ	'bundle'
/o/		ɭip**u**n	'Masculine name'
		ɭip**o**n	'Japan'

In addition to single vowels, vowel sequences of two different vowels were also attested. The clusters of vowels shown in (43) occur morpheme internally. Internal vowel clusters are usually divided into different syllables, with a few cases of diphthongs, which belong to a single slot of nucleus on the syllable structure.

(43) Vowel clusters

a-series	au	ts**au**ts**au**	'person'
	ai	k**ai**laŋan	'stone mortar'
i-series	ia	c**ia**ɭ	'abdomen'
	iu	cəpuʎ**iu**ɭ	'hot spring'
u-series	ua	ɟ**ua**kits	'to adhere'
	ui	k**ui**ɟi	'leaf hat'
ə-series	əa	aʎavəv**əa**n	'spring'

There are a few restrictions of which vowels may occur together as diphthongs. In a V_1V_2 sequence, V_2 must be a different vowel from V_1. When two vowels of the same phoneme occur adjacent to each other, the vowel sequence is phonetically realized as a single vowel without lengthening. Given that schwa never occurs in diphthongs, Northern and Southern Paiwan aboriginal vowels have a sonority scale in vowel sequences as follows: a > i, u. In other words, low vowels are more sonorant than high vowels. A-series vowel clusters are falling-sonority sequences, in which case the second vowel of the sequence usually becomes an off-glide at word-final position, such as *qad<u>aw</u>* 'sun' and *qav<u>aj</u>* 'millet cake'. In rising-sonority sequences /ia/ and /ua/, with the first vowel less sonorous than the second, the preceding high vowels are realized as prevocalic glides, as shown in *qa<u>ja</u>qa<u>ja</u>m* 'bird' and *u<u>wa</u>ts* 'vessel'. However, a high vowel preceding or following schwa cannot be realized as an off-glide or prevocalic glide in any phonological and phonetic environments. In Central Paiwan, vowel sonority affects the assignment of stress. More discussion on Central Paiwan schwa is found in section 2.5.2.

2.4.2 Allophones of Vowels

In this section, the allophonic variation of Paiwan vowels and segmental phonology are discussed. The articulation of vowels and the formation of glides are elaborated and exemplified here.

Paiwan has four single vowels /i/, /u/, /a/, /ə/ and a loan vowel /o/. All vowel segments are with the features [+syllabic, -consonantal, +sonorant]. Ferrell (1982) has reported in his dictionary that /i/, /u/, /ə/ are lowered respectively to [e], [o], [ʌ] by some speakers. The restrictions on the allophones, however, were not clear in Ferrell's (1982) description. Although the allophone [ʌ] was not attested in the current study, coarticulation effect was also found in various phonetic contexts. Examples of allophones are given in (44)-(47).

(44) /i/ [i] high front unrounded vowel.

There are no restrictions on the distribution of [i].

/iku/	[iku]	'tail'
/pitsuḽ/	[pitsuḽ]	'strength'
/qaḽi/	[qaḽi]	'male friend'
/qipu/	[qipu]	'dirt'

[e] mid high unrounded vowel.

It occurs in word-medial or word-final position when adjacent to the uvular stop [q]. [e] and [i] are allophones in free variation when adjacent to [q] in word non-initial position.

/qipu/	[qepu]	'dirt'
/tsaqi/	[tseqe]	'excrement'

(45) /u/ [u] high back rounded vowel.

There are no restrictions on the distribution of [u].

/uta/	[uta]	'also'
/tsuvuq/	[tsuvuq]	'bamboo sprout'
/puḽu/	[puḽu]	'handle'
/uqaʎaj/	[uqaʎaj]	'man'

[o] mid-high back rounded vowel.

It may occur in any syllable position when adjacent to the uvular stop [q]. The distribution of the sound, however, is not always predictable. [o] and [u] are allophones in free variation.

/punuq/	[punoq]	'brain'
/ʎiqu/	[ʎiqo]	'white of eyes'
/uqaʎaj/	[oqaʎaj]	'man'

(46) /a/ [a] low central unrounded lax vowel.

There are no restrictions on the distribution of [a].

/apu/	[apu]	'betel-nut quid'
/masiɭa/	[masiɭa]	'satiated'
/kavakan/	[kavakan]	'water spring'

[ɑ] low back unrounded tense vowel, and it occurs in word-internal or word-final position when adjacent to VELAR or UVULAR consonantal segments. [ɑ] and [a] are allophones in free variation when adjacent to VELAR or UVULAR consonantal segments in word non-initial position.

/qaqa/	[qɑqɑ]	'crow'
/zaŋaq/	[zaŋɑq]	'necklace'
/kavakan/	[kɑvɑkɑn]	'water spring'

(47) /ə/ [ə] central unrounded lax vowel.

It occurs word-internally and word-finally only. It cannot occur in vowel sequences as a member of diphthongs.

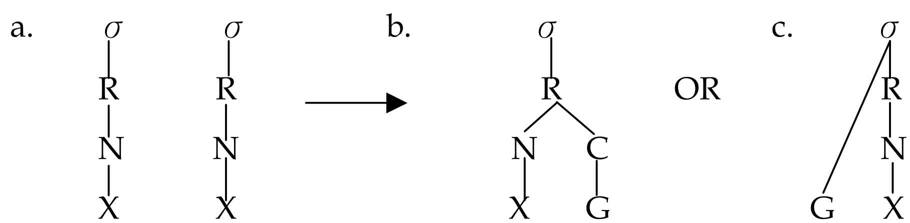
/tsəɭaɭaq/	[tsəɭaɭaq]	'thunder'
/gatsəɭ/	[gatsəɭ]	'itch'
/səʎaʎəɖə/	[səʎaʎəɖə]	'to flinch'

2.4.3 Glide Formation

Paiwan has two glide approximant segments /w/ and /j/. There has been an issue on the status of glides in Formosan languages. Given that there are some instances where glides are clearly associated with underlying vowels, and that stress assignment is regular if some instances of underlying vowels are viewed as consonants, it has been proposed in this study that glides should be treated as phonemes in Paiwan. Although there are no clear minimal pairs showing contrast between glides and high vowels, glide phonemes have a lot to do with syllabification and stress assignment. Much more details on stress assignment are found in section 2.5.

The Formation of Glides, as illustrated in (48), turns a stem into a well-formed prosodic word. Formation (48b) applies to a word when the sonority in V_1V_2 sequence is V_1>V_2, whereas Formation (48c) applies to a word when the sonority in V_1V_2 sequence is V_2>V_1. As the vowel sonority hierarchy in Paiwan is a> i, u, the vowel sequences /au/, /ai/, /ua/ and /ia/ are realized as [aw], [aj], [wa], and [ja] respectively.

(48) Formation of Glides



The evidence for the existence of glides comes from the morphophonemic alternation between *siaw* (<*siau*) and *siav* 'soup' (§ 2.6.3). Given that the final coda slot is reserved for [-syllabic] segment only, Formation of Glides must apply to the vowel sequence **au** (au > aw; aw~av). Other Paiwan words such as *aia* (>*ája*) ‘thus’, *vaua* (> *váwa*) ‘millet beer’ and *uʎai* (> *úʎaj*) ‘thorn’ also support the argument that glides are distinct phonemes in Paiwan.

The phonemes /w/ and /j/ are glides with the features of [-consonantal, +continuant, +sonorant, -syllabic, +high]. The feature [-consonantal] distinguishes glides from the other consonantal phonemes, whereas the feature [-syllabic] distinguishes glides from vowel phonemes.

Glides [w] and [j] do not occur before the schwa [ə]. The distribution of the glides is more restricted than the other consonantal phonemes. The fricative sound [v] is the allophone of [w] in Paiwan under some conditions. Examples of allophones are given in (49).

(49) /w/ [w] labial glide. It occurs in any word position. It does not occur before a schwa.

/wara/	[wara]	‘dried rice-straw’
/uwats/	[uwats]	‘vessel’
/tsiqaw/	[tʃiqaw]	‘fish’
/kasiw/	[kaʃiw]	‘tree’
/mapuɭaw/	[mapuɭaw]	‘drunk’

[v] voiced labiodental fricative, and it occurs word-finally only. [w] and [v] are allophones in free variation when it follows /i/ or /a/ at word-final position in Northern Paiwan.

/tsiqaw/	[tʃiqav]	‘fish’
/kasiw/	[kaʃiv]	‘tree’
/mapuɭaw/	[mapuɭav]	‘drunk’

More discussion on the morphophonemic alternation between /w/ and /v/ is found in section 2.6.3.

2.5 Stress

2.5.1 Distribution of Stress

A Paiwan word typically has a single primary stress in its elicitation form. Word stress usually falls on its penultimate syllable, when the word consists of a single root or derived suffixed forms. Roots, stems, and derivation forms in Paiwan can form a prosodic word to which stress can apply. In describing the Paiwan facts I treat prosodic words as consisting of a stem plus a suffix sequence. A prosodic word usually carries independent components of meanings. In prosodic words without any schwa penult, all the dialects of Paiwan share the same stress patterns. The data collected in this section were attested in Northern, Central and Southern Paiwan. The statement of the stress patterns is general to the dialects of Northern and Southern Paiwan, and it applies to every possible prosodic word of these dialects. Yet, the distribution of stress stated in (50) does not hold of Central Paiwan. In sequences with roots and affixes, the single bracket '[' indicates the left edge of a prosodic word, given that roots and suffixes are always at the right side of the single bracket and main stress was never attested at the left side of the bracket. Note that the segmental differences between Northern Paiwan and Southern Paiwan were ignored in the following statement of the distribution.

(50) The distribution of main stress in Paiwan: main stress in Paiwan falls on the final syllable only in the case of a monosyllabic prosodic word. Otherwise, main stress is on the penult.

a. Stress in Roots

<u>Stress</u>	<u>Shape</u>	<u>Root</u>	<u>GLOSS</u>
σ́	CV́	tú	'burning charcoal'
σ́	CV́C	gáŋ	'crab'

σ́	CV́V	váu	‘feminine name’
σ́	CV́VC	ʎúaŋ	‘cattle’
σ́ σ	CV́CV	píku	‘elbow’
σ́ σ	CV́CVC	púnuq	‘brain’
σ́ σ	CV́VCVC	qáuɭaj	‘dried-up fruit’
σ́ σ	CV́CCVC	ʎámʎam	‘ginger’
σ σ́ σ	CVCV́CV	qarába	‘flat worm’
σ σ́ σ	CVCV́CVC	vaɭátsuk	‘woodpecker’

b. Stress in Suffixed Forms: main stress falls on the penult of a suffixed form.

Stress	Morpheme	Suffixation	GLOSS
σ́ σ	kan-an$_{suffix}$	kánan	‘place where one eats’
σ σ́ σ	vaik-aŋa$_{suffix}$	vaikáŋa	‘already going’
σ σ́ σ	ɟavats-an$_{suffix}$	ɟavátsan	‘muscle ache in legs’
σ σ́ σ	sa$_{prefix}$-[ɭum-an$_{suffix}$	saɭúman	‘fragrance’
σ σ σ́ σ	in$_{prefix}$-[ituŋ -an$_{suffix}$	initúŋan	‘garment’
σ σ σ σ́ σ	kaʎa$_{prefix}$-[quɟaʎ-an$_{suffix}$	kaʎaquɟáʎan	‘rainy season’

c. Stress in Prefixed Forms: main stress falls on monosyllabic roots; it falls on the penult of disyllabic or longer roots.

Stress	Morpheme	Prefixation	GLOSS
σ σ́	pa$_{prefix}$-[kan	pakán	‘to feed’
σ σ́	pu$_{prefix}$-[pan	pupán	‘to bait’
σ σ σ́	pa$_{prefix}$-ki$_{prefix}$-[kan	pakikán	‘to feed (animals)’
σ σ σ́	ma$_{prefix}$-pə$_{prefix}$-[tad	mapətád	‘to dry (something)’

σ σ σ́	sa$_{prefix}$-ru$_{prefix}$-[ŋuaq	saruŋuáq	‘comfortable’
σ σ́ σ	mi$_{prefix}$-[ɭima	miɭíma	‘to wash hands’
σ σ́ σ	ku$_{preix}$-[vuvu	kuvúvu	‘my grandparents’
σ σ σ́ σ	maʎə$_{prefix}$-[ɭaɖuq	maʎəɭáɖuq	‘too long’
σ σ σ́ σ	marə$_{prefix}$-[saɭaɟ	marəsáɭaɟ	‘two companions’
σ σ σ́ σ	pa$_{prefix}$-ki$_{prefix}$-[ʎivak	pakiʎívak	‘to take good care of’
σ σ σ σ́ σ	s$_{prefix}$-əm$_{infix}$-a-[taihuku	səmataihúku	‘to Taipei’

d. Stress in Infixed Forms: main stress falls on monosyllabic roots; otherwise, it is on the penult.

Stress	Morpheme	Infixation Form	GLOSS
σ σ́	k-əm$_{infix}$-[an	kəmán	‘to eat’
σ σ́	k-əm$_{infix}$-[ats	kəmáts	‘to bite’
σ σ́ σ	k-əm$_{infix}$-[aɭi	kəmáɭi	‘to dig’
σ σ σ́ σ	s$_{prefix}$-əm$_{infix}$-u-[kava	səmukáva	‘to take off clothes’
σ σ σ σ́ σ	k$_{prefix}$-əm$_{infix}$-asi-[pana	kəmasipána	‘to come from river’

e. Generalization of the occurrence of main stress in Paiwan: main stress falls on the final syllable only in the case of a monosyllabic prosodic word. Otherwise, main stress falls on the penult of a prosodic word (Prwd).

(i) … σ_{prefix}-(C)$_{\text{stem}}$-σ_{infix} [… $\acute{\sigma}$ σ]$_{\text{Prwd}}$

(ii) … σ_{prefix}-(C)$_{\text{stem}}$-σ_{infix} [$\acute{\sigma}$]$_{\text{Prwd}}$

Stress patterns in Paiwan can be divided into two types: quality-sensitive and quality-insensitive. Kenstowicz (1996) has documented several diverse languages in which vowel quality plays a comparable role in determining the location of stress. He has proposed a vowel sonority hierarchy and showed that peripheral vowels are more optimal than central vowels. In a quality-sensitive stress system, stress seeks out the most optimal vowel. On the other hand, Crowhurst and Michael (2005) have shown an interaction between quantity and quality of stress. They have proposed universal scales of Quantity, Coda, Height, and Diphthong, which are expected to be invariant across languages.

Central Paiwan has a quality-sensitive stress system, whereas the stress system in Northern Paiwan and Southern Paiwan is quality-insensitive. In a quality-sensitive stress system, the primary stress falls on the most sonorant or the most optimal vowel. Vowel-sonority hierarchy interacts with the assignment of stress. On the contrary, when vowel-sonority hierarchy does not play a role in the assignment of stress, the system is quality-insensitive in terms of the parameter in the typology of stress.

2.5.2 Stress Patterns in Central Paiwan

In Central Piuma Paiwan, the primary stress falls on either the penultimate (second-right) or the final (rightmost) syllable, depending on whether the penult has a schwa nucleus and the syllable number of the roots. Schwa affects the stress system in Central Paiwan, but not that in Northern and Southern Paiwan. The stress patterns in Central Paiwan are subject to the quality of vowels, i.e., quality-sensitive.

The description of Central Paiwan stress is given in (51). Again, in sequences with roots and affixes, the single bracket '[' indicates the left edge of a prosodic word. In sequences with roots only or roots plus suffixes, no bracket is placed. Roots and suffixes comprise prosodic words.

(51) a. Stress goes on the final syllable (i) if the prosodic word is monosyllabic, or (ii) if the penultimate syllable of the prosodic word has a schwa. Otherwise, stress falls to the penult.

Central Paiwan Word	Stress	Gloss
ɟiʎ	ɟíʎ	‘anus’
vat	vát	‘husked rice’
pu$_{prefix}$-[pan	pupán	‘to bait’
ma$_{prefix}$-pə$_{prefix}$-[tad	mapətád	‘to dry (something)’
pa$_{prefix}$-ki$_{prefix}$-[kan	pakikán	‘to feed (animals)’
k-əm$_{infix}$-[ats	kəmáts	‘to bite’
cəvus	cəvús	‘sugarcane’
tsəməɭ	tsəmə́ɭ	‘thunder’
qurəpus	qurəpús	‘cloud’
qapədu	qapədú	‘gall’
ʎisəqəs	ʎisəqə́s	‘nit’
quʎivaŋəraw	quʎivaŋəráw	‘rainbow’

b. In a disyllabic or longer prosodic word, stress falls on the penult of the word, regardless of the number of prefixes, infixes or suffixes.

Central Paiwan Word	Stress	Gloss
piku	píku	‘elbow’
qiʎas	qíʎas	‘moon’
vitsuka	vitsúka	‘stomach’
ʎavatsaq	ʎavátsaq	‘horsefly’
ku$_{preix}$-[vuvu	kuvúvu	‘my grandparents’
maʎə$_{prefix}$-[ɭaɖuq	maʎəɭáɖuq	‘too long’

s_{prefix}-əm_{infix}-u-[kava	səmukáva	'to take off clothes'
kan-an_{suffix}	kánan	'place where one eats'
ɟavats-an_{suffix}	ɟavátsan	'muscle ache in legs'
in_{prefix}-[ituŋ -an_{suffix}	initúŋan	'garment'
kaʎa_{prefix}-[quɟaʎ-an_{suffix}	kaʎaquɟáʎan	'rainy season'

The stress patterns in Central Paiwan are generalized as follows: penultimate stress [… $\acute{\sigma}$ σ $]_{Prwd}$ and final stress subject to the rightmost monosyllabic root …[$\acute{\sigma}$$]_{Prwd}$ or subject to schwa penult [… σ ə $\acute{\sigma}$$]_{Prwd}$.

Main stress in Central Paiwan falls on the penultimate syllable of a word, when the penult of the word does not have a schwa. If a word has a schwa in the penult, it will receive final stress. Diphthongs do not attract stress, which is the evidence for a Quantity Insensitive stress system. Secondary stress was not attested in polysyllabic prosodic words of Central Paiwan.

On the other hand, a schwa syllable can bear stress only when it is the final syllable of a word, and the word has another schwa in the penult. Some examples are shown in (52).

(52)

Paiwan Word	Stress	Gloss
a. / σ $\acute{\sigma}$ /	tsəkə́ʎ	'spouse'
b. / σ $\acute{\sigma}$ /	ɭəsə́q	'tear'
c. / σ σ $\acute{\sigma}$ /	vətsəqə́ɭ	'short necklace'
d. / σ σ σ $\acute{\sigma}$ /	quʎipəpə́	'moth'
e. / σ σ σ σ $\acute{\sigma}$ /	qəzəməzəmə́c	'night'

The weak schwa quality was supported not only by its phonetic nature but also by its more restricted distribution than the other vowels in Paiwan (§ 2.4.1). Schwa never appears word-initially as a single syllable. In V̲.CV syllable, the first V cannot be a schwa, e.g., *i̲ta* ‘one’, *u̲ta* ‘also’, *a̲ta* ‘and’, but no *ə̲ta* (**ə̲ta*). In addition, schwa never occurs in diphthongs: /ai/, /au/, /iu/, /ia/, /ua/, /ui/, but no */aə/, */uə/, */iə/, */əa/, */əi/, */əu/. A schwa and its adjacent vowel must be assigned into different syllables.

Now we turn to the question that a final schwa syllable can be stressed but not to an antepenultimate schwa syllable of a word. In a word such as *vətsəqə́ḽ* ‘short necklace’, where schwa nuclei are placed in initial (antepenultimate), penultimate and final position, stress at the right edge of the word is the optimal position for Central Paiwan stress. The right edge position must dominate the constraint of left edge for quality-sensitive stress to get a final stressed schwa. Peripheral vowels are more optimal stress-bearing units than the central vowel in Central Paiwan. On the other hand, though Wolff (1993) has argued PAN *t changed to an affricate under certain accentual conditions of the root, the interaction between stress and consonants was not found in the current study.

To sum up, penult is the most prominent position for Central Paiwan stress, but the right edge of a prosodic word becomes the optimal position for stress among equal prominent vowels in the quality-sensitive stress system.

2.5.3 Stress Patterns in Northern and Southern Paiwan

Stress in Northern and Southern Paiwan differs from that in Central Paiwan in its not seeking out the most prominent vowel. In other words, stress patterns in Northern and Southern Paiwan are quality-insensitive. Penultimate stress is the typical pattern in Northern and Central Paiwan, while monosyllabic roots also bear stress when it occurs at the rightmost position in a prosodic word. The distribution of Northern and Southern Paiwan stress is shown in (53). Due to the consonantal phoneme differences between Northern and Southern Paiwan, data presented in (53) were drawn from Southern Paiwan only. Note that some Northern Paiwan speakers who have frequent contact with Central Paiwan speakers may acquire or learn a quality-sensitive stress. Again, in sequences with roots and prefixes or infixes, the single bracket '[' indicates the left edge of a prosodic word.

(53) a. When a monosyllabic root is the rightmost syllable of a Paiwan word, stress falls on the nucleus of the syllable, regardless of the number of prefixes or infixes

Southern Paiwan Word	Stress	Gloss
va	vá	'lung'
puq	púq	'limestone'
ŋat	ŋát	'grass (for mat)'
$\text{pu}_{\text{prefix}}$-[pan	pupán	'to bait'
$\text{ma}_{\text{prefix}}$-$\text{pə}_{\text{prefix}}$-[tad	mapətád	'to dry (something)'
k-əm_{infix}-[ats	kəmáts	'to bite'

b. In a disyllabic or longer prosodic word, stress falls on the penult of the word, regardless of the number of prefixes, infixes or suffixes.

Southern Paiwan Word	Stress	Gloss
iku	íku	'tail'
ɭava	ɭáva	'flying squirrel'
qacuvi	qacúvi	'snake'
səma	sə́ma	'tongue'
ʎəɭət	ʎə́ɭət	'lip'

ku$_{preix}$-[vuvu	kuvúvu	‘my grandparents’
maʎə$_{prefix}$-[ɭaɖuq	maʎəɭáɖuq	‘too long’
s$_{prefix}$-əm$_{infix}$-u-[kava	səmukáva	‘to take off clothes’
kan-an$_{suffix}$	kánan	‘place where one eats’
ɟavats-an$_{suffix}$	ɟavátsan	‘muscle ache in legs’
in$_{prefix}$-[ituŋ -an$_{suffix}$	initúŋan	‘garment’
kaʎa$_{prefix}$-[quɟaʎ-an$_{suffix}$	kaʎaquɟáʎan	‘rainy season’
sa$_{prefix}$-ka$_{prefix}$-[ɭəva-ŋa$_{suffix}$	sakaɭəváŋa	‘be very happy’

Schwa does not affect the stress assignment in Northern and Southern Paiwan. Examples of contrastive stress between Central and Southern Paiwan are given in (54).

(54)	Word	Southern Stress	Central Stress	Gloss
	a. saɟəɭuŋ	saɟə́ɭuŋ	saɟəɭúŋ	‘heavy’
	b. kəɖəməɭ	kəɖə́məɭ	kəɖəmə́ɭ	‘to know’
	c. kəɖi	kə́ɖi	kəɖí	‘small’
	d. cəvəs	cə́vəs	cəvə́s	‘sugarcane’
	e. qasəɭu	qasə́ɭu	qasəɭú	‘pestle’
	f. ka-ɭəvə-ɭəv-an	kaɭəvəɭə́van	kaɭəvəɭəván	‘sky’
	g. s-əm-u-qəʎəv	səmuqə́ʎəv	səmuqəʎə́v	‘to open (a door)’

Penultimate position is the optimal parameter for stress assignment in Northern and Southern Paiwan. A schwa nucleus has nothing to do with the prominent position for stress. In such a quality-insensitive system, stress always seeks out the penult in a prosodic word. The stress patterns in Northern and

Southern Paiwan are summarized as follows: penultimate stress [… $\acute{\sigma}$ σ]$_{\text{Prwd}}$ and final stress subject to the rightmost monosyllabic root in a prosodic word.

The metrical algorithm set up for penultimate stress in Northern and Central Paiwan is presented in (55). It also applies to every possible prosodic word without schwa penult in Central Paiwan.

(55) Penultimate Stress in Paiwan Words

a. Foot Construction: Form syllabic trochee foot at the right edge

Degenerate feet are permitted in strong position

b. Word Layer Construction: End Rule Right

(x) (x)

(x .) (x .)

… σ $\acute{\sigma}$ σ # and # $\acute{\sigma}$ σ #

Words in (56) are generated by the rules shown in (55).

(56) a. (x) / (x) / σ / vát / 'husked rice'

b. (x) / (x .) / σ σ / pú ɖu / 'kidney'

c. (x) / (x .) / σ σ σ / pa ɭíŋ uʎ / 'surroundings'

d. (x) / (x .) / σ σ σ σ / va cu ʎá jan / 'iron'

e. (x) / (x .) / σ σ σ σ σ / ma ma zɑ ŋí ʎan / 'chieftain'

Stress in monosyllabic words was attested. Since initial degenerate feet in odd-syllable words such as (56c) and (56e) are not placed in strong position, they may be forbidden. Note that secondary stress was not attested in polysyllabic prosodic words in Northern and Southern Paiwan.

Stress in compounds or longer prosodic words also follow the principles of foot and word layer construction stated in (55). Examples are given in (57).

(57) a.
```
( x )       Word Layer
(x .)       Foot Layer
σ σ σ σ σ σ
ka na va ta ḽi ma
kanavat # a # ḽima
right-conjunction-hand
'right hand'
```

b.
```
( x )
(x .)
σ σ σ σ σ
ku ḓa ḽa va ḽi
kuḓaḽ # a # vaḽi
strong-conjunction-wind
'strong wind'
```

c.
```
( x )
(x .)
σ σ σ σ σ σ σ
ka ka vi tsa va va jan
kakavits # a # vavajan
grand-grand parents-conjunction-woman
'great grandmother'
```

Stress falls on the penult in numerals, both bases and complex numerals. The stress pattern of complex numerals is illustrated in (58). The parenthesis '[ ]' in (58) indicates a complex numeral boundary. A word boundary may be embedded in a complex numeral. In other words, a complex numeral may be composed of two or more base words.

(58) Stress in complex numerals

a. 21 (x)

(x) (x) (x) (x)

$[\acute{\sigma}\ \sigma]_{W1}$ $[\acute{\sigma}\ \sigma]_{W2}[\acute{\sigma}\ \sigma]_{W3}[\acute{\sigma}\ \sigma]_{W4}$

[[ɖusa]$_{W1}$#a#[puɭuq]$_{W2}$[saka]$_{W3}$[ita]$_{W4}$]$_{\text{complex numeral}}$

twenty plus one

Penultimate Stress: ɖusapuɭuqsakaíta ‘twenty-one’

b. 101 (x)

(x) (x) (x)

$[\acute{\sigma}\ \sigma]_{W1}$ $[\acute{\sigma}\ \sigma]_{W2}[\acute{\sigma}\ \sigma]_{W3}$

[[ta-idaj]$_{W1}$ [saka]$_{W2}$ [ita]$_{W3}$]$_{\text{complex numeral}}$

hundred plus one

Penultimate Stress: taidajsakaíta ‘one hundred and one’

c. 110 (x)

(x) (x) (x)

$[\acute{\sigma}\ \sigma]_{W1}$ $[\acute{\sigma}\ \sigma]_{W2}[\sigma\ \acute{\sigma}\ \sigma]_{W3}$

[[ta-idaj]$_{W1}$[saka]$_{W2}$[tapuɭuq]$_{W3}$]$_{\text{complex numeral}}$

hundred plus ten

Penultimate Stress: taidajsakatapúɭuq ‘one hundred and ten’

Examples in (58) have shown that stress patterns are predictable in complex numerals, which confirm the description of general stress patterns. None of the existing fieldwork reports have classified Paiwan stress units into prefixed, infixed and suffixed categories, though affixation affects the assignment of stress in a predictable way at word level[19]. In this study, roots and suffixes form a prosodic word, in which word stress in Paiwan falls on the penultimate syllable of the word. Prefixes and infixes are never stressed.

Earlier work on Proto-Austronesian (PAN) stress mainly focuses on the comparison and the reconstruction of the proto forms. Wolff (1993) has proposed that PAN roots had a stress contrast in the final two syllables of the root. According to him, there were two kinds of roots: those with a stressed penult and those with a stressed final syllable. By comparing stress patterns in Formosa and the Philippines, Wolff (1993) argues that in PAN the stress patterns fell on the penult of the root if it was long (or accented) and on the final syllable of the root if the penult was short (or unaccented). In the current study, it has been proved that vowel length is not phonemic in Paiwan, as no sufficient minimal pairs were attested. Vowel length does not affect the assignment of stress, and vowel quality, rather than vowel length, affects the assignment of stress in Central Paiwan. Vowel length may be a phonetic realization or a correlate of stress, not necessarily to be a prerequisite to trigger stress in Paiwan.

Although prefixes or infixes did not affect stress assignment in the cases of Paiwan, other types of affixation have been reported to affect PAN or Austronesian stress in earlier studies (Wolff 1993; Zorc 1993). There was the phenomenon of accent shift whereby the affixed form had the accentual pattern opposite to the pattern of the root, and some affixes dictate accent placement on derivations. Zorc (1993) classifies Austronesian stress and proposes that certain syntactic classes, such as pronouns, deictics, interrogatives, negatives, and numerals had accent on the final syllable. Furthermore, grammatical use of

[19] Gordon (2002) has proposed a computer-generated factorial typology of quantity-insensitive stress and has provided a list of languages with quantity-insensitive stress. Paiwan has been placed in the category of penult (of phrase) stress pattern, and the word stress pattern in Paiwan is not clear yet in his study.

accent is proposed for verbs (in the imperative), for names or kin nouns and stative adjectives all of which have intonation falling on the final syllable, whereas the root word probably had accent on the penult. Syntactic classes in Paiwan, as far as I have observed, do not affect the assignment of word stress in Central Piuma Paiwan.

2.6 Morphophonemics

This section deals with morphophonemic alternations in Paiwan. Ferrell (1982) has reported that allophonic variants of segmental phonemes are very limited in Paiwan and that the segments in question are the consonant /w/ and the schwa vowel /ə/. Nevertheless, in addition to these two segments mentioned in Ferrell's (1982) field report, other types of morphophonemic alternation were also found in the current project. In the following sections, unstressed vowel deletion, the alternation of vowels and affixes, the alternation between glide /w/ and fricative/v/, and reduplication are elaborated and exemplified.

2.6.1 Unstressed Vowel Deletion

Vowel deletion occurs in pre-stressed (unstressed) schwa syllables, in fast speech or natural discourse. It is an alternation in the informant's speech. As we have seen that stress in Paiwan usually falls on the penultimate or the final syllable of a prosodic word, the weak schwa preceding the main stress become the trough position for elision. On the contrary, other peripheral vowels are not deleted in the same position. The distribution of vowel deletion has a bearing on the occurrence of stress, the sonority of vowels, and the position in words. Stressed and sonorant vowels are the peak prominences, whereas unstressed and weak vowels are the troughs. Unstressed schwa nuclei in word-initial position are retained, while the ones in word-medial position are deleted. A few examples of elision alternation (59a-e) and the comparison data (59f-h) drawn from Central Paiwan are shown as follows.

(59)	Paiwan Morphemes	Alternation	Gloss
a.	/k-in-ə̲sa/	[kinə̲sá]~ **[kinsá]**	'cooked food'
b.	/ts-əm-ə̲ɭaɭaq/	[tsəmə̲ɭáɭaq]~**[tsəmɭáɭaq]**	'thunderclap'
c.	/t-əm-ə̲kəɭ/	[təmə̲kə́ɭ]~**[təŋkə́ɭ]**	'to drink'
d.	/pa-pə̲-tad/	[papə̲tád]~**[paptád]**	'to dry something'
e.	/t-in-ə̲kaz-an/	[tinə̲kázan]~**[tiŋkázan]**	'beehive'
	Paiwan Morphemes	Surface Forms	Gloss
f.	/t-ə̲m-ukuʎ/	[tsəmúkuʎ]	'to precede'
g.	/ma-pa̲-paŋuɭ/	[mapapáŋuɭ]	'to beat each other'
h.	/ʎa-ʎi̲suk-an/	[ʎaʎisúkan]	'drawer'

Schwa is in the form of **/k-in-ə̲sa/**, as shown in (59a), because the root of the word is **kə̲sa** 'food'. Schwa is produced in the root **kə̲sa** 'food' but may not be produced in the word **k-in-ə̲sá** 'cooked food'. Similarly, schwa is part of the root in the words (59b, c, e) and part of the infix morpheme in the words (59d, f). Among the data examined, unstressed vowel deletion occurs only in syllables with a schwa nucleus preceding main stress but not elsewhere, in word-medial position but not elsewhere. A word-medial schwa is deleted before a stressed syllable, which will result in consonantal clusters within a prosodic word. Word-medial schwa deletion and word-medial schwa are in free variation preceding main stress in natural discourse.

As we have noted that schwa affects the assignment of stress in Central Paiwan, the weak schwa has been reported to be the optimal vowel for syllable trough, i.e., an unstressed slot within a prosodic word. The weak quality of schwa is phonetically based. Schwa may represent a neutral tongue position or an overall average of the vowel inventory (Browman & Goldstein 1992), and it has been proposed that schwa is best modeled as a non-target vowel in Dutch (Van Bergem 1994). From coarticulation perspective, the tendency for the mid-point of the vowel /ə/ to be influenced in any consistent way by the place of a preceding consonant is quite weak (Ladefoged & Maddieson 1996). The segment of schwa has been attested in the other Formosan languages such as Amis, Puyuma, Rukai, and Saisiyat. Given that schwa is part of the root in the prosodic words, it is proposed here that schwa is a segmental phoneme in Paiwan. The deletion of the schwa segment is due to its position in words and the distribution of word stress.

2.6.2 Alternation of Vowels and Affixes

As we have seen in section 2.6.1, an unstressed schwa nucleus may be deleted and results in syllable loss. On the other hand, an unstressed vowel may alternate with a schwa. The alternation between schwas and unstressed high vowels occurs not only in fast speech but also in slow elicitation. Some examples are given in (60). The alternation between the low vowel **a** and the weak schwa, however, was not attested, in stressed or unstressed position.

(60) Alternation between schwas and unstressed high vowels

	Schwa Alternation	Gloss
a.	[gád**u**] ~ [gád**ə**]	'mountain'
b.	[bənur**u**s] ~ [bənúr**ə**s]	'to spurt'
c.	[ts**u**qəʎək] ~ [ts**ə**qə́ʎək]	'bone'
d.	[q**u**rəpus] ~ [q**ə**rəpús]	'cloud'

e. [c**i**gəraw] ~ [c**ə**gəráv] 'larynx'

Shown in (60), the alternation between high vowels **u** and **i** and schwa occurs in unstressed position. The absence of the low vowel in this type of alternation has something to do with the hierarchy of vowel sonority. As the low vowel is the most sonorant vowel, it has been an opposite extreme from the schwa. High vowels, on the other hand, are less sonorant and have become better candidates for the schwa alternation.

Another type of Focus morpheme alternation, which has been reported in Ferrell's (1982) dictionary, was also found in the current study. In Paiwan, the morpheme for Agent Focus is VC-infix /*-əm-*/. Agent Focus infixes attach to roots or stems immediately after the initial consonant of the stem morpheme. The distribution of the Agent Focus forms is shown in (61).

(61)

	Morphemes	Surface Forms	Gloss
a.	/q-ə<u>m</u>-əɭuz/	[qə<u>m</u>əɭuz]	'to support'
b.	/k-ə<u>m</u>-upu/	[kə<u>m</u>upu]	'to pure into cup'
c.	/t-ə<u>m</u>-əga/	[tə<u>m</u>əga]	'to waken'
d.	/ɟ-ə<u>m</u>-avis/	[ɟə<u>m</u>avis]	'to grip'
e.	/s-ə<u>m</u>-aŋəɭ/	[sə<u>m</u>aŋəɭ]	'to use pillow'
f.	/ɭ-ə<u>m</u>-ivu/	[ɭə<u>m</u>ivu]	'to invade'
g.	/p-ə<u>m</u>-aɭisi/	[pə<u>**n**</u>aɭisi]	'to disobey taboo'
h.	/m-ə<u>m</u>-atsa/	[mə<u>**n**</u>atsa]	'to see with eyes'
i.	/v-ə<u>m</u>-aɭa/	[və<u>**n**</u>aɭa]	'to be healthy'
j.	/b-ə<u>m</u>-əruŋ/	[bə<u>**n**</u>əruŋ]	'to make a hole'

Two surface forms of the Agent Focus morpheme have been observed in the infixation: **-əm-** and **-ən-**. The form **-əm-** occurs after DORSAL and

CORONAL initial consonants, as shown in (61a-f), whereas **-ən-** occurs after LABIAL initial consonants but not elsewhere, as shown in (61g-j). The observable fact indicates the infix form **-ən-** alternates with **-əm-** after a LABIAL initial consonant of the stem morpheme. The two Agent Focus forms **-əm-** and **-ən-** are in complementary distribution, as the former does not occur after a LABIAL but the latter occurs after a LABIAL initial consonant only.

2.6.3 Alternation between Glide /w/ and Fricative/v/

Quite a few alternations between glides and fricatives or liquids in Formosan languages have been reported in Li's (1974) study, and he has argued that the morphophonemic alternations have a bearing on the controversial issue of the phonetic value of two PAN phonemes.

In Paiwan, only the alternation between glides and fricatives was attested. More specifically, the alternation between /w/ and /v/ was found in all the Paiwan villages investigated in the current study. Earlier fieldwork reports on Paiwan (Ferrell 1982; Chang 2000) have agreed with the derivation from /w/ to /v/, but not from /v/ to /w/. Moreover, the alternation has been described as a free alternation in their reports. It has been found that in Central Piuma Paiwan, however, the phoneme /v/ consistently dominates the syllable coda slot in all the cases examined, in word-final position, across morpheme and word boundaries, in the same phonological environments. On the other hand, the glide **w** in Southern Paiwan does not seem to alternate with the fricative in word-final position or across word boundaries, but it consistently alternates with the fricative **v** in suffixed words.

As we have seen in section 2.3.1, there are no restrictions on the distribution of the fricative /v/ in Paiwan, while the glide /w/ does not occur before a schwa. The distribution of the glide /w/ is more restricted, though it also occurs word-medially and word-finally. There are many cases of /w/ and /v/ morphophonemic alternation in Paiwan. Some examples are illustrated in (62). In these examples, the symbol '#' indicates a lexical word boundary; whereas '-' indicates a morpheme boundary.

(62)	GLOSS	Central Piuma Paiwan	Southern Paiwan
a.	'drunk'	mapuḷav	mapuḷaw
	'I'm drunk.'	mapuḷav#aŋa#kən	mapuḷaw#aŋa#kən
b.	'thirsty'	mapusav	mapusaw
	'I'm thirsty.'	mapusav#aŋa# akən	mapusaw#aŋa#akən
c.	'many'	ḷiav	ḷiaw
	'many things'	ḷiav#a#nəmaŋa	ḷiaw#a#nəmaŋa
d.	'to wash'	səmənav	səmənaw
	'to wash bowls'	səmənav#ta#capaq	səmənaw#ta#capaq
e.	'fish'	tsiqav	tsiqaw
	'big fish'	tsiqav#a#qatsa	tsiqaw#a#qatsa
	'container for fish'	pu-tsiqav-an	pu-tsiqa**v**-an
f.	'tree'	kasiv	kasiw
	'tree!' (Imperative)	kasiv-u	kasi**v**-u
g.	'roof'	qaʎiv	qaʎiw
	'ceiling'	q-in-aʎiv-an	q-in-aʎi**v**-an
h.	'soup'	siav	siaw
	'soup-bowl'	pu-siav-an	pu-sia**v**-an
i.	'high'	vavav	vavaw
	'highest'	vava-vavav-an	vava-vava**v**-an

Shown in (62a-d), glide coda /w/ has become fricative /v/ in Central Paiwan. Fricative /v/ occurs in word-final position after /i/and /a/, whereas glide /w/ does not occur word-finally. The labial glide becomes the labial fricative with or without suffixation in Central Paiwan. Examples in (62e) show the boundary contrast between lexical words and morphemes. Examples in (62e-i) show the alternation between /w/ and /v/ in Southern Paiwan. The alternation between /w/ and /v/ occurs within a prosodic word, across a morpheme boundary but not across a lexical word boundary in Southern Paiwan. In Northern Paiwan, on the other hand, either /w/ or /v/ coda is acceptable in the roots or stems, but /v/ is the only legitimate segment after suffixation across a morpheme boundary within a prosodic word. The sounds [w] and [v] are allophones in free variation when they follow /i/ or /a/ at word-final position in Northern Paiwan but in complementary distribution in Central Paiwan. Yet, the alternation between [w] and [v] at word-final position was not attested in Southern Paiwan. Rather, only the alternation between /w/ and /v/ within a prosodic word was attested in Southern Paiwan.

On the other hand, the alternation between /w/ and /v/ must occur in suffixed forms in Northern and Southern Paiwan. Note that the alternation occurs when the glide is the second member of the diphthong only. The labial glide becomes the labial fricative when it follows /i/ or /a/ at stem-final position followed by suffix morphemes beginning with a vowel within a prosodic word. The alternation rule is stated in (63).

(63) Paiwan Morphophonemic Alternation Rule

$$\begin{bmatrix} -\text{cons} \\ +\text{son} \\ +\text{labial} \\ +\text{cont} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cons} \\ -\text{son} \end{bmatrix} / \ \text{V}\_\_\_\_]_{\text{stem}} \text{-V}\ldots]_{\text{suffix}}]_{\text{Prwd}}$$

where '-' is a morpheme boundary

Li (1974) has examined the direction of this type of alternation, drawn from the Rukai language data and the evidence in other languages as well. He argues that the solution of lenition from a full consonant to a glide is rejected, because many Paiwan words end with a phoneme /v/ in the same phonological environments. From the perspective of the reconstruction of PAN, he also argues that reflexes of Formosan and Philippine languages for PAN *y and *w in the word-final position are mostly *y* and *w* respectively, while in the non-final positions their reflexes vary from approximants to fricatives or liquids. Li (1974) has concluded in his study that the simplest solution for the alternation between glides and fricatives or liquids is to treat glide approximants as the proto-phonemes, and derive historically all the various fricatives and liquids in the daughter languages. The Formosan languages under Li's (1974) examination have quite parallel developments for the two proto-phonemes, PAN *y and *w.

2.6.4 Reduplication

Paiwan has at least two distinct types of reduplication: root reduplication and Ca-reduplication. Root reduplication can be divided into full reduplication and partial reduplication. Ca-reduplication copies the first consonant of the base and adds the vowel segment /a/ to the reduplicant. It has been reported in earlier studies (Chang 2000; Tseng 2003) that root reduplication signifies intensification, continuous aspect, and plurality, whereas Ca-reduplication is either a nominalization or a reciprocal marker. Examples in (64) and (65) respectively illustrate full root reduplication and partial reduplication, whereas Ca-reduplication examples are given in (66). Among the cases examined, the majority of the reduplicants copy the form of CV or CVCV syllable from the bases. The data collected in Central Paiwan are the bases for this section.

(64) Full Root Reduplication in Paiwan: full root reduplication usually occurs in nouns or stative verbs. The bases in this type of reduplication are in the shape of CVCV, and they are either nouns or stative verbs. Full reduplication signifies intensification and plurality here. Examples are given as follows.

Root	Gloss	Reduplication	Gloss
a. kəɖi	'small'	kəɖi-kəɖí	'very small'
b. kuɭa	'leg'	kuɭa-kúɭa	'animal's leg'
c. buqu	'ankle'	buqu-búqu	'knuckles'
d. gadu	'mountain'	gadu-gádu	'mountain peak'
e. gidi	'flank'	gidi-gídi	'side'

(65) Partial Root Reduplication in Paiwan: reduplicants (Red) usually do not copy the final coda of the bases.

BASE	Gloss	Reduplication	Gloss
a. tsəməɭ	'plants'	tsə$_{Red}$-tsəmə́ɭ	'grass field'
b. ɖukuŋ	'a bend'	ɖuku $_{Red}$-ɖúkuŋ	'a hooked knife'
c. -ŋuaq[20]	'good'	ŋua$_{Red}$-ŋúaq	'full moon'
d. vukid	'forest'	vuki$_{Red}$-vúkid	'eyebrow'
e. vudas	'sand'	vuda$_{Red}$-vúdas	'a stretch of sand'

[20] The word *naŋuaq* means good, and the root *-ŋuaq* is usually preceded by a prefix.

f. daŋas	‘top rim’	daŋa$_{Red}$-dáŋas	‘edge’
g. kasiv	‘tree’	kasi$_{Red}$-kásiv	‘woodlands’
h. kuaŋ	‘firearm’	kua$_{Red}$ -kúaŋ	‘pistol’
i. kaɖaɖi	‘a rag’	kaɖaɖi-ɖáɖi	‘small bee’
j. kaɖaŋu	‘small fish basket’	kaɖaŋu-ɖáŋu	‘very small fish basket’

(66) Ca-Reduplication in Paiwan: reduplicants copy the first consonant of the base and adds the vowel segment /a/ to the reduplicants. In the following examples, reduplicants are underlined.

Lexicon	Gloss	Reduplication	Gloss
a. pa-qəʎiŋ	‘be on one side of’	pa-qa-qəʎíŋ	‘to reconcile’
b. ɟəɭi	‘to laugh’	pa-ɟa-ɟəɭi-ɟəɭí	‘to laugh together’
c. ma-guɭa	‘to be interrupted’	ma-ga-gúɭa	‘to break off marriage’
d. ɭisi	‘bride-price’	ma-ɭa-ɭisi-ɭísi	‘wedding’
e. paŋuɭ	‘a stick’	ma-pa-páŋuɭ	‘to beat each other with sticks’
f. ma-ɟaɭu	‘to become placated’	ma-ɟa-ɟáɭu	‘to become friendly with each other’

The only consistent pattern found in the examples above is the place for stress assignment, either at penult or at the ultima, depending on the occurrence of the schwa penult and the number of the syllables in the bases. The prosodic patterns found Paiwan in reduplication indicate stress is usually retained in the bases after reduplication.

It is proposed here that the syllable structure of a reduplicant has a lot to do with partial reduplication. When the base has a *–CVC* syllable at its final position, reduplicants in partial reduplication copy the –*CV* shape from the base and prefix it to the base. This indicates that CVC syllable in word-medial position is more restricted than in word-final position. Prefixing reduplication applies to most of the cases in (65), as disyllabic or monosyllabic reduplicants usually copy CV or CVCV sequences from the base and attach to the initial position of the reduplicated words. Evidence for infixing reduplication comes from the CVCV reduplicants in the same phonological environments. Reduplicants infix into a base, as shown in the word *ʎa-macə-macə́k-an*$_{suffix}$ 'many leeches' (Base: *ʎamacək* 'mountain leech'), and the initial CV syllable of the base becomes a prefix.

Nominalization suffixes and reduplicated prefixes may attach to the bases in full or partial reduplication. Examples are shown in (67), in which reduplicants are underlined.

(67) Prefixing Reduplication with Suffixation

	Lexicon	Gloss	Reduplication	Gloss
a.	ɟui	'thorn'	ɟui-ɟuí-an$_{suffix}$	'briar patch'
b.	guris	'spot'	guri-gurís-an$_{suffix}$	'a spotted animals'
c.	ɭikuz	'behind'	ɭiku-ɭikúz-an$_{suffix}$	'the most back'
d.	ɭaɖuq	'long'	ɭa-ɭaɖúq-an$_{suffix}$	'length'
e.	gicgic	'to cut into pieces'	ga-gicgíc-an$_{suffix}$	'something to be cut into small pieces'

There are also some cases of complex infixing reduplication, in which reduplicants are embedded in the sequences with preceding prefixes and following roots. Some examples are illustrated in (68).

(68) Infixing Reduplication

Lexicon	Gloss	Reduplication	Gloss
a. ki-ʎivak	'to love'	marə$_{prefix}$-ki-ʎiva$_{Red}$-ʎívak	'loving one another'
b. pa-tsun	'to see'	pa-pa$_{prefix}$-tsu$_{Red}$-tsún	'to show to people'
c. kuya	'a defect'	na$_{prefix}$-kuya$_{Red}$-kúya	'be defective'
d. ma-kuda	'how is it'	ma$_{prefix}$-kuda$_{Red}$-kúda	'how much'
e. sə-kuɭuŋ	'ugly'	na$_{prefix}$-sə-kuɭu$_{Red}$-kúɭuŋ	'somewhat ugly'
f. ma-ʎavar	'a meeting'	ma$_{prefix}$-ʎava$_{Red}$-ʎávar	'to converse'
g. ʎukay	'a swing'	ma$_{prefix}$-ʎuka$_{Red}$-ʎúkay	'be swinging'

Given that stress is fixed to the base of the reduplicated words, the assignment of stress in Paiwan reduplication obeys the general principles of word stress. The syllable structure of Paiwan reduplicants is usually monosyllabic CV or disyllabic CVCV, which indicates the subsets of CV or CVCV syllables are generally allowed in the Paiwan language.

To sum up, reduplication in Paiwan preserves full phonological identity of the base, as it copies the syllable structure of the bases and the restriction on the syllable types. Reduplication does not affect the assignment of stress in bases and reduplicated words, in quality-sensitive or quality-insensitive stress system.

2.7 The Phonological Phrase

The phonological phrase provides the domain for secondary stress in Paiwan. A string of sequences has primary and secondary stress in a phonological phrase. The phonological phrase is defined as the minimal string within which word stresses are stronger than the other. It is possible to pause briefly after a phonological phrase. A phonological phrase may consist of at least one construction marker or ligature, which connects two independent words or more in Paiwan. The combination of two or more words forms a grammatical phrase. The rightmost prosodic word in a phonological phrase gets the primary stress. Secondary stress occurs in the remaining prosodic words or syllables. There are utterances consisting of just one prosodic word. Primary stress was attested in the penult, and secondary stress was attested in the remaining syllables of the prosodic word. I have observed that some word stresses are stronger than others within an utterance, but I have not figured out the distribution of these stronger stresses. The phonological phrase is largely coincidental with the clause as a syntactic unit when it occurs in fluent speech. Yet, secondary stress does not occur in word construction. It occurs in a phonological phrase only, which is the motivation for the proposal of the phonological phrase of Paiwan here.

All content words may be stressed, but the rightmost word in a phonological phrase gets the main stress. Only content words (CW) are eligible to receive primary or secondary stress within a phonological phrasal domain, while functional words (FW) such as ligatures or construction markers never receive stress. Two nouns, for instances, can form a phonological phrase within which the penultimate nucleus of the rightmost content word gets the primary stress. Examples of phonological phrases (PPhs) are given in (69). Data presented in this section were collected from Central Paiwan. Secondary stress was attested in the penultimate syllable of the remaining content words in the phonological phrases.

(69) a. [(qatsaqàtsa)$_{\text{CW}}$ a (**riḷaríḷaj**)$_{\text{CW}}$]$_{\text{PPh}}$

tall Lig thin

'tall and thin'

b. [(qatsqàtsa)CW ʎakua (**maríɭaj**)CW]PPh

tall but thin

'tall but thin'

c. [(riɭarìɭaj)CW a (**qatsqátsa**)CW]PPh

thin Lig tall

'thin and tall'

d. [[(riɭarìɭaj)CW a (qatsqàtsa)CW]PPh a (**timáɟu**)CW]PPh

thin Lig tall Lig he

'He is tall and thin.'

Shown in (69a-c), two adjectives form a phrase, and the second adjective receives the primary stress, due to its position within the phrase. On the other hand, the placement of the subject after the adjective phrase, as shown in (69d), results in an embedded phonological phrase. The secondary stress occurs in every content word of the embedded phonological phrase. The penult of the rightmost content word in the outmost phonological phrase receives the primary stress. Multiple or embedded phonological phrases do not change the assignment of phrasal stress, as primary stress falls on the penultimate nucleus of rightmost content word in the phonological phrases.

Penultimate dominant pattern in phrasal stress is also found in verb phrases, as shown in (70).

(70) a. [(təməkə̀ɭ)CW tua (**váva**)CW]PPh

drink Acc wine

'drink wine'

b. [[(təməkə̀ɭ)CW tua (vàva)CW]PPh ti **káma**]PPh

drink Acc wine Nom father

'Father drinks wine.'

Examples in (71) show the assignment of stress in noun phrases and multiple phrases. A brief pause indicated by parentheses shown in (71c) separates longer sequences into two independent phonological phrases, and the primary stress falls on the penultimate syllable of each phonological phrase.

(71) a. qatsqàtsa a riɭarìɭaj na **vavájan**

tall Lig thin Gen woman

'a tall and thin woman'

b. qatsqàtsa a riɭarìɭaj a səpac-a-pùɭuq a tsàviʎ na **vavájan**

tall Lig thin Lig forty Lig year Gen woman

'a forty-year-old tall and thin woman'

c. cəŋəɭaj-ákən [pause] ta qatsqatsa a riɭaríɭaj [pause] a səpac-a-puɭuq a

like –1S.Nom Acc tall Lig thin Lig forty Lig

tsaviʎ na **vavájan** [pause] ʎakua ini ka cəŋəɭaj timaɟu **tianuákən**

year Gen woman but negation like he I

'I like the forty-year-old tall and thin woman, but she doesn't like me.'

d. nasaŋwaq ka **ku-áʎak** [pause] ini ka **na-d-əm-iŋəséɭ**

pretty my-child negation horrid-looking

'I have a beautiful daughter, not an ugly one.

Inside the domain of a phonological phrase, the penult of the rightmost content word becomes the most prominent position for the primary phrasal stress. In the word **na-d-əm-iŋəséɭ** 'horrid-looking', as shown in (71d), the nucleus of the penult is a schwa; stress falls on the final syllable of the word. Central Paiwan has a final stress subject to schwa penult. The right edge of the word is the most prominent position for stress when the penultimate nucleus is also a schwa. It is apparent that phrasal stress patterns also follow the restrictions and principles of word stress. A phonological phrase is the domain for phrasal stress, and both main stress and secondary stress occur in a phonological phrase.

2.8 Orthography and Transcription

Orthography has become an issue since the political release in 1987. As we have seen in section 2.3, consonantal phonemes in different Paiwan regions may vary. Whether dialectal phonemes or morphophonemic alternations should be included in the written system or transcription, and whether or not a united orthography or an identical written system should be established have aroused great attention among the Paiwan speakers. Thus far, there is no standard orthography for the Paiwan language, and the majority of Paiwan speakers under the age of fifty are literate in Chinese characters. Quite a large amount of the churches within Paiwan villages have adopted a Romanized conventional written system, but not a phonetic orthography, to popularize Bibles in Paiwan. Earlier studies on Paiwan such as Ho (1977, 1978) and Ferrell (1982) have adopted different conventional transcription systems, in which palatal and retroflex series of phonemes are not clearly represented. Unclear transcription and various phonemic representations may cause misinterpretation of later fieldworkers. The controversial phonemes in Ho's (1977, 1978) and Ferrell's (1982) transcription and International Phonetic Alphabets (IPA) are given in (72).

(72) The Comparison of Transcription Symbols

Ho (1977; 1978)	Ferrell (1982)	IPA
ḍ	ḍ	ɖ
ḷ	l	ɭ

c	ts	ts
t́	tj	c
d́	dj	ɟ
ĺ	ł	ʎ
ŋ	ng	ŋ
ə	e	ə

Shown in (72), phonemes /c/ and /ɟ/ are represented as /tj/ and /dj/ in Ferrell's (1982) dictionary, which may cause the confusion of CC cluster within syllables. The symbol 'c' represents the phoneme /ts/ not only in Ho's (1978) study, but also in governmental teaching materials, and recent work such as Chang's (2000) and Tseng's (2003) studies. Symbol 'c' may be considered as a palatal stop by the other fieldworkers and international phoneticians, if it is not specified. Although the regions Ho (1977) and Ferrell (1982) have worked are different[21], as they belong to the Central and Southern Paiwan domains in the current study, the identical segment /ts/ was transcribed as /c/ by Ho (1977) but as /ts/ by Ferrell (1982). The real pronunciation of the segment /ts/ is [ts], not [c], in Northern, Central, and Southern Paiwan villages.

Council of Indigenous Peoples, Executive Yuan of Taiwan, has published a written system (2005) for the Paiwan aborigines, as shown in Table 2.10 and Table 2.11. The symbols include the varieties attested in Northern, Central, and Southern Paiwan, as well as the ones in Eastern Paiwan. It has been suggested

[21] Kulalao dialect is the base for Ferrell's (1982) dictionary. According to Ferrell (1982), Kulalao dialect is located in the geographically central location of the Paiwan territory, and it appears to preserve clearly certain phonemic distinctions which have been merged in some other dialect. Ho (1977) has worked on Butanglu dialect of Paiwan, which is located in the Southern Pingtung County, geographically southern part of the Paiwan territory.

that the written system is conventional and will be adopted by all the Paiwan aborigines in the near future.

Table 2.10: Consonants of the Paiwan Written System

Place and Manner	Written Symbol (2005)	IPA
Bilabial Voiceless Stop	p	p
Bilabial Voiced Stop	b	b
Alveolar Voiceless Stop	t	t
Alveolar Voiced Stop	d	d
Retroflex Voiced Stop	dr	ɖ
Palatal Voiceless Stop	tj	c
Palatal Voiced Stop	dj	ɟ
Velar Voiceless Stop	k	k
Velar Voiced Stop	g	g
Uvular Voiceless Stop	q	q
Glottal Voiceless Stop	’	ʔ
Alveolar Voiceless Affricate	c	ts
Labiodental Voiced Fricative	v	v
Alveolar Voiceless Fricative	s	s
Alveolar Voiced Fricative	z	z
Glottal Voiceless Fricative	h	h
Bilabial Nasal	m	m
Alveolar Nasal	n	n
Velar Nasal	ng	ŋ
Alveolar Trill	r	r
Retroflex Lateral	l	ɭ
Palatal Lateral	lj	ʎ
Bilabial Semi-Vowel	w	w
Palatal Semi-Vowel	y	j
Total	24	24

Table 2.11: Vowels of the Paiwan Written System

Vowels	Written Symbol	IPA
High Front Vowel	i	i
High Back Vowel	u	u
Central Vowel	e	ə

Central Low Vowel	a	a
Total	4	4

On the other hand, governmental teaching materials often mistake a syllabic representation as a consonant, such as /tji/ and /si/. Hua and Zeitoun (2005) have pointed out that there are few records of the Formosan languages, and the few records that do exist will have to serve as the basis for further research. Thus, it is important that fieldworkers pay attention to accurate transcription, and accurate transcription is fundamental for any phonetic and phonological studies. In this study, IPA symbols have been adopted for transcription. The IPA symbols are used here and will be used throughout the dissertation.

CHAPTER THREE
PHONETIC VARIATION OF PAIWAN

This chapter provides a detailed phonetic description and empirical evidence for the phonetic varieties of Paiwan. As we have noted that Northern, Central and Southern Paiwan have different numbers of consonantal segments, some distinctive features may be attested within a single marginal region but not another. Some marginal regions simply cannot be classified into Northern, Central or Southern Paiwan, and some sound patterns may spread randomly. Ho (1978) has pointed out the difficulties in mapping the phonemic distribution of /c/ and /ɟ/ in geographical terms, but at the same time, the factors of synchronic phonological and phonetic varieties have been ignored in his study. Ferrell (1982) have noted that for centuries the Paiwan aborigines have been in contact with speakers of the other Austronesian languages such as Rukai and Puyuma to the north. He also noted that although Paiwan dialect divisions involve notably differences in realizations of the voiceless velar, uvular and glottal stop, and of trill and retroflex, Paiwan speakers from all areas communicate among themselves easily, despite regional variations in pronunciation. Nevertheless, the situation described in Ferrell's (1982) report has been changing rapidly, especially in the innovative Paiwan villages. Nowadays the contact in the Paiwan area is not only with the other Austronesian languages but also with Chinese or Taiwanese dialects, and younger generations do not speak the Paiwan language fluently and frequently. For those who are under the age of fifty and speak the Paiwan language fluently cannot understand occasionally the Paiwan speakers from the other villages. Not only the diverse lexicon but also the pronunciation has caused the communication barrier among the Paiwan speakers. The various pronunciations have been found in some recent intertribal families in which the couples are from different regions of the Paiwan territory and currently living in the modern cities. The communication language in these intertribal families is Mandarin, if the couples are not able to communicate with each other in Paiwan. Sound change has occurred, and younger Paiwan aborigines have been continuously producing phonetic varieties. Given that some sound patterns are rather widely distributed while others are rather restricted, and that some phonetic varieties in one region have equivalences or correspondences in another, the description of phonetic variation has become a necessity for a comprehensive field report of Paiwan.

Anderson (1985) has made clear that the phonetic representation is more abstract than a physical record of an utterance. Keating (1985) also points out that sound patterns can operate as abstract phonological rules, and she proposes three candidates for inclusion in the set of phonetic universals—intrinsic vowel duration[1], extrinsic vowel duration[2], and voicing time. The three assumed phonetic universals are not automatic results of speech physiology. They are at least in part determined by language-specific rules. In the case of voicing time, for instance, none of the patterns found is universal, and the patterns are a key to the relation among physical motivation, phonetic rules, and the grammar. Later studies on sound patterns (Keating 1990; Pierrehumbert 1990; Cho & Ladefoged, 1999) have also revealed that there are language specific phonetic rules which must be part of the grammar of each language. Accordingly, certain categorical

[1] In most languages, low vowels such as [a] are longer than high vowels such as [i]. Though the similar pattern of intrinsic vowel durations is not a necessary one, general principles such as economy of effort and motor control must be more subtle than absolute mechanical constraints. Physical factors influence vowel duration, but they do not control it. For more discussion, see Keating (1985). pp.118-120.

[2] General findings show that vowels are shorter before voiceless obstruents than before voiced obstruents or sonorants. Keating (1985) illustrates that a supposed phonetic universal is not in fact universally attested. Extrinsic vowel-duration patterning cannot be automatic or predictable.

phonetic patterns associated with feature values and segmental structure in Paiwan should be accounted for here. The categorical phonetic representation could be the output of the phonology, or at least, part of the grammar of the Paiwan language.

Section 3.1 provides the acoustic description of Paiwan stop segments. Phonetic representations of Paiwan vowel segments are given in section 3.2. Intrinsic and extrinsic vowel durations of Paiwan are examined and discussed in section 3.3. An attempt is also made to figure out the phonetic correlates of Paiwan stress. Finally, section 3.4 deals with the issues on synchronic phonetic varieties and diachronic sound change. The data in the reconstruction of Proto-Paiwan are drawn from previous literature (cf. Ho, 1978) and the fieldwork in the current project.

3.1 Acoustic Description of Paiwan Stops

Paiwan has bilabial, alveolar, palatal, velar and uvular stops. Voice Onset time (VOT) measures were taken for the voiceless non-aspirated stops. The purpose of the investigation of VOTs is to support the earlier phonemic transcription and the variation among the dialects. The VOT of stops in word-initial position was examined in an effort to see how VOT varies according to place of articulation and the different dialects (Northern, Central and Southern Paiwan). VOT has been known to vary with different place of articulation, and it has been found that the further back the closure, the longer the VOT (Fischer-Jørgensen 1954; Peterson & Lehiste, 1960), and that the more extended the contact area, the longer the VOT (Stevens, Keyser & Kawasaki, 1986). The relative size of the supra-glottal cavity behind the point of constriction has been suggested to contribute to VOT differences (Maddieson 1997a). In general, stops with a more extended articulatory contact have a longer VOT. The differences of VOT have become parameters for the distinction of voiceless stops in laboratories and fields.

The Voice Onset Times (VOTs) of Paiwan stop consonants were investigated by reference to the words in Table 3.1. Central and Southern Paiwan data include all the forms in Table 3.1, whereas words with palatal and uvular stops were not attested in Northern Paiwan. Among the data collected from Northern Paiwan, only words same as the Central and Southern Paiwan forms were measured, i.e., words with labial, alveolar and velar stops. Words were recorded in isolation form, one repetition per item.

Table 3.1: Words for VOT investigation in Paiwan stop consonants[3]

CV	Paiwan	Gloss	Paiwan	Gloss	Paiwan	Gloss
pi	piku	'elbow'	pitsuḽ	'bamboo joint'	piqaj	'tumor'
pu	puk	'tree bean'	puq	'limestone'	pudək	'navel'
pa	padaj	'rice plant'	pana	'river'	paruk	'betel kernel'
pə	pənaŋuḽ	'to hit (with stick)'	pətsqi	'to defecate'	pəntəq	'to break'
ti	tima	'who'	tikaj	'maggot'	tidiv	'front tooth'
tu	tutsu	'now'	tutu	'breast'	tuvuʎ	'plow'
ta	tatsu	'clothing louse'	tataqan	'grind-stone'	takəts	'pygmy deer'
tə	təquŋ	'horn'	təʎar	'light'	tənvəḽa	'to answer'

[3] The words in the table were collected in Central Piuma Paiwan. The segments /c/ and /q/ were not attested in Northern Paiwan, for /c/ and /q/ have become /t/ and /ʔ/ respectively in Northern Paiwan. The glottal stop /ʔ/ is usually invisible on the spectrographic displays, and it was therefore excluded from the examination.

ci	cigərav	‘larynx’	ciŋaŋaḓuj	‘lizard’	cikuraj	‘pheasant’
cu	curuvu	‘many (people)’	cuvu	‘sprout’	cuguʎ	‘tree name’
ca	cakit	‘hunting knife’	caguʎ	‘rock’	caʎitiw	‘waterfall’
cə	cəvus	‘sugarcane’	cəvəs	‘Zelkova tree’	cəvət	‘short apron’
ki	kinsa	‘cooked rice’	kina	‘mother’	kipkip	‘eyelashes’
ku	kutsu	‘head louse’	kuku	‘doggy’	kuka	‘chicken’
ka	kapaz	‘root’	kamuraw	‘pomelo’	kasiv	‘tree’
kə	kəḓi	‘small’	kəviŋ	‘scabies’	kəmuʎav	‘to roast’
qi	qiʎas	‘moon’	qipu	‘earth’	qiri	‘fish type’
qu	quɟaʎ	‘rain’	quzu	‘tendril’	quʎav	‘color’
qa	qaʎits	‘skin’	qavu	‘ashes’	qatia	‘salt’
qə	qətsap	‘chopsticks’	qərəpus	‘cloud’	qətim	‘tree juice’

There is a general tendency for VOT to be longer when the closure for a stop is articulated further back in the vocal tract (Fischer-Jørgensen 1954; Cho & Ladefoged, 1999; Taff et al. 2001). If VOT is due to the distance between the open end of the vocal tract and the source of the compression, the VOT for a velar stop will tend to be longer than that for a bilabial stop, and the VOT for a uvular stop will tend to be longer than that for a velar stop. In other words, the VOT for a Paiwan uvular stop will be the longest among the voiceless stop: uvular > velar > palatal > alveolar stop, given that the parameter of VOT is straightforward. Cho and Ladefoged (1999), however, further point out that the factors influencing

VOT varies from language to language. Although some differences in VOT may be determined by aerodynamic factors, others simply reflect the behavior associated with a particular language, as studies on VOT have revealed the inconsistent variation between the stops (Cho & Ladefoged, 1999; Taff et al. 2001).

The recorded data were sampled at 20,000 Hz using the Macquirer spectral analysis system. The interval between the onset of the release burst and the first glottal pulse was measured on simultaneous waveform and spectrographic displays. A total of 312 elicitation tokens (60 X 4 speakers, plus 36 X 2 speakers) from six Paiwan native speakers were measured. The data were statistically analyzed by T-tests and two-factor ANOVAs.

The results are summarized in Figure 3.1 and Figure 3.2. Northern Paiwan tokens were separated from Central and Southern tokens in the figures, due to the merger of voiceless stops in Northern Paiwan. The VOTs for labial stops tend to be shorter than the other two stops in Northern Paiwan, as shown in Figure 3.1. One-factor analyses of variance have revealed that the effect of place was significant ($F [2,69]=38.77$, $p<0.0001$). In *post hoc* analyses, the labial stops were distinct from alveolar and velar stops at $p<0.0001$, and there was significant VOT difference ($p<0.0001$) between alveolar and velar stops. No significant differences were found between the two speakers.

On the other hand, the VOTs for labial stops tend to be shorter than the other four stops in Central and Southern Paiwan, as shown in Figure 3.2. ANOVA analyses of variance of each dialect have revealed that the effect of place was significant (Central Paiwan: $F[4,115]=83.49$, $p<0.0001$; Southern Paiwan: $F[4,115]=88.24$, $p<0.0001$). In *post hoc* analyses, the labial stops were distinct from alveolar, palatal, velar and uvular stops at $p<0.0001$, and there was significant

VOT difference ($p<0.0001$) among alveolar, palatal and velar stops in Central and Southern Paiwan.

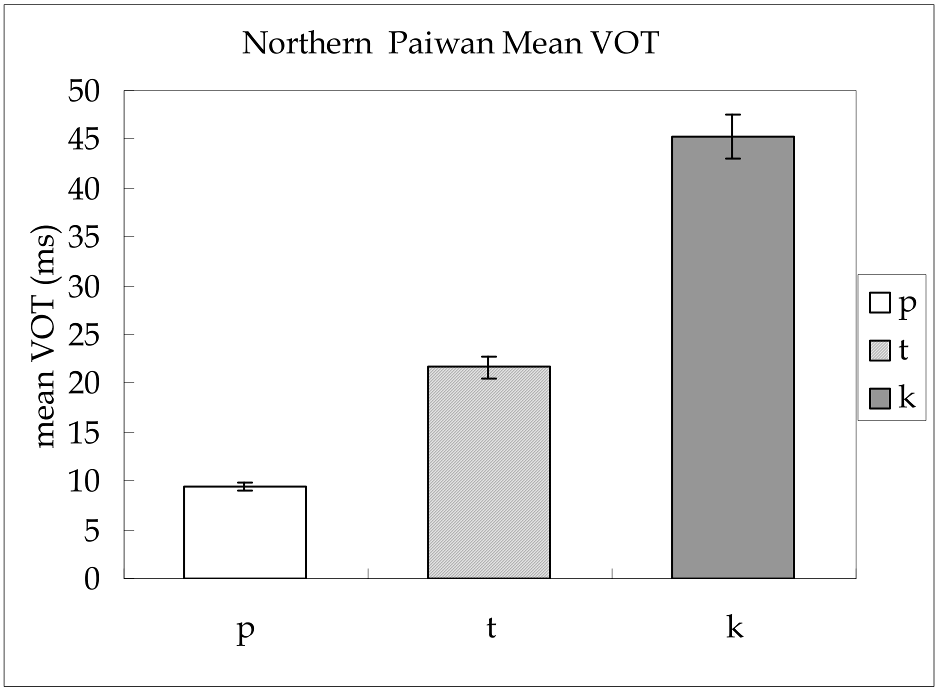


Figure 3.1: Mean VOT of Northern Paiwan stops

The VOTs for palatal stops in Southern Paiwan are about 24% longer than those in Central Paiwan. Palatal stops are distinct from uvular stops at $p<0.0001$ in Southern Paiwan. In Central Paiwan, there was no significant VOT difference between palatal and uvular stops. Yet, velar stops were distinct from uvular stops at $p<0.0001$ in both Central and Southern Paiwan. Among the Paiwan dialects, VOTs for velar stops in Northern Paiwan are the shortest and those in Southern Paiwan are the longest.

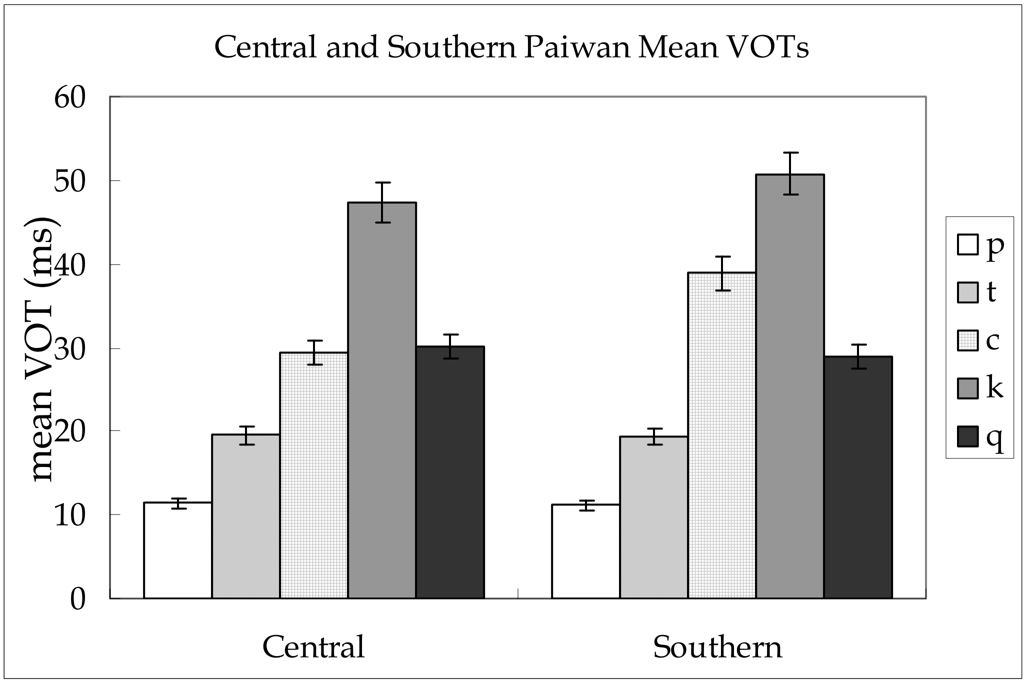
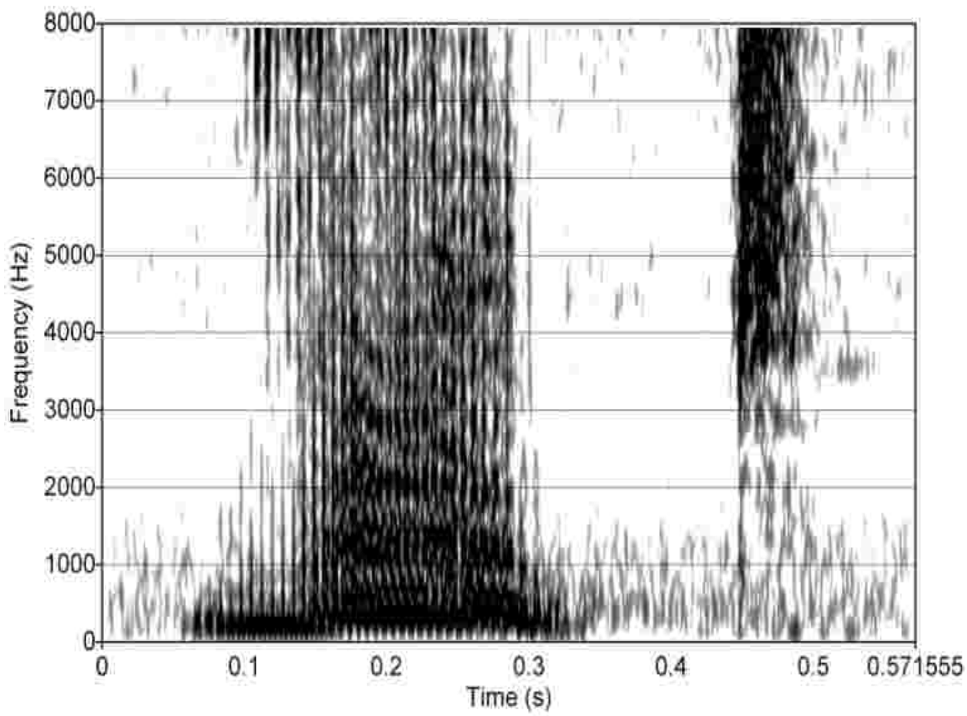


Figure 3.2: Mean VOT of Central and Southern Paiwan stops

The results agree with the general observation that stops with back articulated closure such as /k/ and /q/ have longer VOTs than /p/ or /t/, but no agreement was found in the realization of the uvular /q/. While significant difference was found among the voiceless stops in Northern and Southern Paiwan, no significant VOT difference was found between Central and Southern Paiwan regions.

Cho and Ladefoged (1999) have investigated VOT in eighteen languages and have reported that the differences in VOT between velars and uvulars vary greatly. They suggest that although the volume of the cavity behind the constriction is smaller for uvulars than for velars, the uvular stop might be produced by a constriction with relatively shorter contact. The shorter contact might result in a short VOT for uvulars in Paiwan, as shown in Figure 3.2.

The results on VOT have revealed that alveolar and palatal voiceless stops in Paiwan are not only two separate phonological phonemes but also with independent phonetic representations. Stops [t] and [c] have different volume of the capacity behind or in front of the point of constriction, and they may have distinct movements of articulator and articulatory contact area. The voiceless palatal stop [c], is further illustrated in Figure 3.3.



v u c

Figure 3.3: Example spectrogram of stop **c** in the word **vuc** 'squirrel'

Shown in Figure 3.3, no vowel-like formant was found aside the release burst of the palatal stop. Ladefoged (2003) has shown that approximant /j/ has a high second formant (F2) like the high front vowel /i/ on the spectrogram, and that when F2 is the highest the tongue is in the most high front position. The phonetic representation of an approximant does not occur in the spectrogram of

[c], as shown in Figure 3.3. It is clear that the conventional transcription of the voiceless palatal stop as /ʧ/ does not reflect the phonetic representation of [c]. The sample spectrogram supports the earlier description of the consonantal phonemes, and they also provide evidence for the independent representation of the voiceless palatal stop.

3.2 Phonetic Representations of Paiwan Vowel Segments

Paiwan has a four-vowel system: /i/, /u/, /a/and /ə/. Vowel /i/ has been described as a high front vowel, /u/ as a high back vowel, /a/ as a low vowel, and /ə/ as a central schwa. Words given in Table 3.2 were elicited and recorded by three female Paiwan speakers and three male Paiwan speakers. For each vowel the data consisted of two examples of each vowel after a bilabial, alveolar, velar and uvular stop. Each word was produced once in isolation. Underlined syllables were extracted for formant measurements.

Table 3.2: Words exemplifying contrasts among Paiwan vowels

Bilabial	**Word-Initial**		**Word-Medial[4] or Final**	
pi	**<u>pi</u>ku**	'elbow'	**ʎus<u>pi</u>t**	'thin'
pu	**<u>pu</u>ɖu**	'kidney'	**tsəm<u>pu</u>**	'to spin'
pa	**<u>pa</u>ʎiŋ**	'entrance'	**tsəma<u>pa</u>**	'to roast'
pə	**<u>pə</u>naɭisi**	'superstition'	**qa<u>pə</u>du**	'gall'
Alveolar	**Word-Initial**		**Word-Medial or Final**	
ti	**<u>ti</u>ʎu**	'chopping board'	**maqa<u>ti</u>**	'permitted'
tu	**<u>tu</u>tu**	'breast'	**va<u>tu</u>**	'dog'

[4] Some CV sequences do not occur word-finally, for instance, /pə/, /tə/, /kə/ and /qə/.

ta	**<u>ta</u>tsu**	'body louse'	**i<u>ta</u>**	'one'
tə	**<u>tə</u>kəɭ**	'to drink'	**vəna<u>tə</u>ʔ**	'to wash (clothes)'
Velar	**Word-Initial**		**Word-Medial or Final**	
ki	**<u>ki</u>ziŋ**	'spoon'	**savi<u>ki</u>**	'betel nut'
ku	**<u>ku</u>ɭa**	'foot'	**i<u>ku</u>**	'tail'
ka	**<u>ka</u>paz**	'root'	**nə<u>ka</u>**	'to have not'
kə	**<u>kə</u>maɭi**	'to dig'	**ta<u>kə</u>ts**	'mountain sheep'
Uvular[5]	**Word-Initial**		**Word-Medial or Final**	
qi	**<u>qi</u>pu**	'dirt'	**tsa<u>qi</u>**	'excrement'
qu	**<u>qu</u>ɭu**	'head'	**ɭi<u>qu</u>**	'throat'
qa	**<u>qa</u>ʎa**	'enemy'	**qa<u>qa</u>**	'crow'
qə	**<u>qə</u>tsiɭu**	'egg'	**ʎaʎə<u>qə</u>ɭ**	'cold (weather)'

The phonetic qualities of the Paiwan vowels were examined, based on the measurements of the frequencies of the first, second and the third formant values. The measurements were done using superimposed FFT and LPC spectra on Macquirer and simultaneous spectrographic displays for reference. Recorded data were transferred into the computer at a sampling rate of 22,000 Hz. The formant values were determined from the LPC spectra with a 30 ms frame calculation, and a pre-emphasis was applied to the signal prior to calculation, with an additional 512-point FFT calculation check. The formant values were determined from the LPC spectra, using FFT spectra as supplementary checks. When the LPC measurement did not coincide with the FFT spectra, formant

[5] Uvular stop /q/ was not attested in Northern Paiwan. Stop consonant /q/ has been replaced by the glottal stop /ʔ/ in Northern Paiwan.

values were determined from the LPC. These measurements were also checked against measures taken from a spectrogram. Vowel midpoints were taken for formant measurements. A total of 192 tokens (32 X 6) were selected for the principal formant measurements. For each token only the target syllable was extracted, and the vowel midpoints were measured.

As we have noted that vowel /ə/ is much more restricted and affects the assignment of stress, minimal sets were difficult to find. The words for comparing vowels shown in Table 3.2 may not be the most suitable ones, but the data selected here represent natural sounds of Paiwan. The mean formant values of the main vowels are shown in Table 3.3.

Table 3.3: Mean formant frequencies for Paiwan male and female speakers

Gender	**Female Speakers**			**Male Speakers**		
Vowel	**F1**	**F2**	**F3**	**F1**	**F2**	**F3**
i	445	2398	3120	419	2185	2630
u	517	968	3030	470	809	2631
a	904	1593	2930	812	1235	2534
ə	679	1723	2874	605	1630	2596

Formant plots of Paiwan female and male vowels are illustrated in Figure 3.4 and Figure 3.5 respectively. The plots shown in Figure 3.4 and Figure 3.5 were drawn with UCLA JPlotFormants Version 1.4 software. The ellipses were drawn with radii of two standard derivations along the axes of the first and the second principal formants. Each vowel's symbol was drawn at the mean of the vowel's formant plot in large font. The symbol '>' in the figures indicates schwa /ə/.

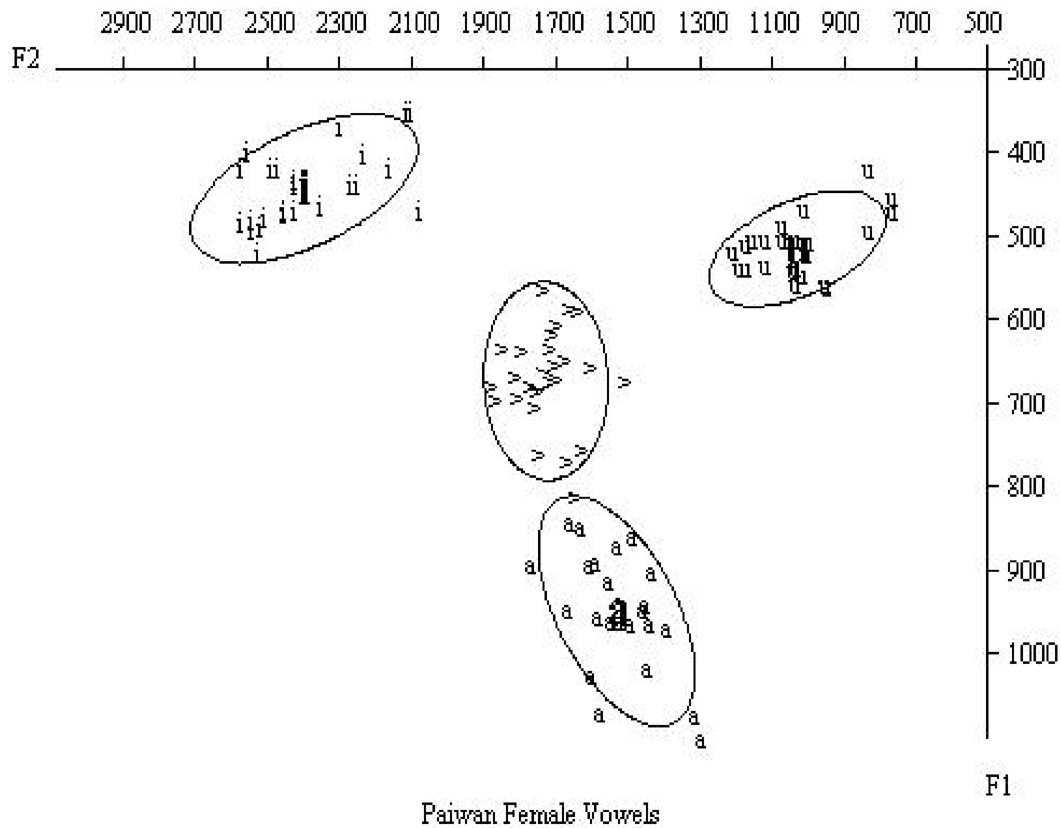


Figure 3.4: Formant Plot for Female Paiwan Speakers

The distribution of the Paiwan vowels shown in the figures supports the dispersion theory (Liljencrants and Lindblom, 1972) which predicts that contrastive vowels are spaced with a sufficient contrast, such as /i/ and /u/. There is greater variance for the schwa in F1 than F2, particularly for the male speakers.

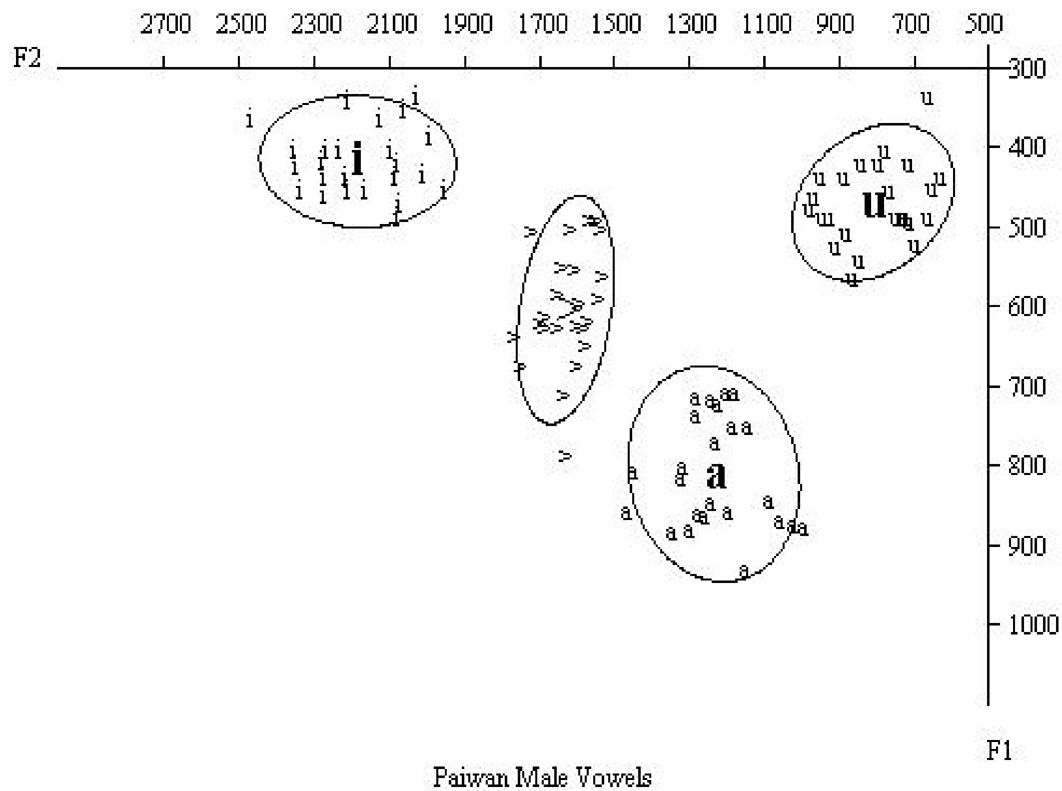


Figure 3.5: Formant Plot for Male Paiwan Speakers

On the other hand, both of the mean F1 values in female and male Paiwan vowel /i/ are lower than those in the vowel /u/, which indicates tongue position for Paiwan vowel /i/ is higher than that for the vowel /u/. The figures provide a phonetic description of the vowel qualities in Paiwan vowels. It shows that in Paiwan the high back vowel **u** is not as high as **i**, which might be perceived and interpreted as **o**. Formant plot for male Paiwan speakers indicates that the low vowel /a/ is more likely to be a back vowel phoneme /ɑ/. Given that the articulation place for the low vowel in Paiwan tend to be back, the feature [+back] should be added to the description of the low vowel phoneme.

3.3 Stressed Vowels

Paiwan has a quantity-insensitive stress. Vowel length is not phonemic. Li (1977) has pointed out that stress plays a part in the phonological change in some Formosan languages, but the role of stress in Paiwan is not clear in his study. The interaction between stress and vowel length in Austronesian languages have been discussed in Wolff's (1993) comparative study. He argues that in the Philippines, which is the only area in which PAN root stress or length is currently still retained in attested languages, the contrast consists of vowel length in most cases, and the stress is predictable in terms of length. Yet, whether vowel length is a phonetic realization of stress in Paiwan is unknown, and phonetic cues to Paiwan stress are never examined in earlier studies.

Native speakers of Paiwan are not aware of their placement of stress until their kids manipulating wrong stress in their speech. Phonetic realization of Paiwan stress, if any, can further verify the existence of stress and the distinction between stress and unstressed vowels. Given that the data presented in the current study were collected from elicitation and that the natural patterns of the Paiwan sounds should be preserved and retained, only minimal pairs for either phonemic or syllabic contrast were selected for comparison here. The following qualified words were found in the recorded voice data: **kaka** 'siblings', **qaqa** 'crow', **va** 'lung', **vava** 'wine', **vat** 'nutlet', **vu** 'intensities', **vuvu** 'grandparents', **vuc** 'squirrel'.

A total of 48 elicitation tokens (8 words X 2 speakers X 3 dialects) from six Paiwan speakers were selected for the measurement of vowel length. For each dialect (Northern, Central, Southern), tokens were recorded from one male and one female speaker. The tokens were recorded in continuous elicitation, one repetition per item. A very short pause was inserted between items. None of the word-final vowels were also phrase-final. Tokens recorded from Southern Paiwan speakers were excluded for figure representation due to sudden background noise. Only two words recorded from Southern Paiwan speakers were clear enough for measurements: **kaka** 'siblings' and **qaqa** 'crow'. Vowel durations of the target vowels were measured from 300 Hz bandwidth spectrograms, including the portion from the burst of the initial consonant to the cessation of high frequency energy.

The comparison of vowel length in the same phonetic context is illustrated in Figure 3.6, whereas the vowel durations of CV_1 syllable, the stressed syllable, are illustrated in Figure 3.7. Due to the limited number of the tokens, no statistical test was conducted to show the significant difference between the groups. Each bar in the figures represents the group mean.

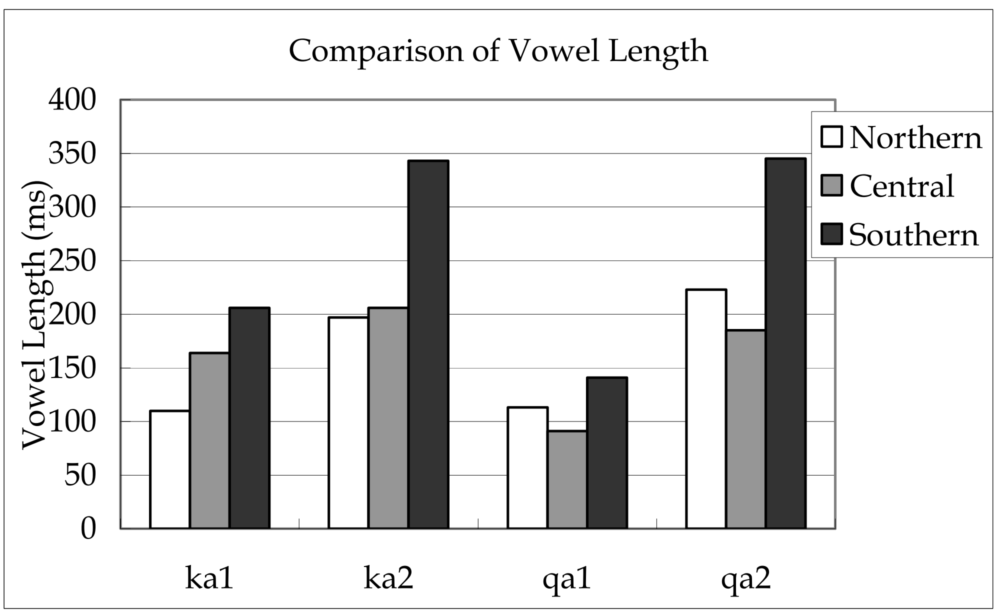


Figure 3.6: Comparison of Vowel Length in Paiwan

Shown in Figure 3.7, vowel durations in the words **k$\acute{a}_1$ka$_2$** and **q$\acute{a}_1$qa$_2$**, CV_1 syllables in both words are stressed, but the vowels in stressed syllables are shorter, compared with the unstressed final syllables CV_2 in the same words. The pattern is rather consistent in Northern, Central and Southern Paiwan. Note that word-final vowels that were also phrase-final were excluded from the measurement. The results indicate that the effect of final lengthening might be imposed on the realization of the unstressed vowels. In the current informal study, final syllables were longer in Paiwan, regardless of stressed or unstressed syllables. Yet, more qualified and clear tokens recorded from more Paiwan speakers are still needed to verify the preliminary observation. No solid conclusion could be drawn before a formal statistical test was conducted.

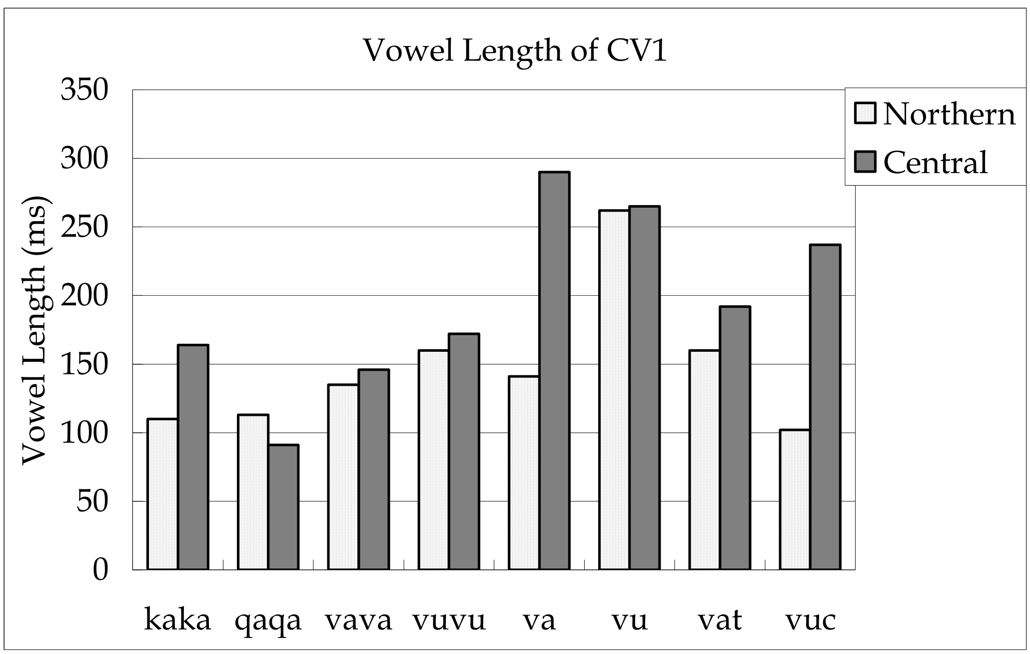


Figure 3.7: Durations of Stressed Vowels in Northern and Central Paiwan

As for the effect of syllable structure on the vowel length, vowels in open syllables tend to be longer than those in closed syllables. Shown in Figure 3.7, all the vowels in the examined CV_1 are stressed, but they apparently have various vowel durations. Vowel length in the closed syllables '**vat**' and '**vut**' is shorter than that in the open syllables '**va**' and '**vu**' of Central Paiwan, and the open syllable '**va'** of Central Paiwan has the longest vowel length. Nevertheless, vowel shortening in closed syllable was not found in the Northern Paiwan word pairs **va** and **vat**, as shown in Figure 3.7. Vowel shortening associated with syllable structure, named Closed Syllable Vowel Shortening (CSVS) by Maddieson (1985), can be used as a cue to the syllabic constituency of a segment string. Many Paiwan words end with a CVC syllable. The phonetic pattern of CSVS was attested in Central Paiwan and thus provides some support for the internal constituent of the syllable in Paiwan. On the other hand, internal vowel length shown in Figure 3.7 indicates that low vowel [a] is not consistently longer than high vowel [u] in the same phonetic context. The high vowel [u] in the open syllable **vu** is longer than the low vowel [a] in the syllable **va** produced by Northern Paiwan speakers.

Now we turn to the puzzle of the phonetic correlate of Paiwan stress. When the quality of the preceding consonant segments and the effect of final-vowel lengthening were controlled, as found in the word **tatáqan** 'grindstone', duration, pitch, and intensity were measured. The word **tatáqan** 'grindstone' is the only qualified trisyllabic word for the controlled factors in the recorded voice data. Due to the recording environment in the field, some tokens were excluded from the measurement due to background noise. Four tokens (one female Northern Paiwan speakers, two female Central Paiwan speakers, and one male Central Paiwan speakers) of the same word were selected for the measurements. All the qualified tokens were recorded in elicitation, one repetition per item. None of the word-final vowels were also phrase-final. Vowel durations of the target vowels were measured from 300 Hz bandwidth spectrograms, including the burst of the initial consonant to the cessation of high frequency energy. The fundamental frequency at the midpoint of each vowel was also measured. Again, no formal statistical test was conducted here due to the limit number of the tokens[6]. The results of the informal measurements are illustrated in Figure 3.8, Figure 3.9[7], and Figure 3.10.

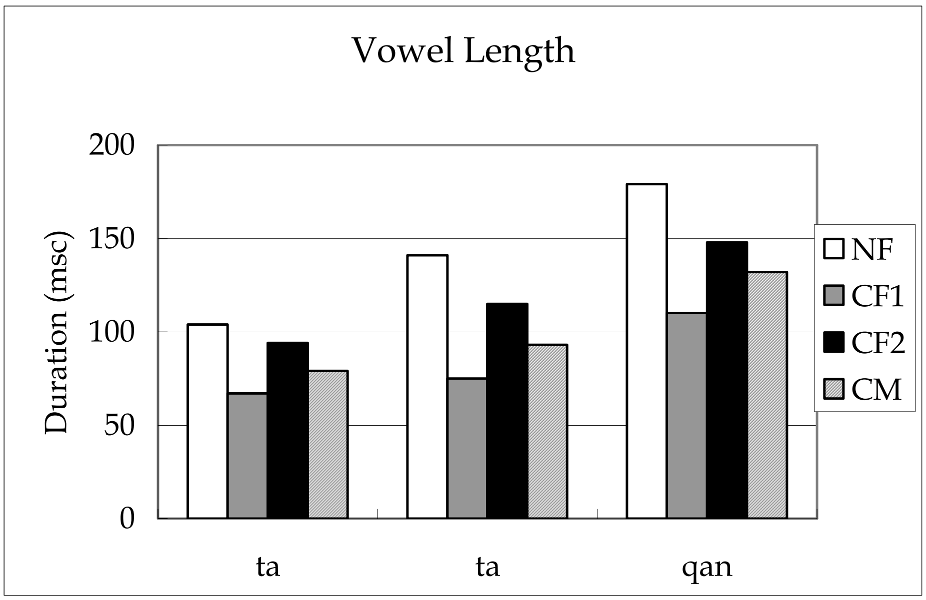


Figure 3.8: Vowel Length in the word **tatáqan** 'grindstone'

NF=Northern Female; CF1=First Central Paiwan;

CF2=Second Central Female; CM=Central Male

Shown in Figure 3.8, the stressed vowels at the penultimate syllables are longer than the unstressed vowels at the initial syllables. On the other hand, stressed vowels have higher pitch than the unstressed initial vowels and the final

[6] One may doubt if the differences are greater than would be expected by chance. However, it is hoped that authentic voice tokens recorded from four native speakers of Paiwan from different dialects may offer a preliminary account for the effect of word position on vowel length. Further studies are needed to verify the current preliminary account.

[7] The trendline added in Figure 3.9 was based on the pitch track of the token produced by the first Central Female speaker (CF1). The gaps between the F0 pitch tracks due to the voiceless consonants shown in Figure 3.9 were discarded to make the F0 lines smooth.

vowels, as shown in Figure 3.9. Penultimate syllables may have higher pitch than the initial syllables due to stress effect, while final syllables may have longer duration due to their position-in-word, as shown in Figure 3.8 and Figure 3.9. It seems that stress lengthening correlates with higher pitch (f0), whereas final lengthening of the unstressed vowels correlates with lower pitch.

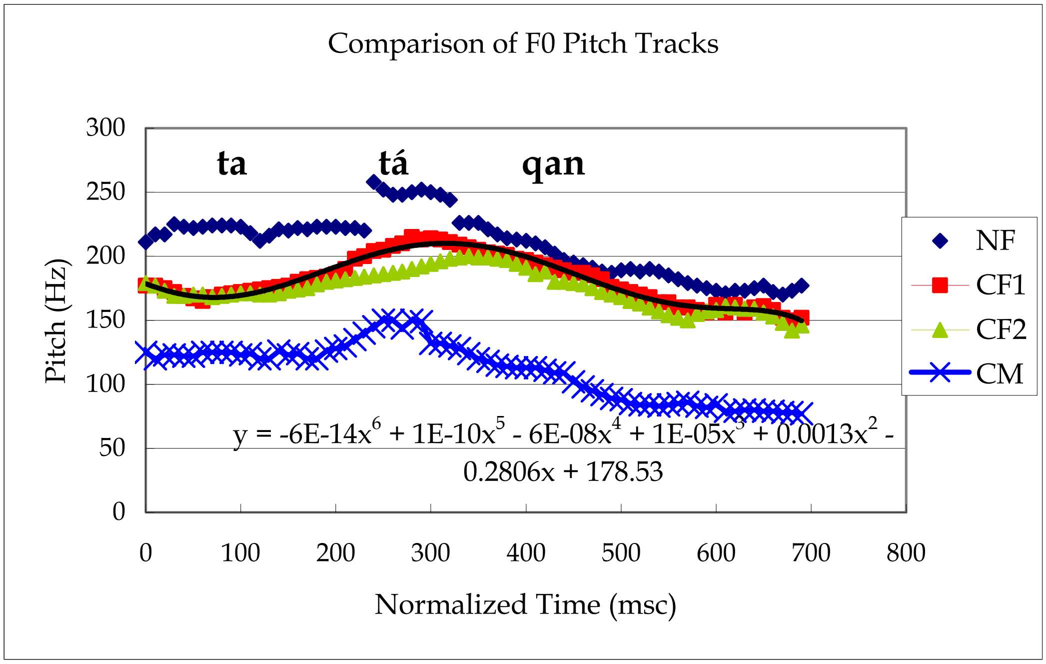


Figure 3.9: Pitch Tracks of the word **tatáqan** 'grindstone'

On the other hand, intensity measured at vowel midpoints in the word **tatáqan** 'grindstone' indicates that stressed vowels generally have greater intensity than unstressed vowels in controlled phonetic contexts, as shown in Figure 3.10. The final unstressed syllables tend to have minimal intensity compared with the other syllables in the same word.

The examination on stressed vowels in Paiwan seems to indicate that phonetic correlates of duration, pitch and intensity tend to match each other for the prominences of stress. In other words, stressed vowels in Paiwan tend to have longer duration, higher pitch, and greater intensity than the initial unstressed vowels. Yet, final lengthening may occur to mask the phonetic correlate of vowel length.

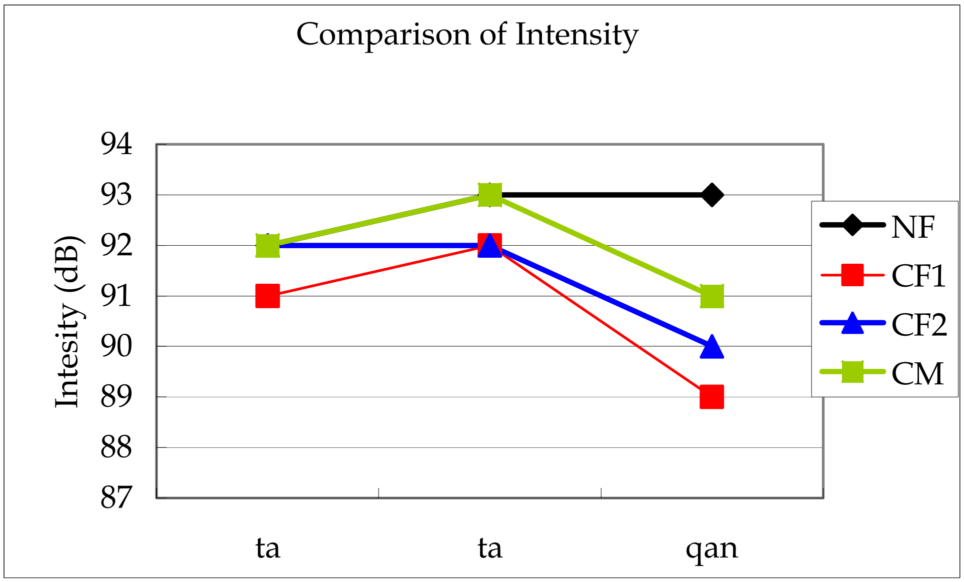


Figure 3.10: Intensity in the word **tatáqan** ‘grindstone’

Final lengthening is due to position-in-word, whereas higher pitch on the penultimate syllable is due to stress effect. Stressed syllables in the examined data always have higher pitch than unstressed syllables, and pitch tends to be a robust cue for the production and perception of Paiwan stress. Stress lengthening correlates with higher pitch, while final lengthening does not. The preliminary observations have a bearing on the issue of the phonetic correlates of stress in diverse languages. De Jong and Zawaydeh (1999) have pointed out that the degree to which the prosodic effects will be manifested in a particular system is part of the linguistic convention which needs to be specified for a particular language. Prosodic systems are not stereotypical. In English, duration is a more effective cue to stress than intensity, and pitch is an even more effective cue than duration (Fry 1955, 1958). It has been disclosed that pitch accent languages such as Japanese use pitch as a correlate of stress to a greater extent than English (Beckman 1986). Laver (1994) investigated different typological lexical stress and has confirmed the dominant role of pitch in conveying stress patterns.

On the other hand, the final unstressed vowel with longer duration and pitch drop provides some support for the Paiwan word as a phonological unit. The boundary of a phonological word in elicitation is usually aligned with pitch drop and longer vowel length.

The observation of vowel length as a phonetic correlate of stress in Paiwan somehow corresponds to the claim made by Wolff (1993) that stress is predictable in terms of length in many languages spoken in Philippines. The evidence from Formosan Paiwan language indicates that vowel length might be phonemic in Proto-Paiwan.

3.4 Synchronic Varieties and Diachronic Sound Change

3.4.1 Phonetic Varieties of Paiwan

A variety of sound change has been attested in earlier Paiwan studies (Ho 1978; Ferrell 1982). Ferrell (1982) has reported the following phonetic varieties in his field report, shown in (1)[8].

(1)	<u>Caʎakavus</u>	<u>Kuʎaʎau</u>	<u>Cavuaʎi</u>	
	/ʔ/	/q/	/q/	
	ʔadid	qadid	qadid	'bitter'
	ʔuma	quma	quma	'field'
	/k/	/k/	/k/	
	kəḍi	kəḍi	kəḍi	'little'

[8] The villages of Caʎakavus, Kuʎaʎau, and Cavuaʎi are respectively located at northern, central, and southern Paiwan area.

iku	iku	iku	'tail'
/ʔ/	/k/	/ʔ/	
ʔasiv	kasiw	ʔasiw	'tree'
vaiʔ	vaik	vaiʔ	'to leave'

The dialectal varieties of /q/ and /ʔ/ were attested in the current study. As we have seen in Chapter 2, Northern Paiwan has the phonemes /k/ and /ʔ/ but does not have the phoneme /q/. The change of [**k**] ~ [**ʔ**] is phonetic, in which case free variation occurs. Phonetic variation does not change the phonemic inventory of Northern Paiwan or Southern Paiwan. On the other hand, the change of ***q** > **ʔ** in Northern Paiwan is phonemic, in which case only the phoneme /ʔ/ was attested. Phonemic change affects the arrangement of the consonantal inventory in Northern Paiwan.

Although phonological inventory of each dialect has been constructed, unpredictable phonetic variation was also attested in the informant's speech. Synchronic phonetic varieties found in the current study can be categorized into palatal series, uvular and glottal stops, fricatives, and the trill. Varieties of Paiwan palatal series are shown as follows.

(2) Variation of voiceless palatal stop among the dialects

Northern	Central	Southern	GLOSS
tacit	**c**akit ~ **tacit**	**c**akit	'knife (for hunting)'
tula	**c**uʎa	**c**uʎa	'eel'
tagul	**t**aguʎ	**c**aguʎ	'rock'
tara	**t**ara	**c**ara	'ring'
tukuzaŋ	**c**ukuzaŋ	**c**ukuzaŋ	'crutch'

(3) Variation of voiced palatal stop among the dialects

Northern	Central	Southern	GLOSS
dapal	**ɟ**apaʎ	**ɟ**apaʎ	'thigh'
daɭay	**ɟ**aɭay	**ɟ**aɭay	'phlegm'
da**d**ilaʔ	**ɟ**a**ɟ**iʎaq	**ɟ**a**ɟ**iʎaq	'lizard'
su**d**u	su**ɟ**u ~ su**d**u	su**ɟ**u	'lover'
saɭa**d**	saɭa**ɟ** ~ saɭa**d**	saɭa**ɟ**	'companion'
ŋa**d**aj	ŋa**ɟ**aj	ŋa**ɟ**ay	'spittle'
dalav ~ **d**alaw	**ɟ**aʎav	**ɟ**aʎaw	'fast'

As we have seen that palatal stops were merged to alveolar stops in Northern Paiwan, the sound patterns of ***c > t and *ɟ > d** attested in Northern Paiwan are phonemic. On the other hand, phonetic varieties of alveolar stop ([c]~[t] and [ɟ]~[d]) were also attested in Central Paiwan. While both **c** and **t** sounds are acceptable in Central Paiwan, **c** sound is considered a more conservative one. Yet, the varieties in Southern Paiwan were rather restricted. This phenomenon indicates that the sound patterns in Southern Paiwan are more conservative, whereas the sounds in Northern Paiwan are innovative. The phonetic varieties in Central Paiwan are more active, probably due to the frequent contact with the merger sound patterns in Northern Paiwan. Native speakers of Central Paiwan have more flexibility than those of Southern Paiwan in the production and perception of the varieties of palatal stop sounds.

Besides palatal stops, variants of palatal lateral were attested in Paiwan. The variation of palatal lateral among the three dialects of Paiwan is given in (14).

(4) Variation of palatal lateral among the dialects

Northern	Central	Southern	GLOSS
tsavi**l**	tsavi**ʎ**	tsavi**ʎ**	'year'
latsəŋ	**ʎ**atsəŋ	**ʎ**atsəŋ	'vegetable'
pa**l**iŋ	pa**ʎ**iŋ	pa**ʎ**iŋ	'door'
aŋa**l**	aŋa**ʎ**	aŋa**ʎ**	'month'
va**l**ua**l**ut	va**ʎ**ua**ʎ**ut	va**ʎ**ua**ʎ**ut	'alive'
la**l**əʔəɭ	**ʎ**a**ʎ**əqəɭ	**ʎ**a**ʎ**əqəɭ	'cold (weather)'

Generally speaking, the sound **ʎ** occurs in Central and Southern Paiwan, and the sound **l** occurs in Northern Paiwan. Yet, I have observed the variation among the different age groups of the Paiwan speakers. The phonetic variety of [ʎ] ~ [l] was also attested in the younger speaker's speech in Central and Southern Paiwan, whereas some elder speakers in Northern Paiwan were able to produce the sound **ʎ**. In other words, the variety of the **ʎ** sound (***ʎ** > **l**) is acceptable among the younger speakers in Southern Paiwan. The sound **ʎ** might be retained in some conservative villages in Northern Paiwan, while the sound **l** has been attested in some innovative villages or produced by younger speakers of Central and Southern Paiwan.

Now we turn to the question why the palatal sounds become alveolar sounds but not vice versa. The phonological features, the quality of the sounds, and the phonemes of the contact languages should be taken into consideration. Given that both **t** and **c** are voiceless stops, the contact languages such as Rukai, Japanese, Mandarin and Taiwanese do not have a palatal stop, and the chance for the preservation of the sound **c** is relatively smaller. When the frequency of the palatal sounds in the languages the Paiwan aborigines use is low, the preservation of the palatal sounds will be placed in jeopardy. The overlapping sounds such as **t**, **d**, and **l** shared by Paiwan, Mandarin and Taiwanese will get higher probability of preservation, while phonetic variation or sound change more likely occurs in the sounds with unique features, such as **c**, **ɟ** and **ʎ** attested in Paiwan only.

Another evidence for the preservation issue on the palatal sounds comes from the varieties in the learning of the target sounds. The pronunciation of the **c** sound was described as [tʂ] or [tɕ], two equivalences of Mandarin, in language textbooks for elementary kids (cf. governmental teaching materials, 1993). When the non-target sounds are learned or acquired, more varieties of the target sound will appear in the future. Sound change has occurred in Northern Paiwan, and the spreading of the merger sound is ongoing in Central Paiwan. The authentic palatal sounds attested in Central and Southern Paiwan thus should be preserved and circulated among the bilingual or multilingual younger speakers.

As we have seen in Chapter 2, the uvular stop was not attested in Northern Paiwan. The sound change of ***q** > **ʔ** is phonemic in Northern Paiwan. The glottal stop **ʔ** in Northern Paiwan was sometimes lost in speech flow, especially in word-initial and word-final position. The varieties of Paiwan uvular and glottal stops are illustrated as follows.

(5) Variation of uvular stop among the dialects

Northern	Central	Southern	GLOSS
tsəɭaɭa**ʔ**	tsəɭaɭa**q**	tsəɭaɭa**q**	'thunder'
litə ~ litə**ʔ**	ʎitə**q**	ʎitə**q**	'viscous liquid'
ʔa**ʔ**a	**q**a**q**a	**q**a**q**a	'crow'

tsaludu**ʔ**an	tsaʎuɟu**q**an	tsaʎuɟu**q**an	‘finger’
ɭusə**ʔ** ~ ɭusə	ɭəsə**q**	ɭəsə**q**	‘tear’
iʃi**ʔ** ~ isi	iʃi**q**	iʃi**q**	‘urine’
ʃi**ʔ**alud	ʃi**q**aʎuɟ	ʃi**q**aʎuɟ	‘to flow’
tata**ʔ**an	tata**q**an	tata**q**an	‘grind stone’
muta**ʔ** ~ muta	muca**q**	muca**q**	‘to vomit’
ʔətʃiɭu ~ ətsiɭu	**q**ətʃiɭu	**q**ətʃiɭu	‘egg’
ʔəmila ~ əmila	**q**əmiʎa	**q**əmiʎa	‘to hide’
ʔadid ~ adid	**q**adid	**q**adid	‘bitter’

(6) Variation of voiceless velar stop among the dialects

Northern	Central	Southern	GLOSS
kaluaɭaʔ	**k**aʎuaɭaq	**ʔ**aʎuaɭaq	‘spider web’
kisədam	**k**isəɟam	**ʔ**isəɟam	‘to borrow’
kitsaʔuan	**k**itsaquan	**ʔ**itsaquan	‘to learn’
kikutsu	**k**ikutsu	**ʔ**ikutsu	‘to delouse’
kiɭaŋda	**k**iɭaŋda	**ʔ**iɭaŋda	‘to listen’
kitaŋəz	**k**itaŋəz	**ʔ**itaŋəz	‘to lie’
kiumal	**k**iumaʎ	**ʔ**iumaʎ	‘to repeat’
kiʔila	**k**iqiʎa	**ʔ**iqiʎa	‘to hide’

Shown in (5) and (6), while the sound change of ***q** > **ʔ** is phonemic in Northern Paiwan, the deletion of the glottal stop at word-initial or word-final position in Northern Paiwan is a phonetic variation. The variety sound **ʔ** (k ~ ʔ) attested in Southern Paiwan is also a phonetic variation.

On the other hand, palatalization occurs in Paiwan fricative and affricate phonemes when followed by a high front vowel. In addition to the predictable phonetic alternation, some other phonetic varieties were also found in Central Paiwan. Older speakers in Central Paiwan tend to produce the palatalized sounds more frequently than younger speakers in the same village. Note that the following Central Paiwan data were collected from the older speakers in Piuma Paiwan village[9].

(7) Variation of affricate among the dialects

Northern	Central	Southern	GLOSS
kəma**ts**	kəma**tʃ**	kəma**ts**	'to bite'
ɭuku**ts**	ɭuku**tʃ**	ɭuku**ts**	'mountain perilla'
tsau**ts**au	**tʃ**au**tʃ**au	**ts**au**ts**au	'human being'
ma**ts**a	ma**tʃ**a	ma**ts**a	'eye'
ma**ts**am	ma**tʃ**am	ma**ts**am	'spicy'
ma**tsu**ɭəʔ	ma**tʃ**uɭəq	ma**tsu**ɭəq	'deaf'
ravu**ts**	ravu**tʃ**	ravu**ts**	'twitch grass (thin)'

The trill phoneme /r/ is realized as a velar voiced fricative **ɣ** in some villages of Central and Southern Paiwan. The distribution of the variety **ɣ** is restricted to the Central or Southern regions. Both of the sounds **r** and **ɣ** were attested in Southern Paiwan, in different villages. While the speakers in one

[9] The palatalization sounds presented here are the phonetic varieties. The sound [ts] was also attested in the same Central Paiwan village, and it has been treated as the phoneme.

village preferred the sound **r**, the speakers in the other liked the sound **ɣ** better. Varieties of the Paiwan trill are given as follows.

(8) Variation of trill among the dialects

Northern	Central	Southern	GLOSS
ruvu	**r**uvu	**r**uvu~ **ɣ**uvu	‘nest’
ravuts	**r**avuts	**r**avuts~**ɣ**avuts	‘twitch grass’ (thin)
radaj	**r**aɟaj	**r**aɟaj ~ **ɣ**aɟaj	‘sharp’
rida**r**id	**r**iza**r**iz~ **ɣ**iza**ɣ**iz	**r**iza**r**iz ~ **ɣ**iza**ɣ**iz	‘saw’
kəma**r**im	kəma**r**im	kəma**r**im ~ kəma**ɣ**im	‘to find’

It was reported in Ho’s (1978) study that the alveolar voiced retroflex **ɖ** was produced as a trill **r** in a northeastern Paiwan tribe, and the trill **r** was produced as a retroflex lateral **ɭ** in Tjavuali, an eastern tribe. It is apparent that the eastern region of the Paiwan territory may have much more sound change or phonetic varieties that have not been attested in the current project.

Thus far, four groups of phonetic varieties have been presented, i.e., variation of palatal, uvular/velar, affricate, and trill consonants among Northern, Central and Southern Paiwan. Sound change of ***q** > **ʔ**, ***c** > **t** and ***ɟ** > **d** in Northern Paiwan is phonemic, i.e., sound change affects the arrangement of the phonemic inventory. Besides phonemic change, much more phonetic varieties have been attested in the dialects of Paiwan.

3.4.2 Historical Sound Change

Given that phonetic and phonological varieties of Paiwan were attested in earlier studies (Ho 1978; Ferrell 1982) and the current study, the phonemes of

Proto-Paiwan have become crucial for the directionality of sound change. An attempt has been made in Ho's (1978) reconstruction of Proto-Paiwan to disclose the phonemic and phonetic change in the varieties of Paiwan. In general, the phonemes reconstructed in Ho's (1978) study reflect the sound patterns described here. The Proto-Paiwan consonantal segments reconstructed in his study are illustrated in (9a), whereas the synchronic consonantal phonemes and sound patterns of Northern, Central, and Southern Paiwan attested in the current study are given in (9b).

(9a) Proto-Paiwan	(9b) Northern	Central	Southern
*p	p	p	p
*b	b	b	b
*t	**t**	t	t
*c		c	c
*d	**d**	d	d
*ɟ		ɟ	ɟ
*ɖ	ɖ	ɖ	ɖ
*k	k	k	k
			ʔ
*g	g	g	g
*q	**ʔ**	q	q
*v	v	v	v
*s	s	s	s
*z	z	z	z
*ts	ts	ts	ts
*m	m	m	m
*n	n	n	n

*ŋ	ŋ	ŋ	ŋ
*r	r	r	r
			ɣ
*ʎ	**l**	ʎ	ʎ
*ɭ	ɭ	ɭ	ɭ
*w	w	**v**	w
	v		
*j	j	j	j

Shown in (9a) and (9b), the sound change of merger occurs in Northern Paiwan, and the palatal phonemes of Proto-Paiwan have been retained in Central and Southern Paiwan. In fact, Paiwan is unique in its palatal sounds, which were not attested in any other Formosan languages. The merger of palatal segments has a bearing on the reconstruction of PAN. Synchronic phonetic varieties and diachronic historical sound change have verified the existence of the palatal phonemes. The comparison among the Paiwan tribes has reinforced the understanding of the phonetic and phonological varieties spreading within the Paiwan territory.

CHAPTER FOUR
PROSODIC STRUCTURE OF PAIWAN

This chapter deals with the prosodic properties of the Paiwan language. Prosody includes a number of speech characteristics traditionally considered suprasegmental or separating from segment phonology. I have observed that prosody plays an important role in the Paiwan language, in many aspects of Paiwan phonology, such as phonological phrases, intonation, and beyond sentence level. Some spatial concepts and the degree scale in Paiwan do not have their morphological or semantic representation. Rather, they are embedded in the organization of prosody. One may ask: what is the prosodic structure in a language? More specifically, what are the prosodic constituents and prosodic hierarchy of Paiwan? The chapter aims to answer these questions and draws a clear picture on how prosody works in the speech of Paiwan.

The study of prosody in Austronesian languages is rather scanty. Moreover, the term 'accent' has been used to describe various aspects of prosody. Zorc (1993), for instance, classifies Paiwan as an Austronesian language with accent falling regularly on the penult. Wolff's (1993) work on PAN accent patterns does not distinguish accent from stress, as he argues that in Proto-Austronesian (PAN) the stress patterns fell on the penult of the root if it was long (or accented) and on the final syllable of the root if the penult was short (or unaccented). It is rather vague, under Wolff's (1993) reconstruction, whether accented syllables trigger stress and whether accented syllables are always long in PAN. The work on accentual contrasts and the feature of PAN stress is still in its infancy (cf. Wolff 1993). On the other hand, variation of the accent patterns of Paiwan has been attested in recent empirical work (Chen 2004). Informants under the age of fifty tend to over-generalize specific prosodic pattern in their speech and lose the prosodic features of the ancestral tone. Younger generations of Paiwan are able to say a Paiwan lexical word, as many second language learners can do, but the change of prosodic patterns in their speech could result in the misunderstanding of communication or the loss of verbal arts. Chiang and Chiang (2005) claim that Saisiyat, another Formosan language, is a pitch accent language. They measure various prosodic parameters of syllable rhymes, such as F0 height at onset, offset, peak and trough, pitch range, duration, and slope of content words in Saisiyat, and they suggest that accent in Saisiyat should be classified as pitch accent. Though they do not distinguish phonological accent from phonetic accent, and no minimal pairs with distinctive features are found in their lexical accent patterns, their account has been an innovative view for the empirical analysis of Formosan prosody.

It is apparent that some aspects of prosody need to be clarified before we move on. What are stress, tone, and accent? And how are they different from one another? Gussenhoven (2004) points out that the notions 'stress', 'tone' and 'accent' all refer to suprasegmental aspects of the phonological structure, but they are in fact rather different. A tone language, defined by Pike (1948), is a language having lexically significant, contrastive, but relative pitch on each syllable. The pitch of the word can change the meaning of the word in a tone language (Yip 2002). While a tone language can allow a high tone to occur on more than one syllable of a word, the basic principle in a stress language is that only one syllable per word will receive primary stress (Garde 1968). If the position of stress cannot be predicted from a word-boundary, one speaks of free stress. Generally speaking, stress can be predicted on grammatical grounds. In a stress language, every utterance has a rhythmic structure, and the rhythmic structure serves as an organizing framework for the utterance's phonological and phonetic realization (Hayes 1995). A stressed syllable is frequently characterized by a pitch change, by greater duration and by greater intensity (Bolinger 1958; Fry 1955, 1958). It has been disclosed that pitch accent languages such as Japanese use pitch as a correlate of stress to a greater extent than English (Beckman 1986). Most important perceptual cue of primary stress is changing pitch (Bolinger 1958). As we have seen in Paiwan (§ 3.3), pitch has been claimed to be a phonetic correlate of stress.

Accent, apart from stress and tone, has been widely studied but sometimes vaguely used. In the prosodic structure of a language, accent syllables are associated with a pitch accent. Functionally, pitch accents may be lexical, as in Japanese or Swedish, or intonational, in which case they are frequently focus-marking, as in English (cf. Gussenhoven 2004). The term 'accent' is used to mean a place marker for the insertion of a tone or word melody (Hyman 1978; Gussenhoven 1991a; van der Hulst 1999). 'Accent', like 'word melody', is an analytical notion, and cannot be measured (Gussenhoven 2004). Beckman (1986) argues that melodic accent (pitch accent) and dynamic accent (stress accent) are actually two distinct accent types. In pitch accent languages such as Japanese, pitch change is the only acoustic cue to accent; whereas in stress accent languages such as English, stressed syllables are differentiated using pitch height, duration, intensity, and vowel quality. The concepts of accent are different from stress, which is typically an observable phenomenon, and different also from tone, whose existence is measurable.

Three types of lexical-level prosodic properties have been proposal by Remijsen (2003), lexical tones, lexical stress, and lexical pitch accent. He argues that the function of lexical tone is to distinguish words from one another, while lexical stress and lexical pitch accent are categorized as varieties of lexical accent. Lexical pitch accent consists of an independent and specific F0 pattern, whereas lexical stress is realized using F0, duration, and intensity.

In the present chapter, word-level pitch accent, intonation, and prosody beyond sentence are described and analyzed. Section 4.1 is a review of critical prosody issues, a theoretical background for the construction of Paiwan prosodic structure. Section 4.2 comprises several types of pitch accent in Paiwan, imperative accent and pragmatic accent in different discourse contexts. Section 4.3 describes sentence–level prosody. Intonational phonology of Paiwan and the phonetic implementation components are found here. Section 4.4 is the prosody in Paiwan oral narrative and natural discourse. Finally, a discussion of prosody in linguistic documentation is found in section 4.5.

4.1 Review of Prosody Issues

To better understand the prosodic structure of Paiwan, I wish to first review some critical issues in prosodic categories and hierarchy, phonology-syntax connection, and the interface between discourse and prosody. Relevant and proper proposals in earlier studies will be adopted for the description and the discussion of Paiwan prosody.

4.1.1 Prosodic Hierarchy

Prosodic structure is initially proposed by Selkirk (1978, 1980a), and further developed by Nespor and Vogel (1986) and Hayes (1989a). The so-called prosodic hierarchy is composed of the specific hierarchy of prosodic constituents in the following: phonological word, phonology phrase, intonational phrase, and utterance. Selkirk (1984) further points out that those domains must enter into a hierarchical relationship. Syntactic effects in phonology can be mediated by a structure, for which the prosodic hierarchy appears to be an appropriate representation.

Later, a number of studies have been made to verify the representation of prosodic constituents and the prosodic hierarchy theory. Beckman and Pierrehumbert (1988) have shown that boundary tones are ordered by size of domain in the realization of English stress-accent and Japanese pitch accent.

The work of Nespor & Vogel (1986) on prosodic structure tends to support the layered conception of derived domains in phonological representation. Selkirk (1984) have suggested that the hierarchy for English includes at least the following categories, as shown in (1):

(1) Prosodic Hierarchy of English (Selkirk 1984)

Intonational phrase (IP)

Phonological phrase (PhP)

Prosodic word (Wd)

Foot (Ft)

Syllable (Syl)

Selkirk (1984) points out that the prosodic word is not motivated as a domain of phonological rules. Either the rhythmic disjuncture of syntactic timing or the syntactic structure itself gives the appropriate representation of the prosodic word. On the other hand, Hayes (1990) argues that the prosodic hierarchy cannot serve as a complete theory of the phonological phenomena that are syntax-dependent. The prosodic hierarchy as syntactic-motivated, correlated or syntax-independent may vary from language to language, from one analysis to another.

On the other hand, Pierrehumbert (1980) proposes a theory of intonational phonology and shows that the English intonational contour must be analyzed as a sequence of one or more pitch accents. Selkirk (1984) argues that the assignment of intonational structure to a sentence is logically prior to the assignment of phrase stress. The pitch accent units of the intonational contour are aligned with the syllable of a sentence. The correspondence between Pierrehumbert's (1980) and Selkirk's (1984) proposals is the verification of pitch accent as a part of English intonational contour.

It is ascertained that in Prosodic Hierarchy Theory phrasal rules do not refer directly to syntactic structure. Different languages may have different definitions of clitics. As far as Paiwan is concerned, function words such as ligatures, constructional markers, and unfooted prefixes may be considered as a clitic group on the prosodic hierarchy. But is it necessary to distinguish words from clitic groups on the prosodic hierarchy in Paiwan? Is it reasonable to classify all the affixes into the category of clitics? We leave this question to later proposal of prosodic hierarchy of Paiwan.

On the other hand, Natural Prosody (cf. Hurch 1996) presents a series of preferences and corresponding processes. The origin of primary accentuations may be lexical, morphological, or prosodic. Hurch (1996) argues that a concrete accentuation is nothing more than the syntagmatic mapping of a given word onto such pre-established patterns. It is apparent that prosodic layers or levels become unnecessary in Natural Prosody.

Does the prosodic hierarchy exist in Paiwan? If yes, can it be verified? Now let us begin with the prosodic constituents and categories in Paiwan. It has been proposed in Chapter 2 that the alternation between /w/ and /v/ occurs within a prosodic word, across a morpheme boundary but not across a word boundary. The category of clitics may not be appropriate to cover both affixes and construction markers. Construction markers are usually in connection with phonological phrases, whereas suffixes are cooperated into a prosodic word for footing. Word boundaries provide evidence for the hierarchy of prosodic words under phonological phrases.

The intonational level, observed in Chen's (2004) preliminary report, is characterized by pitch accent and the boundary tones. A high boundary tone occurs at the end of yes/no question and exclamations, whereas a low boundary tone occurs at the end of declaratives and WH-questions. Boundary tones in Paiwan do provide evidence for the independent intonational level being distinct from the phonological phrasal level. The temporary prosodic hierarchy of Paiwan is insofar summarized in (2).

(2) Prosodic Hierarchy of Paiwan[1] (provisional)

Intonational phrase (IP)

Phonological phrase (PhP)

Prosodic word (Wd)

Foot

Syllable (Syl)

4.1.2 Phonology-Syntax Connection

At the end of section 4.1.1, we have seen a distinction between phonological phrases and intonation. Selkirk (1984) discusses the grammar of intonation and clarifies the relation among rhythmic structure, intonational structure, meaning, and focus. Selkirk (1984) argues that phrase stress plays no role in determining where and how the tonal units of the intonational contour

[1] A prosodic word consists of a stem plus a suffix sequence; it provides a domain for word stress. A phonological phrase provides a domain for secondary stress in Paiwan. An intonational phrase provides a domain for sentence-level prosody; distinctive boundary tones occur in an intonational phrase.

are aligned with the syllables of a sentence. Semantic and pragmatic aspects of intonation were cooperated in her studies of intonational meaning in English.

Paiwan does have a lexical focus system, as we have seen in Chapter 2. Agent Focus is indicated by the infix *-əm-*, Patient Focus as the suffix *-ən*, Locative Focus as the suffix *–an*, and instrumental Focus as the prefix *si-* (§ 2.1.2.7). Focus structure in Paiwan, however, is not correlated with intonational components, and neither does it affect the assignment of stress or pitch accent at phrasal or intonational level. The major difference between Paiwan and English focus structure is the correlation with pitch accent. Pitch accent is not associated with focus markers in Paiwan. Pitch accent in Paiwan intonation, on the other hand, may signify emphatic or other pragmatic functions, which correlate with expressiveness component or informational structure, but not a focus structure.

Selkirk (1984) makes more effort in the connection between syntax and phonology. She suggests that the syntactic category labels for function words are simply "invisible" to principles of the syntax-phonology mapping. On the other hand, Nespor (1990) proposes the separation of prosodic and rhythmic phonology. Prosodic structure mediates between syntax and the prosodic component of postlexcial phonology, and the grid mediates between prosodic phonology and the phonology of rhythm. The interface between syntax and phonology is limited to prosodic phonology, whereas rhythmic phonology seems to have nothing to do with syntax at all.

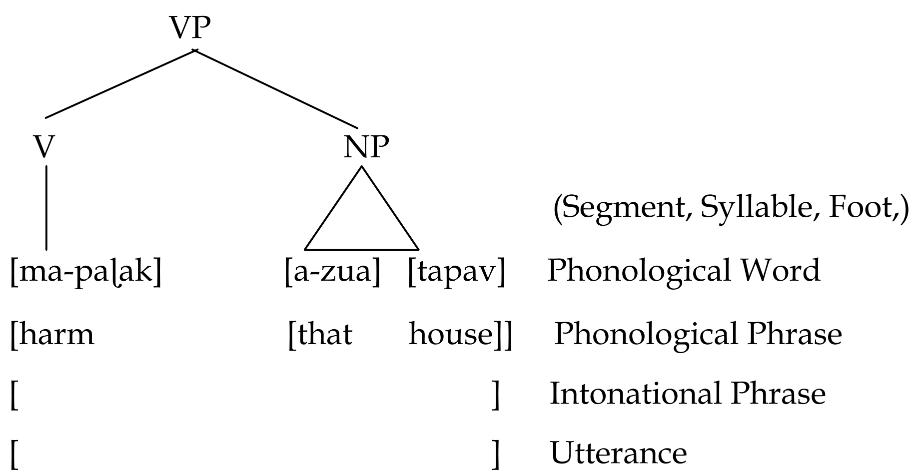
In utterance or natural discourse, much more pragmatic factors or expressiveness components would take part in the surface representation of prosody. Following Selkirk's (1984, 1995) proposal, the prosodic layers of a sentence and the prosodic surface representation (cf. Gussenhoven 2004) in Paiwan are proposed as follows.

(3) a. Paiwan Sentence: Typhoons destroyed the houses.

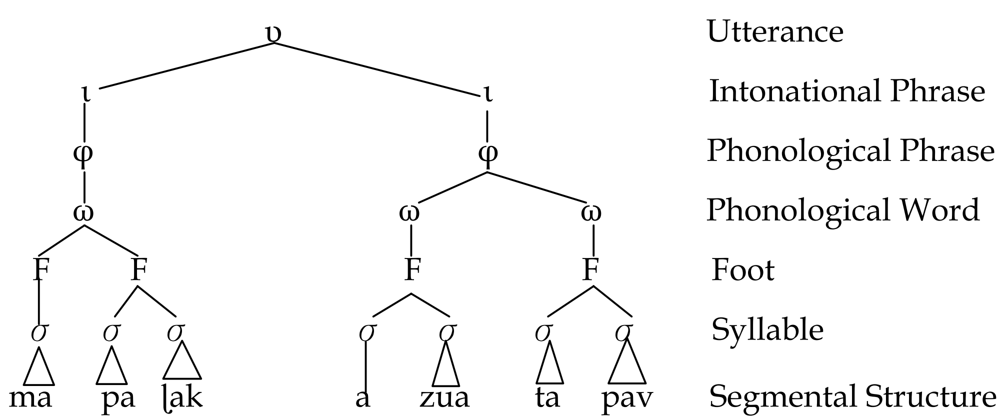
maŋəcəz	a	vaɭi	a	kuɖaɭ	nasa	[ma-paɭak	[a-zua	tapav]$_{NP}$]$_{VP}$
come	Lig	wind	Lig	strong	seemingly	harm	that	house

‘Typhoons destroyed the houses’

b. Prosodic Structure of Paiwan: the verb phrase [ma-paɭak[a-zuatapav]$_{NP}$]$_{VP}$ is represented.



c. Prosodic Surface Representation of Paiwan



In the prosodic structure shown in (3b), the phonological word refers to the domain where word stress can apply. A phonological phrase provides a domain for secondary stress in Paiwan; phrasal stress occurs in a phonological phrase. The intonational phrase is the domain where sentence-level distinctive boundary tones occur. As we have seen in (3a), the verb phrase is at the right edge of the sentence. Boundary tones or sentence-level prosodic prominences apply to the syntactic verb phrase embedded in the prosodic intonational phrase. The utterance is a string of phonological words, phonological phrases or maybe intonational phrases. Pausing, breathing patterns or pitch movement can be included in an utterance. In Paiwan, utterances can be any spontaneous speech, a stretch of speech preceded or followed by pauses. No consistent prosodic prominences were attested in utterances, and they were changing from one speaker to another. Utterance prosody may overlap with an intonational phrase, depending on the speech rate and the context of the speech. The prosodic categories shown above represent different types of prosodic prominences. Yet, the categories may overlap or collapse in utterance or natural discourse.

4.1.3 Prosody-Narrative Interface

It is true that the higher levels beyond sentences of prosody have been less extensively studied than syllables, feet and words. The majority of phoneticians or phonologists do not get into the prosody in discourse or narratives.

Wennerstrom (2001) is one of the few who investigates the relationship between prosody and everyday speech. She examines the role of prosody in discourse analysis, conversation, oral narratives and second-language discourse. She characterizes the properties of prosody as follows: prosody is compositional, cohesive, interactional, and expressive.

Pierrehumbert and Hirschberg (1990) argue that each individual and contour tone has a unique form as well as a distinctive meaning in the information structure of the discourse. They suggest that there is an expansion of the speaker's pitch range to signal the beginning of a new topic, whereas the degree of final lowering at the end of an utterance reflects its finality in the discourse organization. Chafe (1994) on the other hand provides a psychological account of the interplay between pitch accents and information structure invoking principles of cognitive psychology. In his view, high-pitched items, with more acoustic energy behind them, are physically easier for listeners to hear.

Schiffrin (1994) analyzes the illocutionary force of high-rising intonation attached to grammatical statements. Speakers may use high-rising intonation in a context in which they already have the information provided in the statement. Wennerstrom (2001) summarizes intonation as one system, along with lexical and grammatical systems, that speakers use to convey their intentions. Pragmatic principles and background information are also assessed in determining the illocutionary force of a speech act. Based on Grice's (1975) notion of detachability and cancelability, initonational meaning was argued to have a more stable, conventional form-meaning correlation than what has been described as conversational implicature.

In conversation analysis (CA), everyday talk is regarded as a highly organized social achievement. Prosody is an important focus of the microanalysis that has traditionally been characteristic of CA. In particular, conversation analysts always pay attention to the timing of turn (turn-taking). The coding system in Gumperz's (1982) and Schiffrin's (1987) analysis include symbols for syllable and pause duration, tempo, volume, stress, and various intonational phenomena, all recognized as central to the study of conversation.

As far as narrative analysis is concerned, Labov (1972) published both a grammar and phonology of Black English Vernacular, with a simple model of components in informal stories as follows: abstract, orientation, complicating actions, resolution, coda, and evaluation. Wennerstrom (2001) illustrates that high-rising pitch boundaries are used in an orientation to a story as a teller checked whether the listeners are following. Oral narratives are likely to include performance features that express a storyteller's values and emotions. Schegloff (1998) discusses the treatment of prosody in interaction and points out a pitch peak can project upcoming possible turn completion. He concludes in his study that implementing the incorporation of prosody into the analysis of talk-in-interaction faces seems to be a challenge.

Although the documentation and analysis of prosody in narratives or discourse have been claimed to be a challenge or a time-consuming task, the preservation of verbal arts in the indigenous languages cannot be accomplished without the sketch of prosody. An attempt was made in this study for the documentation of prosody in Paiwan oral narratives and discourse, which can be found in section 4.4.

4.2 Word-Level Pitch Accent in Paiwan

Paiwan has different prosodic representations from the other languages such as Mandarin and Taiwanese spoken in its geographically contiguous districts. Vowels originally long in Japanese may be stressed in Paiwan, which violates the general principles for stress assignment in the language. Japanese is a non-stress pitch accent language, while stress pattern in Paiwan is predictable in prosodic words. In Tokyo Japanese, it has been assumed that accent is not fixed in two- and three-syllable nouns, though accent assignment usually falls to the final vowel of the stem (or root) of an accented adjective or verb (cf. Harahuchi, 1991). For instance, there are three classes of accented nouns: antepenultimate-accented, penultimate-accented and final-accented. The smallest unit in Japanese has a basic tonal pattern which may be schematized as 'LH (L)'. The only lexically distinctive property is the location of the fall from High to Low. The syllable after whose first mora the fall occurs is accented, whereas no fall occurs referred as unaccented.

Pitch accent in Paiwan occurs in words and sentences. Accent attested in Paiwan words is word-level accent, and the words with accent include prosodic words in imperatives or pragmatic contexts. Canonical stress rule or cyclic phonological rules cannot account for the distribution of word-level pitch accent, which will be analyzed in terms of phonetic implementation in this section. There are a lot of factors that affect f0 timing (cf. Silverman and Pierrehumbert 1990; Prieto et al. 1995; Xu 1998, 2001; Myers 2003), and the factors controlled in the investigation of the word-level accent here are the contexts and the position in utterance, depending on the categories of the words. For instance, address forms were collected from face-to-face discourse contexts.

In an isolated Paiwan prosodic word, stress is the only parameter to determine the alignment of peak prominence. A prosodic word with penultimate stress is illustrated in Figure 4.1. The token was recorded from a Central Paiwan female speaker in isolation. Vertical dashed lines represent the timed f0 landmark with respect to syllables.

Shown in Figure 4.1, the word starts from the pitch around 200 Hz, followed by a trough, presumably due to the voiced stop [d]. The pitch track line then goes up to 238Hz, the f0 peak, in the second syllable. A falling track line occurs in the third syllable, down to 151 Hz at the end. Word stress falls on the second syllable of the word, and the f0 peak occurs in the second syllable. It is clear that word stress is realized as an f0 pitch peak. Note that the f0 peak does not occur at the beginning of the stressed syllable **dí**. Rather, it occurs around 52 milliseconds later than the starting point of the syllable.

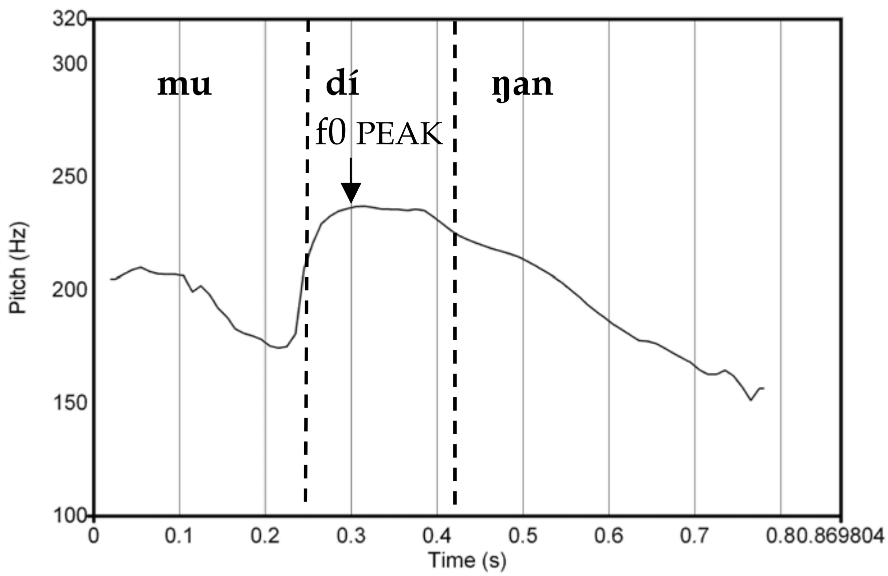


Figure 4.1: Pitch track of the prosodic word *mudiŋan* 'face'

When a prosodic word is placed in different discourse contexts, pitch accent may occur to change either the f0 timing or the peak alignment in the prosodic word. Two major types of accent were investigated: imperative accent and pragmatic accent.

4.2.1 Imperative Accent

Imperative construction in Paiwan is formed by a vocalic morpheme *–u* following a verb stem, when the theme is an exclusive imperative construction. On the other hand, a verb stem is followed by the vocalic morpheme *–i* to form an inclusive imperative construction. In other words, Paiwan inclusive imperative is indicated by the vocalic morpheme *–i*, whereas exclusive imperative is indicated by the vocalic morpheme –*u*. Some examples of Paiwan exclusive imperative construction are given in (4). In the following examples, 'H' indicates a high tone, a phonetic pitch peak in the prosodic word.

(4)	Verb Stem	Gloss	Imperative Verb	Gloss
a.	kán	'to eat'	kán-u H	'(You) Eat!'
b.	kiqíʎa	'to hide oneself'	kiqíʎa-u H	'(You) Hide!'
c.	kím	'to search for'	kím-u H	'(You) Look for!'
d.	qívu	'to speak'	**qivu-u** **H**	'(You) Say!'
e.	súpu	'number'	**supu-u** **H**	'(You) Count!'

Shown in (4a-c), imperative construction is marked by a low boundary tone when the vocalic morpheme is added to the consonant-final stems or vocalic stems ending with vowels other than **u**. The imperative words were recorded in isolation. It is very likely that the end of the word is also the end of an intonational phrase, which may result in the low boundary tone. The pitch peak is aligned with the stressed syllable, i.e., the penultimate syllable of the imperative words. A pitch track of the imperative word **kán-u** '(You) Eat!' is illustrated in Figure 4.2. The vertical dashed line represents the timed f0 landmark with respect to syllables.

Shown in Figure 4.2, the f0 peak occurs at the beginning of the stressed syllable **ká**, and the high flat pitch line in the first syllable is followed by a falling tone in the second syllable **nu**, also the final syllable of the imperative word.

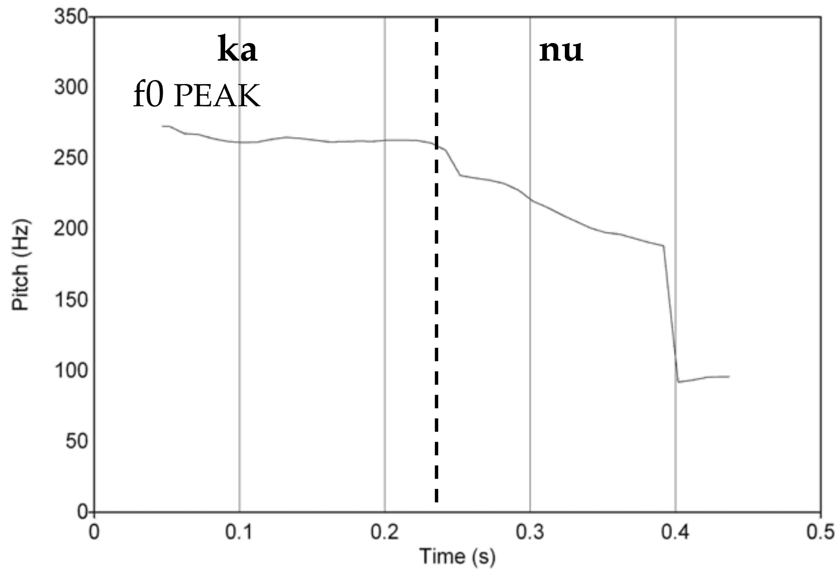


Figure 4.2: Pitch Track of the Word *kánu* '(You) Eat!'

However, when the imperative vocalic morpheme is added to vocalic stems ending with the same vowel **u**, the pitch peak is aligned with the right edge of the construction, i.e., the final syllable of the prosodic word, as shown in (4d-e). Imperative forms in (4d-e) differ from non-imperative forms in the occurrence of f0 peaks in the final syllable. The final syllables in the two imperative examples are not stressed, and they just bear high tone. For instance, the prosodic word **súpu** 'number' has a stress on the first syllable **sú**, and the f0 peak in the word occurs in the syllable **sú**. When the imperative morpheme **–u** is added to the word to form **supu-u** '(You) Count!', the f0 peak occurs in the second syllable **pu**, the final syllable of the imperative form. A pitch track of the imperative form **supu-u** '(You) Count!' is illustrated in Figure 4.3. The vertical dashed line represents the timed f0 landmark with respect to syllables.

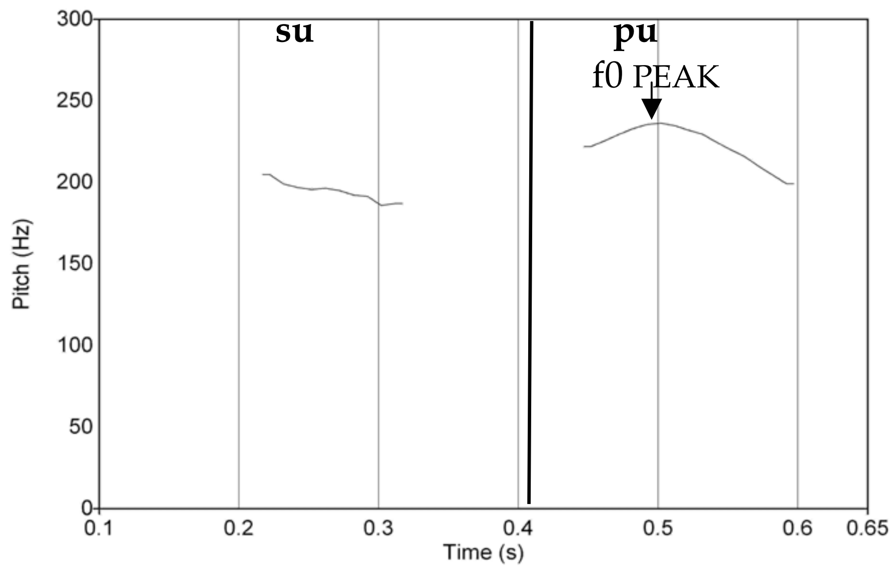


Figure 4.3: Imperative pitch accent in the word *supu* '(You) Count!'

Shown in Figure 4.3, the f0 peak occurs in the second syllable **pu**, also the final syllable of the imperative word. Note that the peak does not occur at the begging of the second syllable, around 85 milliseconds late.

The paradigm of Paiwan imperative construction is illustrated in (5). The data presented here were collected from Central Piuma Paiwan, in which penultimate schwa will result in a final stress. In the imperative paradigm, pitch peaks occur in the stressed syllables when the vocalic morpheme is added to the consonant-final stems or vocalic stems ending with the vowel other than **u** and **i** respectively in exclusive and inclusive imperative construction. The alignment of the pitch peak with the stressed syllable indicates no extra pitch accent occurs in the prosodic words, and the pitch peak is the phonetic realization of stress. On the other hand, when the imperative vocalic morpheme is added to stems ending with the identical vowel, pitch peaks always occur in the final syllable of the prosodic words. In the following examples, final pitch accent in imperative construction is underlined with a sketch of pitch track.

(5)

Exclusive Imperative	Gloss	Inclusive Imperative	Gloss
a. pasəɟám-u	‘(You) Borrow!’	pasəɟám-i	‘(We) Borrow!’
b. pabərús-u	‘(You) Spurt!’	pabərús-i	‘(We) Spurt!’
c. kaɭáva-u	‘(You) Wait!’	kaɭáva-i	‘(We) Wait!’
d. ɟapəs-ú	‘(You) Blow!’	ɟapəs-í	‘(We) Blow!’
e. ɖukúŋ-u	‘(You) Stoop!’	ɖukúŋ-i	‘(We) Stoop!’
f. káts-u	‘(You) Bite!	káts-i	‘(We) Bite!’
g. patsún-u	‘(You) Look!’	patsún-i	‘(We) Look!’
h. aɭáp-u	‘(You) Take!’	aɭáp-i	‘(We) Take!’
i. mucáq-u	‘(You)Vomit!’	mucáq-i	‘(We)Vomit!’
j. pavái-u	‘(You) Give!’	<u>**pavái-i**</u>	‘(We) Give!
		H	
k. qíʎa-u	‘(You) Store!’	qíʎa-i	‘(We) Store!’
l. sənáv-u	‘(You) Wash dishes!’	sənáv-i	‘(We) Wash dishes!
m. gatsáʎ-u	‘(You) Stand up!’	gatsáʎ-i	‘(We) Stand up!’
n. váik-u	‘(You) Go!’	váik-i	‘(We) Go!’
o. káɭi-u	‘(You) Dig!’	<u>**káɭi-i**</u>	‘(We) Dig!’
		H	
p. səʎúp-u	‘(You) Suck!’	səʎúp-i	‘(We) Suck!’
q. zurúŋ-u	‘(You) Push!’	zurúŋ-i	‘(We) Push!’
r. kivadáq-u	‘(You) Ask!’	kivadáq-i	‘(We) Ask!’
s. pasəmaɭáv-u	‘(You) Tell’	pasəmaɭáv-i	‘(We) Tell’

t. ɟumák-u ‘(You) Come in!’ ɟumák-i ‘(We) Come in!’

v. sənái-u ‘(You) Sing!’ **<u>sənai-i</u>** ‘(We) Sing!’

H

w. suqəɭəv-ú ‘(You) Open!’ suqəɭəv-í ‘(We) Open!’

x. taɭəm-ú ‘(You) Plant!’ taɭəm-í ‘(We) Plant’

w. qəʎəv-ú ‘(You) Close!’ qəʎəv-í ‘(We) Close!’

z. qərəŋ-ú ‘(You) Lie down!’ qərəŋ-í ‘(We) Lie down!’

Imperative final accent results in the pitch peak not aligned with the stressed syllable. Accent occurs at the final syllable to distinguish a verb stem from an imperative verb, when the stem ends with the identical vowel with the imperative vocalic morpheme. As we have seen in Chapter 2, vowel length in Paiwan is not phonemic (§ 2.4). The imperative morpheme does not form a long vowel with its preceding vowel in prosodic surface representations[2]. Some imperatives ending with a high tone is due to the realization of stress, when the vowels in the penultimate syllables are weak schwas.

Blust (2003) investigates the Thao language, another Formosan language, and proposes *vetative stress shift rule* in which the imperative suffix is stressed in vetative constructions when it occurs in consonant-final stems or vocalic stems which do not produce a diphthong. Blust (2003) claims that vetative stress shift is conditioned by a mixture syntactic and phonological consideration. However, the connection between syntax and phonology in Thao is not clear in his dictionary. The patterns of vetative stress shift in Thao are somewhat similar to

[2] Informal measurements of vowel length have been done for the imperative data. Voice data from two Central Paiwan female speakers were examined. Imperative final vowels were not longer than the final vowels in non-imperative prosodic words in the same condition. Phonetic long vowels were not attested in Paiwan imperative construction.

those of Paiwan imperative. A few examples drawn from Blust's (2003) dictionary are given as follows.

(6) a. /ata tu sakup-i/ [ata tu sakp-í] 'Don't catch it!'

b. /ata tu pasiz-i/ [ata tu pasið-í] 'Don't put it back together!'

c. /ata tu riri-i/ [ata tu reré] 'Don't seek revenge!'

The difference between Paiwan and Thao imperatives is the distribution of 'vetative stress shift', termed by Blust (2003). In Thao, *vetative stress shift rule* applies to all the imperative construction. The 'vetative stress shift', however, does not occur in all the imperative constructions in Paiwan. Peak alignment with the final syllable of a prosodic word occurs only in sequences of two identical vowels across a morpheme boundary in Paiwan. When the imperative vocalic morpheme follows a consonant-final stem or vocalic stems ending with vowels other than **u** or **i**, the vocalic morpheme is integrated into a well-formed prosodic word. Stress assignment occurs in the prosodic word.

Peak alignment with the final syllable of a prosodic word provides another strong evidence for the proposal of word-level pitch accent. The distinctiveness of pitch accent was attested in the production and perception of Paiwan speech. Some accented words are phonemic, in which cases the alignment of peak prominence with the final syllable of the word is obligatory. Failure to implement prosodic rules may result in mispronunciation. Minimal pairs are given in (7). Utterance with imperative pitch accent is underlined and in bold. Again, 'H' indicates a high tone in the prosodic word.

(7)	Paiwan	Pitch Accent	Gloss
	a. paisu	páisu H	'money'

paisu (<paisu-u) **<u>paisu</u>** ‘(excl. imperative) Pestle!
H

b. katsu (<kats-u) kátsu ‘(excl. imperative) Bite!’
H

katsu (<katsu-u) **<u>katsu</u>** ‘(excl. imperative) Bring (it)!’
H

c. vənəɭi vənə́ɭi[3] ‘to buy’
H

vənəɭi (vənəɭi-i) **<u>vənəɭi</u>** ‘(incl. imperative) buy!’
H

Shown in (7), the placement of imperative accent plays a crucial role in the interpretation of the lexical forms. Exclusive imperative ‘pestle’, for instance, differs from ‘money’ only in its pitch accent. In the word **páisu** ‘money’, the high tone is aligned with the penultimate stressed syllable, whereas the imperative high tone is aligned with the final syllable in the word **paisu** ‘(You) Pestle!’ Listeners must catch the pitch accent to distinguish imperative ‘bite’ **kátsu** from imperative ‘bring’ **katsu**. And **vənə́ɭi** ‘to buy’ differs from **vənəɭi** ‘(We) Buy!’ only in its pitch accent.

When the imperative verb is at the end of each turn in conversation or natural discourse, another slight falling appears at the end of the pitch peak. Imperative pitch accent in the word **vənəɭi** ‘(We) Buy!’ is illustrated in Figure 4.4.

[3] The token was collected in Northern Paiwan villages. In Northern Paiwan, penultimate schwa bears stress.

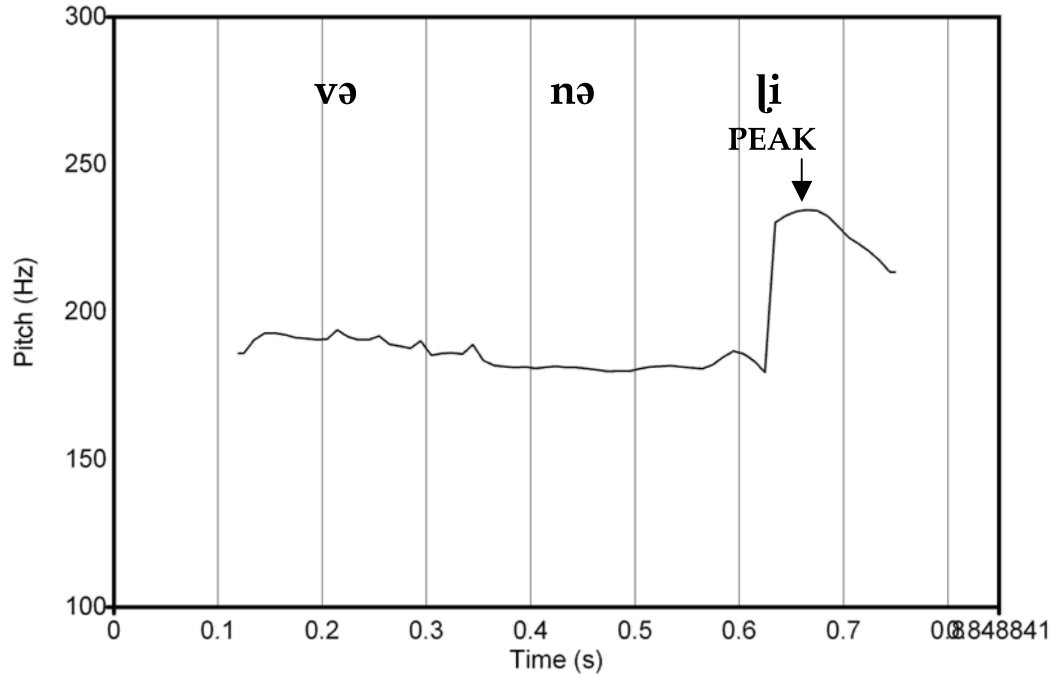


Figure 4.4: Imperative pitch accent in the utterance *vǝnǝḽi* '(We) Buy!'

4.2.2 Pragmatic Accent

In this section, pragmatic functions of pitch accent in Paiwan is described and analyzed. A sketch of accent in address forms is drawn from the prosody in pronouns and proper names in discourse contexts. The emphatic accent investigated here is mainly word-level accent in the contexts of narrative or natural discourse.

4.2.2.1 Accent in Address Forms

Generally speaking, stress pattern is predictable in Paiwan pronouns, as long as pronouns are treated as a well-formed prosodic word. However, it has been observed that second person pronouns in Paiwan demonstrate different patterns of peak prominence from the other categories of pronouns. The prosody in independent pronouns is shown in Table 4.1. 'H' indicates a high tone. All the pronoun tokens were recorded in isolation. However, the second person independent pronouns demonstrate different prosodic patterns from the other independent pronouns in the same context.

Table 4.1: Paradigm of Pronouns

Free Pronoun	**Nominative**	**Genitive**	**Accusative**
1sg	tiakən ($\acute{\sigma}\ \sigma$)	niakən ($\acute{\sigma}\ \sigma$)	canuakən ($\sigma\ \acute{\sigma}\ \sigma$)
2sg	tisun ($\acute{\sigma}\ \sigma$) **H**	nisun ($\acute{\sigma}\ \sigma$) **H**	canusun ($\sigma\ \acute{\sigma}\ \sigma$) **H**
3sg	timaɟu ($\sigma\ \acute{\sigma}\ \sigma$)	nimaɟu ($\sigma\ \acute{\sigma}\ \sigma$)	caimaɟu ($\sigma\ \acute{\sigma}\ \sigma$)
1pl (inclusive)	ticən ($\acute{\sigma}\ \sigma$)	nicən ($\acute{\sigma}\ \sigma$)	canuicən ($\sigma\ \acute{\sigma}\ \sigma$)
1pl (exclusive)	tiamən ($\acute{\sigma}\ \sigma$)	niamən ($\acute{\sigma}\ \sigma$)	canuamən ($\sigma\ \acute{\sigma}\ \sigma$)
2pl	timun ($\acute{\sigma}\ \sigma$) **H**	nimun ($\acute{\sigma}\ \sigma$) **H**	canumun ($\sigma\ \acute{\sigma}\ \sigma$) **H**
3pl	tiamaɟu ($\sigma\ \acute{\sigma}\ \sigma$)	niamaɟu ($\sigma\ \acute{\sigma}\ \sigma$)	caiamaɟu ($\sigma\ \sigma\ \acute{\sigma}\ \sigma$)

Shown in Table 4.1, Paiwan second person independent pronouns, either singular or plural, have a pitch high accent falling on the final syllable, not the stressed syllable. The pitch accent attested here has something to do with the spatial concept of the Paiwan speakers. Second person pronouns were elicited as calling persons face-to-face. The words were not used when the recipients were not present. In other words, second person pronouns were treated as address forms, to call a listener or addressee with short distance from the speakers. Similar pitch accent was also attested in Paiwan proper names.

Proper names and kinship terms of Central Piuma Paiwan with their address forms and pragmatic accent are illustrated in (8). In the following examples, shortening often occurs in juvenile forms.

(8)	Paiwan Names	Address Form		Pitch Accent
	a. Báḷis	Baḷis		Baḷis
	b. Cəbəḷáŋ	Ibaŋ / əḷaŋ		Ibaŋ
	c. ḷaváus	ḷavaus		ḷavaus
	d. ḷúzəm	ḷuzəm		ḷuzəm
	e. Zíbuḷ	Zibuḷ		Zibuḷ
	f. Múni	Muni		Muni
	g. Íḷiŋ (=ə́ḷəŋ)	Iḷiŋ (=əḷəŋ)		Iḷiŋ
	h. Kikiḷəkíḷau	Iḷau		Iḷau
	i. Caḷúbak	Ubak		Ubak
	j. ḷúʎi	Uʎi		Uʎi
	k. kína	ina	‘mother’	ina
	l. káma	ama	‘father’	ama

High pitch accent in address forms falls to the final syllable of the proper nouns or kinship terms, regardless of the quality of the vowel and the position of the stressed syllable. The assignment of the pragmatic accent occurs in the context where the face-to-face relationship between the speaker and the listener has been established. Pragmatic pitch accent falls on the address forms in prosodic words or words in pragmatic accentual phrases (APs). Accentual phrases provide a domain for phrasal accent to occur. For instance, proper nouns and kinship terms can form an address phrase within which phrasal pitch accent occurs. An accentual phrase comprises pitch accent words or contexts where pitch accent can occur. A syllable associated with a pitch accent at the right edge of a prosodic word is more prominent than any syllable that is not associated with a pitch accent.

The high boundary tone at the right edge of the address forms is not an imperative accent. As we have seen that imperative vocalic morphemes always follow verb stems, and the pragmatic high pitch accent occurs at the right edge of proper names or kinship terms in vocative context. The similarity between imperative and the address accent is the high tone alignment with the final syllable of a prosodic word. Both imperative and vocative contexts require the presence of at least two persons, one speaker and one listener. The examples of pragmatic accent in Paiwan address forms provide evidence for the important role of prosody in face-to-face interaction. A high pitch accent in address forms usually falls on the final syllable, the right edge of the prosodic word, regardless of the word stress in the proper names.

4.2.2.2 Emphatic Degree Accent

Emphatic degree accent, usually indicated by a high pitch, was attested in prosodic words in discourse contexts of Paiwan. Emphatic accentuation can be found in many other languages. Laver (1994) argues that the function of emphatic stress is to call the listener's attention to a given syllable or word with greater insistence. A paralinguistic emphatic accent is to signal the degree of intensity judged by the speaker in a discussion context. Emphatic accent in reduplication or affixation does not violate the principles of regular stress, as the pitch peak in emphatic accent is aligned with the stressed syllable. Emphatic accentuation in Paiwan is not only to signal the degree of intensity but also to change the dimension or quantity of lexical interpretation. In word formation, reduplication of a stative verb stem denotes the meanings of plural (many) or intensity. Some reduplication examples already shown in Chapter 2 (§ 2.1.2.8) are repeated here.

(9)

	Stem	Gloss	Reduplication	Gloss
a.	qatsa	'big'	qatsa-qatsa	'tall'
b.	kəḑi	'small'	kəḑi-kəḑi	'very small'
c.	qadid	'bitter-tasting'	qadi-adid	'very bitter-tasting'
d.	vuɭuŋ	'100-pace snake'	vuɭu-vuɭuŋ	'old; very old'

The stem **vuɭuŋ** 'snake' originally signals the type of snake respected by the Paiwan aborigines. The base stem also denotes the meaning of 'old'. Reduplication of the stem denotes the meaning of 'old' or '(more, much more, quite, rather, extremely,) very old', a degree intensifier or emphatic tune. There is no degree adverb 'very' or 'extremely' in the Paiwan lexicon, though the Paiwan aborigines do have the concept of degree scale. The most common way to express the concept of 'very' is either to reduplicate stems or by means of prosodic prominences. In other words, no semantic representation of degree scale was found in the Paiwan grammar structure, but the meaningful process of prosody denotes the degree scale. In the case of the reduplicated form **vuɭuvuɭuŋ** 'old', for instance, the distinction between 'old' and 'very old' is the prosodic representation. The contrast of pitch tracks in the pair **vuɭuvuɭuŋ** 'old' and **vuɭuvuɭuŋ** 'very old' is shown in Figure 4.5.

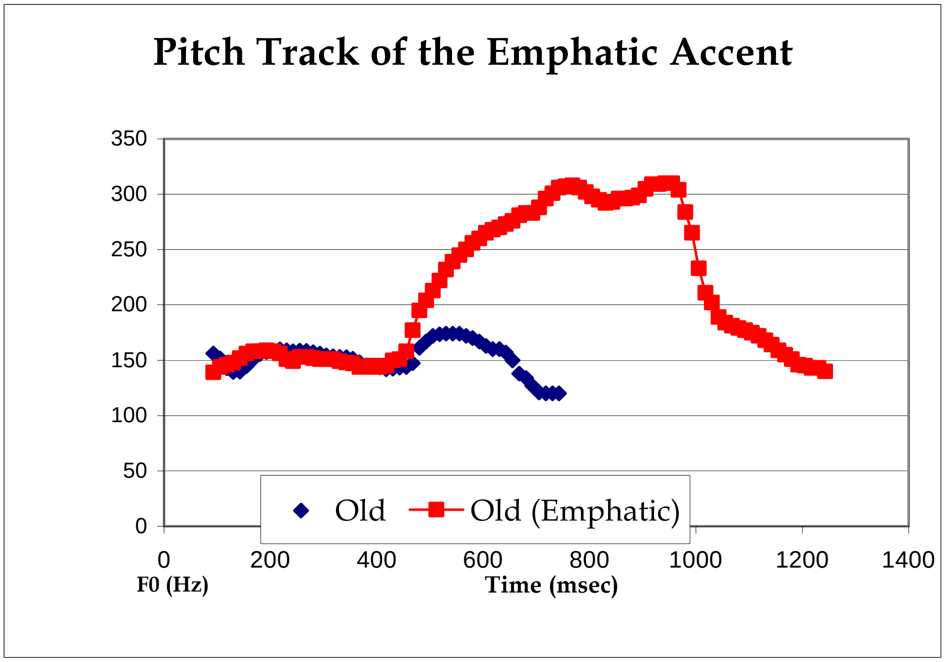


Figure 4.5: Pitch Contrast of *vuɭuvuɭuŋ* 'old' and ***vuɭuvuɭuŋ*** 'very old'

Shown in Figure 4.5, **vuɭuvuɭuŋ** 'very old' has longer duration and higher F0 peak (over 300 Hz) than **vuɭuvuɭuŋ** 'old'. Emphatic accentuation differs from the pitch accent in address forms in its implementation of vowel lengthening of the stressed syllables and the peak alignment with the stressed syllable. Word-level pitch accent in imperatives and address forms is realized as a high pitch peak at the accented syllable, usually the final syllable, whereas both vowel lengthening and high pitch peak of the stressed syllables were attested in the phonetic realization of emphatic accentuation. Emphatic accent applies to any well-formed prosodic word in the context of natural discourse.

To sum up, emphatic accentuation signals both degree of intensity and the distinctiveness on the degree scale. Pitch peaks and vowel lengthening due to emphatic accentuation occurs in the stressed syllables.

4.3 Sentence-Level Prosody in Paiwan

In the section, sentence-level prosody of Paiwan is investigated. The description of prosody is initiated from phrasal stress, prosody in phonological phrases, and the distribution of intonational patterns. An attempt has been made here to capture the prosodic dynamics in Paiwan intonation, such as gradient f0 realization, boundary tone, downstepped or upstepped pitch peak. The transcription of the tone targets presented in this section mainly captures the distinctive tone features. Minor or sporadic tonal realization may be ignored in the transcription. The components of prosodic hierarchy are summarized at the end of this section.

4.3.1 Derivation from Phrasal Stress to Sentential Prosody

As we have seen in Chapter 2, a phonological phrase provides a domain for secondary stress in Paiwan (§ 2.7). A phonological phrase may consist of one construction marker or ligature, which connects two independent words in Paiwan. Word stress is usually retained in the phrasal construction. Ligatures or construction markers refrain from receiving peak prominence in a phonological phrase. The distribution of peak prominences in Paiwan noun phrases is exemplified as follows. Data presented here were collected from Central Paiwan, in which penultimate schwa will result in a final stress.

(10) Peak Prominence in Paiwan noun phrases

	Noun Phrases	Peak Prominence	Gloss
a.	matʃiʎiʎ a aʎak	[[ma.tʃì.ʎiʎ]$_N$a[á.ʎak]$_N$]$_{NP}$	‘one child’
b.	maʎənəm a aʎak	[[ma.ʎə.nə̀m]$_N$a[á.ʎak]$_N$]$_{NP}$	‘six children’
c.	maʎəaɭu a aʎak	[[ma.ʎə.à.ɭu]$_N$a[á.ʎak]$_N$]$_{NP}$	‘eight children’

d. matʃiʎiʎ a suntʃiu	[[ma.tʃì.ʎiʎ]$_{N}$a[súntʃiu]$_{N}$]$_{NP}$	'one village head'
e. ita a kava	[[ì.ta]$_{N}$a[ká.va]$_{N}$]$_{NP}$	'one piece of clothing'
f. ɖusa a kava[4]	[[ɖù.sa]$_{N}$a[ká.va]$_{N}$]$_{NP}$	'two pieces of clothing'
g. unəm a kava[5]	[[ù.nəm]$_{N}$a[ká.va]$_{N}$]$_{NP}$	'six pieces of clothing'
h. aɭu a qaqa	[[à.ɭu]$_{N}$a[qá.qa]$_{N}$]$_{NP}$	'eight crows'
i. ita a vatu	[[ì.ta]$_{N}$a[vá.tu]$_{N}$]$_{NP}$	'one dog'
j. unəm a vatu	[[ù.nəm]$_{N}$a[vá.tu]$_{N}$]$_{NP}$	'six dog'

It is apparent from the examples of noun phrases that the rightmost content word always receives the primary stress, whereas the secondary stress occurs in other content word. Aside from the regular peak prominence in the noun phrases, the data in (10) show the distinctive feature of [+HUMAN] in Paiwan numeral-counting system, indicated by the prefix *ma*- at the left edge of the numeral. Prosodic peak prominence is always retained in the content words.

On the other hand, in phrase-level or sentence-level discourse, more variation of peak prominence was attested. Word stress and word-level accent are usually aligned with specific positions in utterances. In the short phrase *manu udoŋ* 'or noodles', for instance, the conjunction word *ma-nu* 'or; but; however' is not stressed. Phonetically, however, a pitch peak is aligned with the conjunction word. The content word *udoŋ* 'noodles', also a Japanese loan word, is either first accented or second-accented. When the phrase is placed in an interrogative context, the intonational peak prominence, realized as a high boundary tone, is

[4] The complete form of this noun phrase is *ɖusa a tʃauʈʃau wan a kava* 'two piece of clothing'. Older speakers prefer the complete form, according to the informants.

[5] Similarly, the complete form of the noun phrase is *unəm a tʃautʃau wan a kava* 'six pieces of clothing'.

aligned with the right edge of the phrase. A pitch track of the short phrase *manu udoŋ* 'or noodles' is illustrated in Figure 4.6.

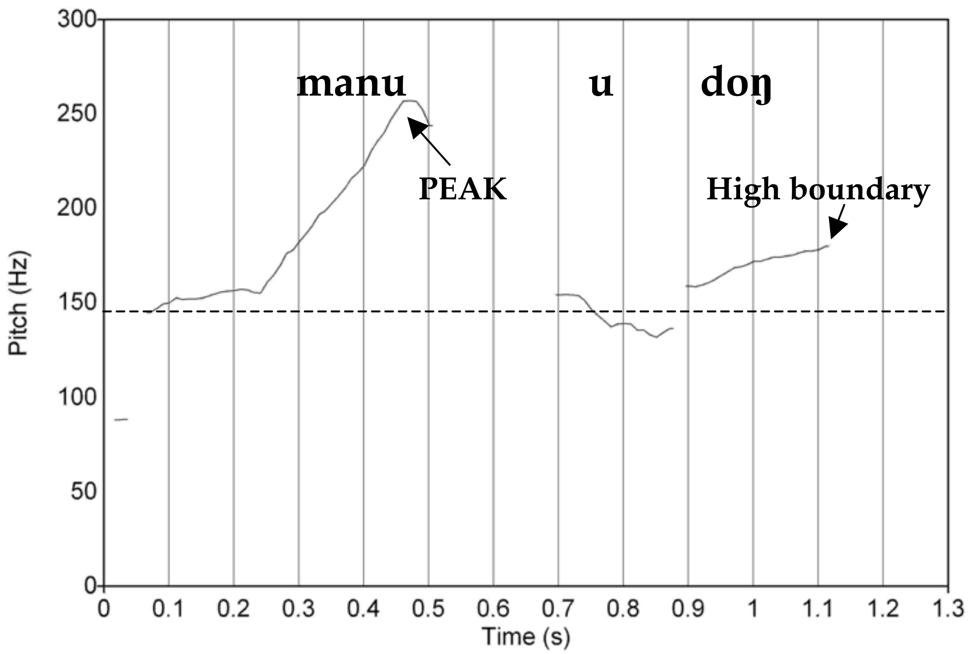


Figure 4.6: Pitch Track of the interrogative phrase *manu udoŋ* 'or noodles'

The prosodic domain of intonational phrases (IPs) and bracketing are created for the different types of prosodic categories and contexts. An Intonational Phrase (IP) consists of at least one prosodic word. The immediate constituents of an intonational phrase must form a sense unit. The prosodic representation in the Paiwan phrase *manu udoŋ* 'or noodles' is illustrated in (11). Each prosodic word in an interrogative context is aligned with a high tone at its right edge.

(11) Intonational Phrasing in Paiwan

manu udoŋ

H H (downstepped)

$[(\ldots\ldots\ldots\ldots)_{\text{Prwd}}\ (\ldots\ldots\ldots\ldots)_{\text{Prwd}}]_{\text{IP-interrogative}}$

Shown in Figure 4.6, the most significant peak prominence in the interrogative phrase is aligned with the right edge of the conjunction word *manu* 'or, but', and a downstepped high tone is aligned with the right edge of content word *udoŋ* 'noodles', the boundary of the interrogative IP.

It is apparent that in an intonatonal phrase, stressed syllables or content words not necessarily trigger a high tone or a phonetic pitch peak. Contexts or types of intonational phrases may determine the occurrence and the alignment of a high tone or pitch peak.

4.3.2 Descriptive Paiwan Intonation

In this section, a preliminary observation and description of Paiwan intonation is presented. Consequential phonetic features, peak prominence, and tonal shape are also noted for the sketch of intonational phrases. One prosodic word may form an independent Paiwan sentence, especially in discourse and conversation. However, many paralinguistic factors are also involved in the face-to-face utterance or discourse. To better capture the contrastive and distinctive prosodic properties of Paiwan intonational phrases, elicitation of minimal pairs from the same speakers was adopted for the preliminary sketch.

The most distinctive intonational feature in Paiwan is the boundary tones at the right edge of intonational phrases. Contrastive types of intonational phrases are declarative/statements and yes/no questions. Declarative sentences in Paiwan are usually aligned with a low boundary tone, whereas yes/no questions are marked by a high boundary tone. Neither does a question marker nor movement of auxiliaries form a yes/no question in Paiwan. Two identical syntactic phrases are differentiated from each other at the intonational level, in terms of intonational boundary tones. The first examples of contrast intonational phrases (IPs) are given in (12). In the examples, 'L' indicates a low tone, and 'H' indicates a high tone.

(12) <u>Syntactic Stratum</u> <u>Prosodic Stratum</u>

a. timaɟu mamazaŋiʎan a′ (timaɟu mamazaŋiʎan)$_{\text{IP-declarative}}$

He is a chieftain. H L

b. timaɟu mamazaŋiʎan b′ (timaɟu mamazaŋiʎan)$_{\text{IP-y/n interrogative}}$

Is he a chieftain? H H

The pitch contrast of the IPs in (12) is illustrated in Figure 4.7. Pitch tracks of these two intonational phrases show the distinctive prosodic structures of intonation. The declarative IP in (12a) has a low ending, while the yes/no question in (12b) has a high ending. The declarative sentence has a distinct pitch contour from the yes/no question in Paiwan. The pitch track of the declarative intonation is represented as the solid line, whereas the pitch track of the yes/no question intonation is represented as the dashed light line.

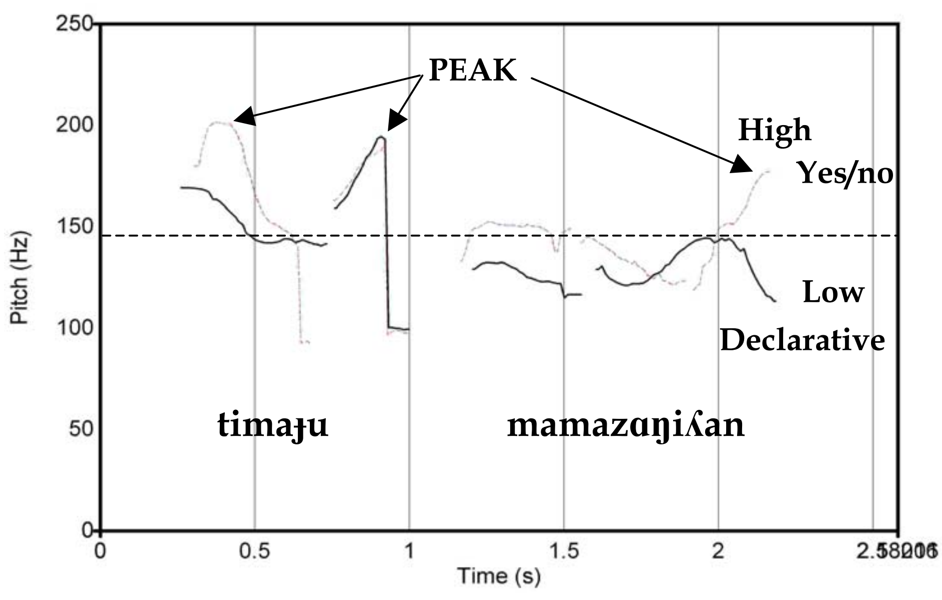


Figure 4.7: Pitch tracks of High and Low boundary tones in *timaɟu mamazaŋiʎan*

Shown in Figure 4.7, the f0 values and the pitch peaks are generally higher in the yes/no question than in the declarative IP. It has been reported that f0 values are higher in questions than in statements (Hadding-Koch and Studert-Kennedy 1964; Inkelas and Leben 1990; Myers 1996). The prosodic facts in Paiwan seem to correspond to the general observations in the other languages.

Intonation in Paiwan overlays the prosodic implementations of word stress, phrasal stress, and accent. In the word **mamazɑŋiʎan** 'chieftain', for instance, word stress falls on the penultimate syllable. When the well-formed prosodic word is placed within the yes/no question IP domain, word stress is overlaid by the high boundary tone at the right edge of the IP.

Tag questions in Paiwan are also aligned with a high boundary tone. One interesting phenomenon attested in Paiwan tag questions is the alignment of the high boundary tone at the right edge of every prosodic word within the IP domain. On the other hand, negation in Paiwan does not show any peak prominence or distinctive prosodic feature. The syntactic phrases of tag and negation, and their prosodic properties are given in (13). The appearance of a rise preceding the negation morpheme, as shown in (13b'), signals the presence of more than one word in the IP.

(13) Syntactic Stratum	Prosodic Stratum
a. timaɟu mamazɑŋiʎan ini	a' [(timaɟu)$_{W1}$(mamazɑŋiʎan)$_{W2}$(ini)$_{W3}$]$_{IP\text{-}TagQ}$
'He is a chieftain, isn't he?'	H H H
b. timaɟu <u>ini-ka</u> mamazɑŋiʎan	b'[(timaɟu)$_{W1}$(ini-ka)$_{W2}$(mamazɑŋiʎan)$_{W3}$]$_{IP\text{-}Neg}$
'He is not a chieftain'.	H H L

A pitch track of the tag question *timaɟu mamazaŋiʎan ini* 'he is a chieftain, isn't he?' is illustrated in Figure 4.8, and a pitch track of the negation intonation *timaɟu ini-ka mamazaŋiʎan* 'he is not a chieftain' is illustrated in Figure 4.9.

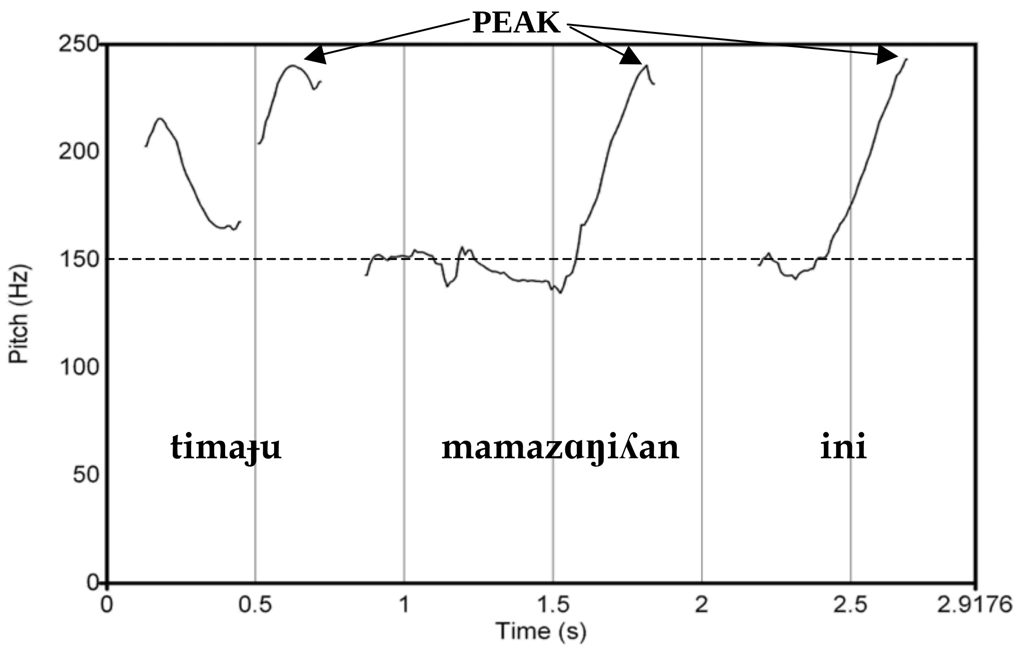


Figure 4.8: Pitch Track of 'He is a chieftain, isn't he?'

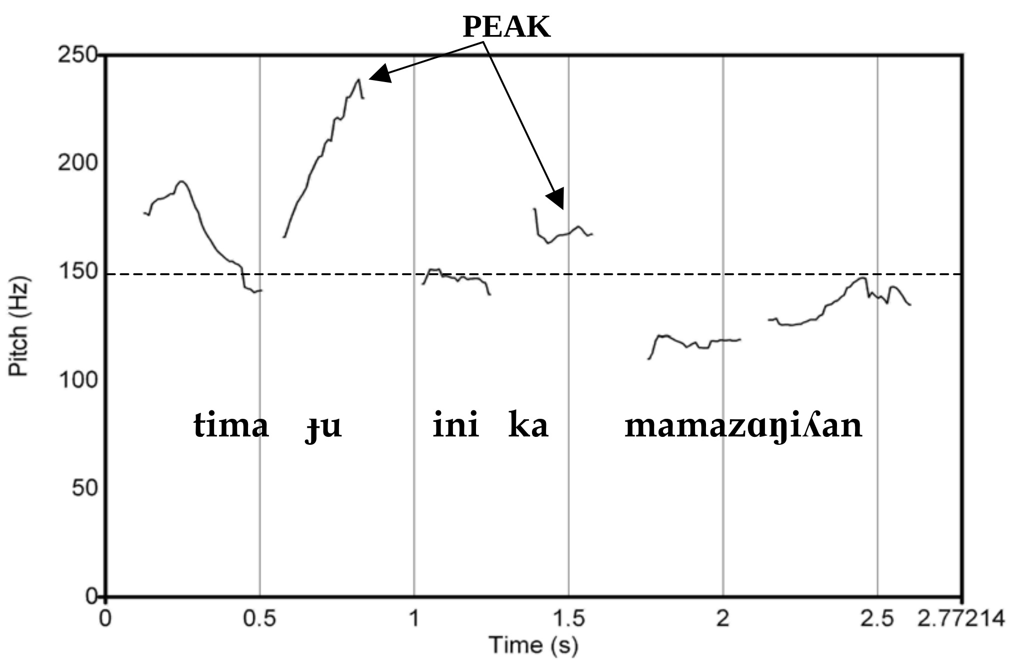


Figure 4.9: Pitch Track of 'He is not a chieftain.'

Shown in Figure 4.8, the right edge of every single prosodic word in the Tag IP is aligned with a high tone. On the other hand, low boundary tone is the prosodic feature of the negation intonation, as shown in Figure 4.9. The pitch peak aligned with the right edge of the first prosodic word followed by the pause signals the upcoming more words. Another high tone may occur in negation words. Negation phrases usually have pitch contours aligned with a low boundary tone at the right edge of the IPs.

In alternative questions connected by the conjunction word *manu* 'or', high boundary tones were also attested. Again, spreading of the high boundary tone occurs at the right edge of every prosodic word within the IP. Specifically, the most significant pitch peak is aligned with the conjunction word *manu* 'or', which is the major component of the interrogative construction. The example of the syntactic phrase with its prosodic properties is given in (14), and the pitch track of the syntactic phrase is illustrated in Figure 4.10.

(14) <u>Syntactic Stratum</u>

timaɟu mamazaŋiʎan manu suntʃiu

he chieftain or village head

'Is he a chieftain or a village head?'

<u>Prosodic Stratum</u>

[(timaɟu)$_{W1}$(mamazaŋiʎan)$_{W2}$(manu)$_{W3}$ (suntʃiu)$_{W4}$]$_{\text{IP-interrogative}}$

H H H H

PEAK (upstepped)

Shown in Figure 4.10, all the prosodic words in the alternative sentence have a rising high boundary tone, which is the evidence for the tone spreading account. All the prosodic words are affected by the interrogative high boundary tone, and the IP ends with a rising tone at its rightmost edge. The highest pitch peak falls to the alternative conjunction *manu* ‘or’.

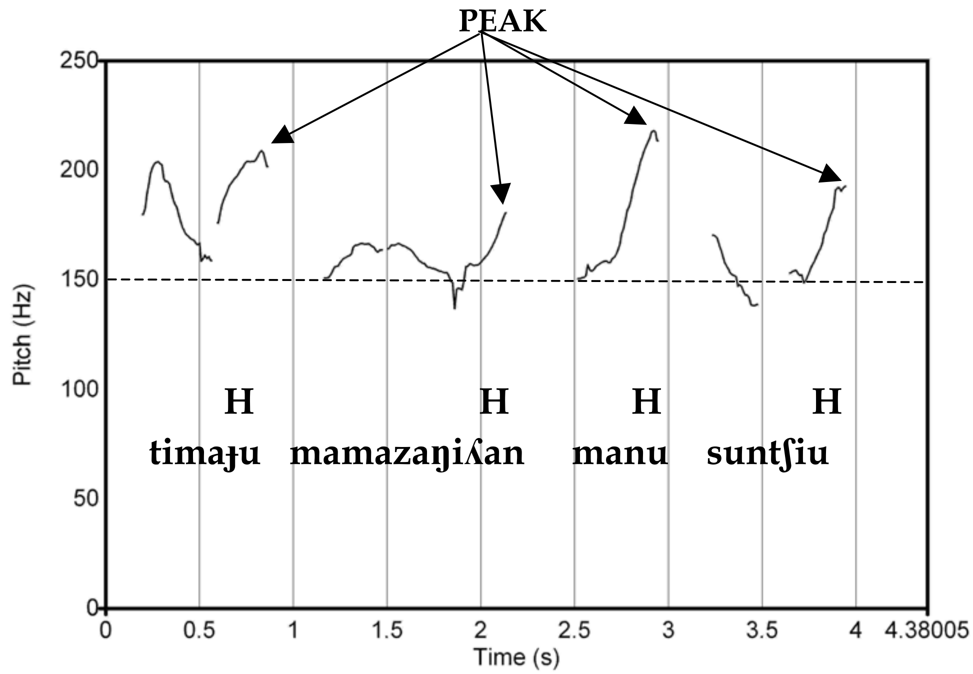


Figure 4.10: Pitch Track of ‘Is he a chieftain or a village head?’

Several types of Paiwan IPs have been investigated so far: declarative, yes/no question, tag question, negation, and alternative question. Now we turn to the prosodic representations of WH-questions in Paiwan. Though there are some WH-words in Paiwan such as *ima* ‘who’, *nəma* ‘what’, *inu* ‘where/which’, *kəmuda* ‘how, why’, *aku* (a zua) ‘why’, there is no question marker except for one particle borrowed from Taiwanese. Yes/no questions in Paiwan cannot be accomplished without the distinctive prosodic properties. Based on the phonetic pitch tracks of the IPs, the distinction between declaratives and yes/no questions in Paiwan has been disclosed. Yes/no questions are aligned with a high boundary tone at the right edge of the IPs. Note that questions in Paiwan are generally aligned with a rising tone, excluding WH-Questions. In WH-Questions, the pitch peak is usually aligned with the WH-words. The WH-questions always end with a low boundary tone. Examples are given in (15), and the WH-words in the examples are underlined.

(15) Syntactic Stratum — Prosodic Stratum

a. ma-inu-sun — a′ [ma-(inu)$_{\text{WH}}$-sun]$_{\text{IP-WHQ}}$

'Where are you going?' — H L

b. tima-sun — b′ [(tima)$_{\text{WH}}$-sun]$_{\text{IP-WHQ}}$

'Who are you?' — H L

c. a nəma i-tsu — c′ [a (nəma)$_{\text{WH}}$ i-tsu]$_{\text{IP-WHQ}}$

'What is this? — H L

d. a nəma a-zua — d′ [a (nəma)$_{\text{WH}}$ a-zua]$_{\text{IP-WHQ}}$

'What is that?' — H L

e. tima sun ŋadan — e′ [(tima)$_{\text{WH}}$ sun ŋadan]$_{\text{IP-WHQ}}$

'What is your name?' — H L

f. Syntactic Stratum

maka inu a caɭan a səma tia sutsiu

road where Lig walk Lig in direction of Lig village head

'How to walk to the village head's house?'

Prosodic Stratum

[maka (inu)$_{\text{WH}}$ a caɭan a səma ta i-sutsiu]$_{\text{IPpWHQ}}$

H H H L

A pitch track of the sentence (15f) 'how to walk to the village head's house' is illustrated in Figure 4.11. No matter how many pitch peaks occur in the

WH-question IP, the final syllable of the IP is aligned with a falling tone. One of the peaks is aligned with the WH-word.

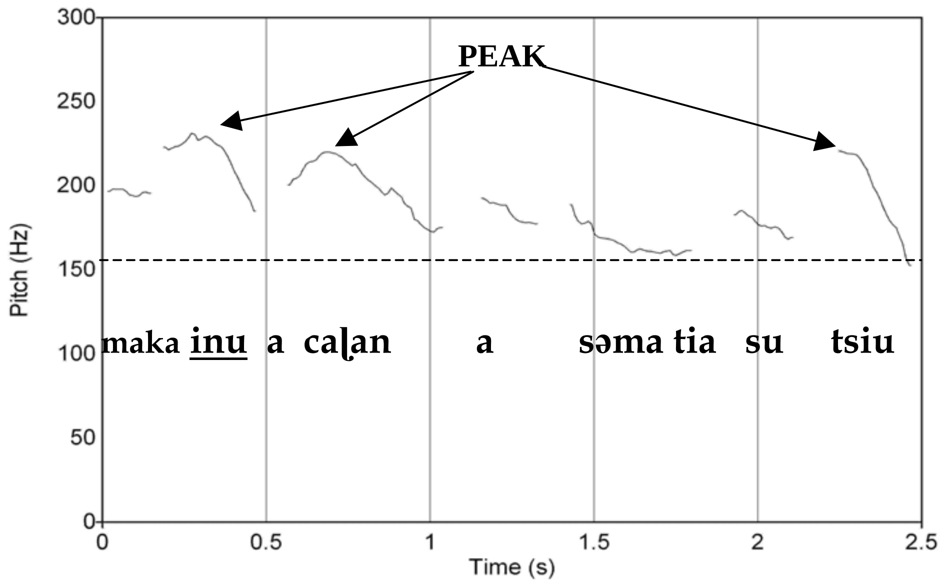


Figure 4.11: Pitch Track of 'How to walk to the village head's house?'

Thus far, four types of Paiwan interrogative intonation have been investigated: yes/no, tag question, alternative, and WH-questions. The prosodic typology of the interrogative intonation in Paiwan is summarized in (16).

(16) a. Types of interrogative intonation with a high boundary tone:

(i) Yes/No: Is he a chieftain?

(ii) Tag: He is a chieftain, isn't he?

(iii) Alternative: Is he a chieftain <u>or</u> village head?

b. Types of interrogative intonation with a low boundary tone:

WH-Questions: Where, When, What, Who, How, Why

Distinctive features in minimal pairs of declarative and yes/no IPs were also attested in embedded or complex sentential construction. Primary prosodic envelope, prominence and modality of Paiwan intonation are usually retained in longer IPs with slow tempo in elicitation. For instance, a high boundary tone at the right edge of an IP is never associated with declarative sentences. A few more contrastive pairs of declarative/Yes-No Question are illustrated in (17)-(19). In these pairs, syntactic phrases are numbered as letters, whereas their prosodic intonational phrases are marked with diacritics. For example, **a′** is the prosodic representation of the syntactic phrase **a**.

(17) Declarative/ Yes-No Question Contrast

a. azua timaɟu a uqaʎaj vaik-aŋa qəmaʎup tua vavaj

this he Lig man go-Past.AF hunt Lig boar

'The man went hunt for boars.'

a′ [azua timaɟu a uqaʎaj vaik-aŋa qəmaʎup$_P$ tua vavaj]$_{\text{IP-declarative}}$

L

b. azua timaɟu a uqaʎaj vaik-aŋa qəmaʎup tua vavaj

=na vaik-aŋa qəmaʎup tua vavaj zaua timaɟu a uqaʎaj

'Did the man go hunt for boars?'

b′ [na vaik-aŋa qəmaʎup tua vavaj zaua timaɟu a uqaʎaj]$_{\text{IP-yes/no Q}}$

H

(18) a. azua unəm a puɭuq a tsaviʎ a uqaʎaj vaik-aŋa qəmaʎup

this six Lig ten Lig year Lig man go-Past.AF hunt

'The sixty-year old man went for hunting.'

a′ [azua unəm a puɭuq a tsaviʎ a uqaʎaj vaik-aŋa qəmaʎup]$_{\text{IP-declarative}}$

H L

b. azua unəm a puɭuq a tsaviʎ a uqaʎaj vaik-aŋa qəmaʎup

this six Lig ten Lig year Lig man go-Past.AF hunt

'Did the sixty-year old man go for hunting?'

b′ [azua unəm a puɭuq a tsaviʎ a uqaʎaj vaik-aŋa qəmaʎup]$_{\text{IP-yes/no Q}}$

H H H

(19) a. azua aɭu a puɭuq a tsaviʎ a vavajan ŋuaŋuaq-aŋan

this eight Lig ten Lig year Lig woman pretty-AF

'The eighty-year old woman is very pretty.'

a′ [azua aɭu a puɭuq a tsaviʎ a vavajan ŋuaŋuaq-aŋan]$_{\text{IP-declarative}}$

H L

b. azua aɭu a puɭuq a tsaviʎ a vavajan ŋuaŋuaq-aŋan

this eight Lig ten Lig year Lig woman pretty-AF

'Is the eighty-year old woman very pretty?'

b′ [azua aɭu a puɭuq a tsaviʎ a vavajan ŋuaŋuaq-aŋan]$_{\text{IP-yes/no Q}}$

H H H

Prosody in conditional clauses is aligned with a low boundary tone at the right edge of the IPs. The conditional word *nu* 'if' at the left edge of the IPs is usually aligned with a high tone. Whenever a continuation rise appears sentence-medially, with or without disjuncture, it usually signals the presence of more than one prosodic word or clause in the sentence. A downstepped pitch peak, an F0 peak that is lowered relative to a preceding high accent peak, was usually attested in the second subjective clause in fast speech. Examples of conditional clauses and the subjunctive phrases are given in (20). Again, **a′** is the prosodic representation of the syntactic phrase **a**.

(20) a. nu vənaɭi mata i Baɭis-akən

if wind Lig go Baɭis-I.AF

'If typhoon comes, I will go to Baɭis's place.'

a′ [(nu vənaɭi)Clause1(mata i Baɭis-akən) Clause2]IP-Conditional

H H L

b. nu vənaɭi ini-ka-kən a səma Akau

if wind Neg-I.AF Lig toward Pingtung

'If typhoon comes, I will not go to Pingtung.'

b′ [(nu vənaɭi) Clause1 (ini-ka-kən a səma Akau) Clause2]IP-Conditional

H H H L

(downstepped)

c. ka-patsun tua azua a vavajan a ɟukuɟukuɭən (nua azua uqaʎaj)

AF-see Lig this Lig woman Lig hit (Lig this man)

vaik a pasəmaɭav tua mamazaŋiʎan

go Lig tell Lig chieftain

'When you see a woman being hit (by a man), go tell the chieftain.'

c′ [(ka-patsun tua azua a vavajan a ɟukuɟukuɭən) Clause1

H H

Disjuncture(vaik a pasəmaɭav tua mamazaŋiʎan) Clause2]IP-conditional

H H L

(downstepped)

As we have seen in (20c′), the syllable with final schwa nucleus in the word **ɟukuɟukuɭən** 'hit' is aligned with a pitch peak in the IP. The intonational phrasal level must dominate the prosodic word level to accomplish the alignment of peak prominence in the IP. This provides some support for the proposal of prosodic hierarchy and prosodic stratum in Paiwan.

To sum up, boundary tones are the major distinctive features in Paiwan intonational phonology. Specific word categories, such as alternative conjunction markers, tags, WH-question words, conditional clauses, and subjunctive moods may trigger the alignment of peak prominence within the IP domain. Peak prominence at the right edge of each IP classifies the intonational typology of Paiwan. Word stress and phrasal prosodic properties are overlaid by the peak prominences in the IPs. In natural speech, phonetic downstepped or upstepped pitch peaks may occur in the prosodic representations of the IPs.

4.3.3 The Mapping between Syntax and Phonology in Paiwan

Does the boundary tone always correspond to the types of syntactic phrases? Does the prosodic representation always reflect the grammatical categories? Given that some syntactic phrases form an independent IP while others do not, the gray area between different types of syntactic phrases and IPs should be accounted for. In the section, an attempt was made to capture the mapping between syntax and phonology in Paiwan, the combination of various syntactic phrases within a global intonational phrase domain.

A set of declarative and negation IPs is given in (21). Again, **a′** is the prosodic representation of the syntactic phrase **a**.

(21) a. vaik a patsun tua quʎivaŋərau

go see Lig rainbow

'I went to see the rainbow.'

a′ [vaik a patsun tua quʎivaŋərau]$_{\textbf{IP-declarative}}$

H H L

b. <u>ini ka</u> kən a patsun tua quʎivaŋərau

=ikakən

Neg I.AF Lig see Lig rainbow

'I did not see the rainbow.'

b′ [ini ka kən a patsun tua quʎivaŋərau]$_{\text{IP-negation}}$

H H L

c. patsun-akən tua quʎivaŋərau, ika-kən a patsun tua qərəpus

see-I.AF Lig rainbow Neg-I.AF Lig see Lig cloud

'I saw the rainbow, not clouds.'

c′ [[patsun-akən tua quʎivaŋərau]$_{\text{IP}}$, ika-kən a patsun tua qərəpus]$_{\text{IP}}$

H H H L

The sentence in (21c) can be parsed into two independent intonational phrases (IPs): 'I saw the rainbow' as the first IP, and 'I did not see the cloud' as the second IP. When two IPs come together in utterances, the first IP is aligned with a high tone at its right edge to signal the upcoming presence of more IPs, whereas the second IP is aligned with a low tone at its right edge to signal the end of the sentence. The negation morpheme **ika** is not aligned with any pitch peak. It is embedded in the global event of the external IP.

Conditional sentences have the similar prosodic patterns. The fist IP with conditional morpheme is aligned with a pitch peak at its right edge, whereas the second IP is aligned with a low boundary tone at its right edge. A pair of conditional sentences of Paiwan is shown in (22).

(22) a. nu qəmuɟaʎ, kikən a patsun tua quʎivaŋərau

if rain future-I.AF Lig see Lig rainbow

'If it rains, I will see the rainbow.'

a′ [[nu   qəmuɟaʎ]$_{IP1}$, [ki-kən a   patsun tua quʎivaŋərau]$_{IP2}$]$_{IP}$

H   H   H   L

b. nu   ini-ka   qəmuɟaʎ,   ki-kən   a   patsun   tua   qərəpus

If   Neg   rain   future-I.AF   Lig   see   Lig   cloud

'If it does not rain, I will see clouds.'

b′ [[nu   ini-ka   qəmuɟaʎ]$_{IP1}$, [ki-kən a   patsun tua qərəpus]$_{IP2}$]$_{IP}$

H   H   H   L

In some cases the clauses in the intonational construction are not equal, as one of them is an independent sentence in the Paiwan grammar, while the others may be supporting information relying on presupposition. Presupposition of each syntactic phrase forms an independent intonational phrase, with additional postscript in the information structure. Examples are given in (23) and (24).

(23) Presupposition: my pants are red

quɟiʎ   a   kuɭa nua ku-kuŋ,   ini-ka ʎi-ʎuaʎuas

red   Lig foot Lig   I.Gen-pant   Neg   green

'My pants are red, not green.'

Prosodic Representation:

[[quɟiʎ a kuɭa nua ku-kuŋ]$_{IP}$, ini-ka ʎi-ʎuaʎuas]$_{IP}$

H   L   H   L

(24) Presupposition: the eighty-year old woman is pretty

azua   aɭu   a puɭuq   a tsaviʎ   a vavajan   a   ŋuaŋuaq, ini-ka na dəmiŋəsəɭ

this   eight Lig ten Lig year Lig woman Lig   pretty   Neg   Lig   ugly

'The eighty-year old woman is pretty, not ugly.'

Prosodic Representation:

[(azua aɭu a puɭuq a tsaviʎ a vavajan a ŋuaŋuaq)$_{IP}$, ini-ka na dəmiŋəsəɭ]$_{IP}$

H H L H L

Shown in (23) and (24), the low boundary tone within each internal independent IP is aligned with the right edge of the IP. When the extra or supporting information structure is added to the right edge of an independent IP, a new intonational phrase is formed. The supporting information structure, with a high tone falling on the first negation word, is aligned with a low boundary tone at its right edge. This type of presupposition intonation is rather different from the prosodic representation of conditional clauses, as shown in (22), with the first IP aligned with a high tone at its right edge.

Thus far, various prosodic categories have been investigated. Prosodic structure in Paiwan comprises syllables, feet, prosodic words, phonological phrases, accentual phrases, and intonational phrases. The constituents of prosodic hierarchy in Paiwan are summarized in (25), a revision of the earlier proposal in (2). Each category is of one level on the hierarchy. However, overlapping between prosodic levels may occur in a wide diversity of syntactic phrases and discourse contexts.

(25) Prosodic Hierarchy of Paiwan (revised)

Utterance (U)

Intonational Phrase (IP)

Accentual Phrase[6] (AP)

Phonological Phrase (PhP)

Prosodic Word (Wd)

Foot (F)

Syllable (Syl)

[6] An accentual phrase, as mentioned in section 4.2.2.1, provides a domain for phrasal accent to occur.

Prosody hierarchy shown in (25) may collapse in utterances or natural discourse, as we have seen the vague distinction between phrases (APs, PhPs) and intonational phrases (IPs), and sometimes even between prosodic words (Wds) and intonation phrases (IPs). Woodbury (1998) has found from an hour-long tape of Cup'ig (Nunivak Central Alaskan Yupik Eskimo) natural discourse that pausing and final pitch cadences are local events but governed by linguistic conventions in their use in context. Based on his findings, he argues that pausing and final pitch cadences in Nunivak offer no positive support for the prosodic hierarchy. In the current project, the discourse data collected in the Paiwan villages did show pause variation among the speakers. It is apparent that the prosodic hierarchy is based on some assumptions, while much more natural and spontaneous peak prominence or pausing of speech may come to contradict the clear-cut levels of the hierarchy.

4.4 Prosody in Paiwan Oral Narrative and Discourse

4.4.1 Prosody in Paiwan Oral Narrative

In this section, a preliminary description of the prosody in Paiwan oral narrative is provided. Data presented here were drawn from the Academia Sinica Formosan Language Archive[7].

The topic of the oral narrative is "the establishment of the Kuskus Tribe". The old narrator was telling the interviewer how his tribe was established and the migration and the settlement in his tribal history. In the overall 273 lines of oral narrative, *muri* 'have intention of doing' occurs most frequently in the *Abstract*, an introductory element. The word is usually aligned with a high tone

[7] Academia Sinica Formosan Language Archive is available from the following website: http://formosan.sinica.edu.tw/formosan/ch/text_frame.asp

at its second syllable, followed by variable degree of pausing. The occurrence of '*muri*' in story-telling narrative has a bearing on both information structure and prosody. The intentional marker usually brings new information structure in the speech flow, and the marker is associated with vowel lengthening and a rising tone. A high pitch tone alignment with the right edge of the intentional marker, as a function word, signals the upcoming new information structure. Peak prominence, on the other hand, occurs most frequently in the complicating action stanza. The wider pitch range between high and low tones occurs in the events of the narrative's plot. As far as speech tempo is concerned, slow tempo usually occurs at the beginning of each stanza, and the tempo accelerates when a string of information structure follows one another, usually in the middle of a stanza. Fast tempo also triggers peak prominence in complicated actions, especially when the peak prominence is associated with the narrator's attitude and emotion. Boundary tones are cues for pausing, lengthening, beginning and ending of an information structure. It is noted that word stress is overlaid by phrasal accent and intonation, and peak prominence alignment is more evaluative than structural. Prosodic representations together with speech tempo and volume are added to a few lines in the narrative, as illustrated in (26). In the following examples, '>>' denotes tempo accelerating, and '<<' denotes fast slowing. High volume is indicated by capital letters. Pausing is indicated by decimals or dots inside the parentheses. The symbol '::' indicates vowel lengthening.

(26) Prosodic Representations in Paiwan Narrative

002 **muRI**(.) ʔi-kai-aʔən(.), **muri** (.) s-əm-anə(0.0) miɭi-miɭiŋ-an-aʔən TAʔ::(.2)-

H **L** **H** **H**

003 in-a-qati-an NA:: (.5) --hh nimica (ʔasi-maza i kuskus (.). >>tu **muri** (.)

H **L** **H**

004 s-in-anə) caw-tsikəɭ-aŋa(.), tu **muri** (.) ka-kəʎaŋ-an-aŋa<<pacə-MIɭIŋ NA::

L H L H H

005 ma-qati-qati a paru (0.0)pacə-VU::VU::(.4) >>a **muri** (.) ʔu-si-cumaʎ,

L H H

muri (.) si-san- miɭi-miɭiŋ-an,

H H L

'I want to narrate our migration to the Kuskus tribe. I want to tell you this story, our oral history, to pass it on to the next generation.'

Orientation

008 **SA:** itsu a (.) ʔu-kinəʎaŋ (.), masa ʔasi-taʔu-**vuvu** a (0.0)

H L L H

<< **VUɭU:-VUɭUŋ:** (.), zua a na-

H H

'Regarding the geographical location of the old village (Saqetsenglj), it was my ancestor who told me.

Complicated Action[8]

045 **qua** (.3), na-**KUMUDA** aqu (.) na::hh (.3) -ma-qaɭuvuʔ (0.0) aqu (0.0)

H H L H L

>>na-mara-rivu == tiamaɟu==

046 → nu==**<u>aja-icən?</u>**(.5) masa(0.0)aitsua(.) i-maza ta tapaw nutsua== maru (.)

H H L

047 →ca-ʎaʎak== ta maru (.) hh ʔa-ɭaiŋ-an a (0.0) **<u>MA-ZA-ZAŋIʎ-AN</u>**?

L L H

'Well, why did the turmoil happen? What did they quarrel about?

[8] In the following stanza, the symbol '= =' indicates latched utterances with no gap. The arrow '→' is to draw attention to location of direct interest to discussion.

What happened din the small chieftain's house was about a grow-up pretty girl (Salrang).'

Peak prominence alignment and volume is evaluative, as observed in the content words such as **pacəmiḷiŋ** 'preserve; pass on' in line 004 and **vuvu** 'grandchildren' in line 005 of the Abstract stanza, and **vuḷuvuḷuŋ** 'ancestor; the elder' in line 008. As we have seen earlier (§ 4.3.2) that WH-Questions in elicitation usually end with a low boundary tone, WH-interrogative mood, however, is realized as a high boundary tone at the right edge of the intonatioal phrase in the narrative context, as shown in line 045-047. This is the evidence for the argument that peak prominence in the narrative context is often evaluative. Structural prominence such as the low boundary tone in WH-Questions is overlaid by the evaluative mood in the narrative. In other words, the levels of prosodic hierarchy collapse in the Paiwan narrative.

4.4.2 Prosody in Paiwan Natural Discourse

The piece of the conversation presented here was drawn from Central Paiwan. Two older Paiwan speakers were introducing themselves to me on my fieldwork trips, as shown in (27). The letter 'M' indicates male speakers, while 'F' indicates the female speaker. The symbol '==' indicates utterances with no gap.

(27) Introducing Conversation

005 M1: ʔə…hh ca-vai ca-vai ʎakua (.)a-… cavai==cavai tima sun a(.) ŋadan
H **H** **H** **L**

006 F: (0.0) ti==Baḷisa:kən
L **H** **L**

'M: Em…our this lady (our this lady) but our this lady, what is your name?
F: My name is Baḷis.'

007 F: ca-vai ca-vai (.) kama (.2) tima hun ?
H L H H L

008 M2: a- (.) ti viguŋ-akən(.), tina.
L H H

'F: Our this gentleman, who are you?

M2: I am Viguŋ, Aunt[9].'

Shown in (27), WH-Questions are aligned with a high boundary tone at their left edge of the sentence in conversation, while answering the inquiry is usually aligned with a low boundary tone at its left edge. The phenomenon is consistent in both male's and female's speech. A speaker's self-correction was attested in line 005, indicated by the function word *ʎaku-a* 'but; however', with a high boundary tone at the right edge of the word to signal unfinished inquiry. On the other hand, the high pitch accent in the final syllable of the address forms was attested sentence-medially in line 007 (*kama* 'father; respected male elder') and sentence-finally in line 008 (*tina* 'aunt; respected female elder'). While word stress is usually overlaid by higher phrasal accents and intonational boundary tones, the high pitch accent in address forms is retained in the conversation. This indicates that the pragmatic accent dealt with social relationship in Paiwan is observably transparent in Paiwan speech, from words to conversation. Paiwan speakers are very cautious about their mutual relationships in the tribal society.

4.5 Prosody in Linguistic Documentation

How do we preserve the speech prosody of an unknown language? People may use digital recording facilities to collect the voice data in the field.

[9] It is polite to address an older woman as "aunt" in the Paiwan tribal society, even if the older woman is not the sister of the addresser's parents or grandparents.

But how can the digital recording be presented in literal transcription? How can the dynamics of prosody be associated with segmental representation? There is no doubt that the prerequisite for documenting the prosody of a language is to describe the observable prosodic patterns and to construct the prosodic structure of that language.

This chapter has provided a description and analysis of different types of Paiwan prosody. The prosodic structure of Paiwan may consist of syllable, foot, prosodic word, phonological phrase, accentual phrase, intonational phrase, and utterance. Stress, word-level accent, and sentence-level intonation boundary tones were attested in the prosodic structure of Paiwan. Phonetic implementations of high and low tones are important indices for word-level pitch accent and the syntactic types of phrases and sentences of Paiwan. However, much more spontaneous peak prominences or pausing of speech may come to contradict the prosodic hierarchy.

Word-level accents conveying various types of semantic and pragmatic information have been investigated. Much more information about the traditional culture of Paiwan and the interaction between the speakers has been revealed in narrative, discourse, and conversation. I believe prosody is a primitive device in Paiwan speech. Prosody could be cohesive in Paiwan, as we have seen a number of contrastive and distinctive prosodic features in intonational phrases. One important finding in this chapter was that tone or intonational variation was best modeled in terms of the f0 realization. Finally, it is hoped that this chapter provides a preliminary framework for describing the prosodic structure of the other Formosan languages or Austronesian languages.

CHAPTER FIVE

PHONETICS AND PHONOLOGY OF BUDAI RUKAI

This chapter deals with the major features of Budai Rukai phonology and the segmental phonetics of Budai Rukai. Segmental phonemes of Budai Rukai have been briefly introduced in earlier field reports (Li 1977a; Zeitoun 2000), but a clear picture on segmental phonology, word stress, and prosodic formation is scanty. Earlier studies (cf. Li 1977a; Ho 1983) focus on either reconstruction or the internal relationships of Rukai. Much more attention has been drawn on whether Rukai is closer to Tsouic or Paiwanic branch. As a result, a comprehensive description of the sound patterns in the individual Rukai dialect is yet in need. Li (1973) depicts the structure of Tanan Rukai, and Hsin (2000) describes some aspects of Maga Rukai phonology. The two studies on different dialects of Rukai have shown distinct phonological representations of Rukai. For instance, Tanan Rukai does not have onset clusters, while onset clusters are important features in Maga Rukai. This indicates distinctive features attested in one dialect could be absent in another dialect of Rukai. Being capable of speaking one dialect of Rukai does not guarantee the intelligibility of the other dialects of Rukai. Furthermore, any claim that Rukai is closer to the Tsouic language or the Paiwanic language based on the data of one single dialect of Rukai is premature. The description of individual dialect of Rukai has become essential for both diachronic reconstruction and the clarification of the internal relationships. Shelley (1978) deals with some socio-linguistic aspects of the Budai dialect of Rukai, with an analysis of the genetic relationship with the other Rukai dialects and Formosan languages. However, phonological and phonetic details have been ignored in his study. On the other hand, though phonemic inventory of Budai Rukai has been constructed in Li's (1995) wordlist, phonetic representations and prosodic structure have not been described. The chapter focuses on a detailed description of distinctive phonemes, segmental phonology and phonetics, and word stress of Budai Rukai, but other parameters of prosodic words that involve in the process of morphology or morphophonemics are also found here.

Section 5.1 is a thumbnail sketch of Budai Rukai morphology. Section 5.2 provides the canonical syllable structure of Budai Rukai. Section 5.3 includes consonant inventory of Budai Rukai. Vowel inventory is given in section 5.4. Section 5.5 focuses upon segmental phonetics. Stress patterns are discussed in section 5.6, in which parameters of stress in Budai Rukai are illustrated. Metrical theory (Hayes 1995) will be adopted for the description of stress. Section 5.7 deals with morphophonemics. Finally, the IPA transcription used for the current study is addressed in section 5.8, with a brief summary of the other types of transcription. The orthography issues are briefly discussed at the end.

While Rukai is a small linguistic group among the Formosan languages, it includes six dialects: Tanan, Budai, Labuan, Maga, Tona, and Mantauran. Li (1995) proposes two main dialect groups of Rukai: (1) Rukai proper—Budai, Tanan and Labuan, and (2) the "Lower Three Villages"—Maga, Tona and Mantauran. The former is located to the west and east, while the latter is located to the north. Li (1973) states that the Tanan and Budai dialects of Rukai are fairly close to each other, whereas the dialects of the Lower Three Villages are more distantly related to the other two groups of Rukai. Based on the tribal classification, Rukai can be divided into three groups: the Eastern Rukai group, the Western Rukai group, and the Lower Village group. In addition, mutual language contact and frequent intertribal marriage have been attested in the newly settlements of the Western Rukai group, such as the villages in the

Sandimen township, and the southern Sanhe Village in the Majia township, where the Northern Paiwan aborigines are located. Due to the geographical environments of their settlements, the Rukai aborigines have had close relations with their adjacent Puyuma and Paiwan aborigines. The aborigines had become related by marriage long before the Chinese people's arrival. Frequent contact with the other neighboring tribes such as Puyuma and Paiwan has influenced the Rukai culture. However, the Rukai people who live at Wutai township in Pingtung County are less influenced by the other tribes, and nowadays they still preserve much of their traditional culture. The geographical distribution of the Rukai language includes three different areas in three counties, with a total population of 10,000 for all three groups: eastern Tanan dialect in Taitung County, southern Budai dialect in Pingtung County, and the northern Lower Three Villages in Kaohsiung County. The three subgroups differ not only geographically but also culturally and linguistically. Budai is referred as Rukai proper, including the villages of Vədai (Budai), Kutsapuŋanə (Haocha), Adiri (Village), Karaməmədəsan (Chiamu) and the other newly settlements in Pingtung County. Geographical names are given inside the parentheses for reference. Li (1973) points out that the local communities where these dialects are spoken identify themselves by the name given to their villages. Budai tribe is geographically close to the Northern Paiwan tribes, and some of the newly settlements are located within the Paiwan territory. Although the influence from Paiwan is inevitable, Budai is treated as the most representative Rukai dialect in Li (1995) wordlist. According to Li (1995), Budai is the most conservative in terms of phonological change.

The investigation of the Budai language in the current study started from the Budai Village in the Wutai township, where the entrance to the mountain area is rather restricted. Earlier field trips to the Northern Paiwan villages have traced the settlements of the Budai Rukai people in the Sanhe Village, Majia township. The Northern Paiwan speakers live in the northern and central Sanhe Village, whereas the Budai Rukai speakers live in the southern Sanhe Village. Most of the Budai speakers who live in the Sanhe Village speak or understand the Paiwan language. The ancestors of the Budai speakers in the Sanhe Village were mainly from Vədai (Budai), Kutsapuŋanə (Haocha), and Karaməmədəsan (Chiamu). All of the Rukai languages spoken in these villages are classified into the Budai dialect. To better assess the sound patterns of the Budai language, I made field trips to Vədai (Budai), Kutsapuŋanə (Haocha) and southern Sanhe Village. The villages investigated in the current study are illustrated in Figure 5.1. The number '1' in the figure indicates Vədai (Budai), '2' indicates Kutsapuŋanə (Haocha), and '3' indicates Sanhe Village in the Majia township.

The informants are two male and three female Budai speakers, ages 50-70. A few elicitation words were double-checked with one younger female speaker in Budai. All of them speak very fluent Budai Rukai language.

Vədai (Budai) and Kutsapuŋanə (Haocha) villages are older villages among the Budai Rukai tribes in Pingtung County. Nearly 100% of the residents in the communities are Budai Rukai aborigines. Budai Rukai is the primary communication language in the tribe. The data collected in Vədai (Budai) and Kutsapuŋanə (Haocha) villages are the bases for this chapter.

Age difference within the same aboriginal community has been mentioned in Li's (1973) study. The younger generation speaks Mandarin in public educational institutions and Taiwanese outside of the tribe. Li (1973) has found a couple of features among the younger speakers of Tanan Rukai, such as

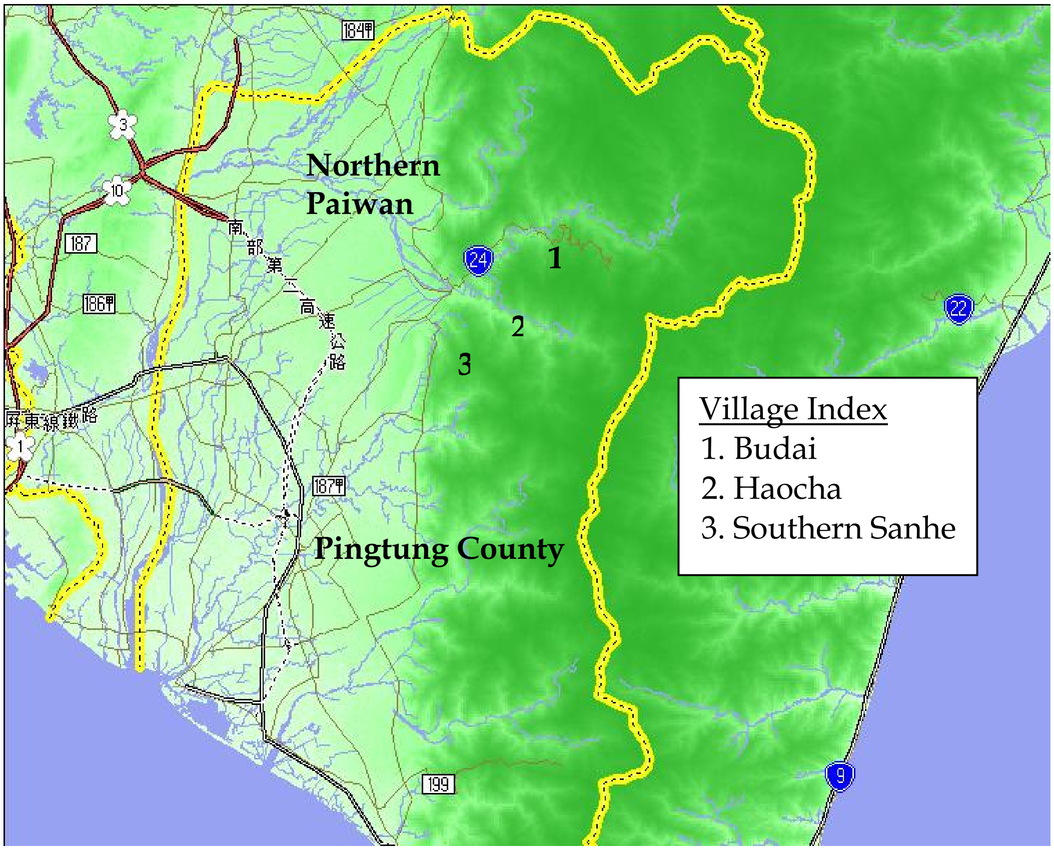


Figure 5.1: Budai Rukai tribes investigated in the current study

different vowels from older ones, metathesis of diphthongs, and the variants of interdental fricatives. In the current study, phonetic variants of interdental fricatives were also attested, as far as segments are concerned. Moreover, it has been observed in my fieldwork that Budai speakers who live in the southern Sanhe village or have frequent contact with the Paiwan speakers tend to produce the Paiwan stress patterns. The description of the contact prosodic variation is found in Chapter 6.

5.1 Thumbnail Sketch of Budai Rukai Morphology

Again, to better facilitate our understanding of Budai Rukai phonetics and phonology, a thumbnail sketch of Budai Rukai morphology is offered here.

Budai Rukai morphemes can be classified into roots and affixes. Roots are independent free morphemes that can be used independently as complete words or utterances, while affixes are bound forms that must be used in combination with other morphemes. Derivational morphemes in Budai Rukai include prefixes, suffixes, infixes, circumfixes and multiple affixes. Derivation and reduplication are productive processes in Budai Rukai. Words are independent forms comprised of independent morphemes or the combination of free stems and bound morphemes. Compounds and loans are restricted in Budai Rukai.

5.1.1 Independent Morphemes

Roots are the independent morphemes as affix targets. Roots in Budai Rukai are generally in the shapes of VCV, CVCV, VCVCV and CVCVCV. Roots longer than three syllables are rather restricted. The word minimality of Budai Rukai is shown in (1).

(1) Word Minimality of Budai Rukai

	Shapes	Roots	GLOSS
a.	VCV	iθa	'one'
b.	CVCV	sapa	'mat'
c.	VCVCV	aŋatu	'tree'
d.	CVCVCV	tuluŋu	'leg'

Affixes may prefix, infix or suffix to a minimal independent word. Prefixes attach to the left edge of roots, and suffixes attach to the right edge of roots. Infixes attach to neither the right edge nor the left edge of roots, usually right after the first consonant or vowel of roots. Circumfixes are the combination of prefixes and suffixes; they attach to both right edges and left edges of roots. Multiple prefixes and suffixes may attach to the right edge or the left edge of roots; infixes may be embedded in prefix sequences. The combination of prefixes, infixes or suffixes may attach to roots to form independent words. Roots in Budai Rukai carry the main components of meanings in a word. In the following sections, fours types of independent morphemes are exemplified: primary nouns, verb stems, stative verb stems as adjectives, and particles.

5.1.1.1 Primary Nouns

Primary nouns in Budai Rukai are simple morphemes that cannot be segmented into simper components. Nouns in Budai Rukai can be used as verbs by adding prefixes to their left edges, as shown in the right column of (2). In the following verb examples, noun roots are in bold and underlined.

(2)	Nouns	Gloss	Verbs	Gloss
	daanə	'house'	tu-a-**daanə**	'to build a house'
	sapa	'mat'	tu-a-**sapa**	'to weave a mat'
	lalakə	'child'	tu-a-**lalakə**	'to give birth'
	ɭima	'hand'	tau-**ɭima**	'to wash hands'

5.1.1.2 Verb Stems

Verb stems generally cannot be used as independent complete words or utterance without proper affixation. Some typical examples are given in (3), in which the verbs in the right column are Agent Focus forms. Agent Focus verbs are formed by adding the prefix morpheme **u-a-**, sometimes realized as **wa-** at the left edges of the verb stems. In the following verbs, stems are underlined.

(3)	Stems	Gloss	Verbs	Gloss
	kanə	'eat'	u-a-kanə	'to eat'
	lupu	'hunt'	u-a-lupu	'to hunt'

uŋulu	'drink'	u-a-<u>uŋulu</u>	'to drink'
ələbə	'close'	u-a-<u>ələbə</u>	'to close'
ituku	'jump'	u-a-<u>ituku</u>	'to jump'

5.1.1.3 Stative Verb Stems as Adjectives

The number of independent stative verb stems in Budai Rukai is rather restricted. Many stative verbs are with the prefix **ma-**, which attaches to the left edge of the stems. Stative verb stems serve as modifiers or adjectives, with or without affixation. In the following examples, prefixes or suffixes are underlined.

(4)

Stative Verbs	Gloss	Stative Verbs	Gloss
tikiŋ-<u>anə</u>	'to be small'	tsələ	'to be deaf'
adaili	'to be far'	adəəθə	'to be near'
ŋəta	'to be raw'	əɖək-<u>anə</u>	'to be short'
baav-<u>anə</u>	'to be new'	<u>ma</u>-palili	'to be bitter'
<u>ma</u>-ɭəmə	'to be ripe'	<u>ma</u>-ɖau	'to be big'

5.1.1.4 Particles

Particles are generally interjections used independently in utterances. Interjections are often in the forms of vowel sequences without consonantal onset. Examples are given in (5).

(5)

Particles	Gloss	Particles	Gloss
iini	'no; do not'	kaɖau	'not have'
ai	'ai (exclamation)'	əənə	'all right'
ha	'ha! (laughing sound)'	oo	'oh! (exclamation)'

5.1.2 Bound Forms

Bound forms in Budai Rukai are non-independent morphemes that must be in combination with either independent roots or other non-independent morphemes to form words.

5.1.2.1 Prefixes

Like Paiwan, prefixes in Budai Rukai are productive derivational morphemes. The number of prefixes is the largest among the affixes. One single prefix morpheme may have different grammatical functions and meanings. Prefixing always occurs at the left edge of roots or stems, shown as follows: PREFIX-$[\ldots]_{stem}$. Prefixes are generally in the shapes of V, CV, VCV, CVCV, and CVCVCV. Prefixes longer than three syllables are restricted. While the number of CV-roots is rather samll, many prefixes are in the form of CV-syllable. Some examples of prefixes are illustrated in (6).

(6)

Prefixes	Functions	Examples	GLOSS
a-	become	a-kaaŋə	'to become fish'
	why	a-su	'why you?'
ana-	if	ana-ɖəmə-ɖəmə	'if think'
api-	like; want	api-kanə	'like to eat'
i-	at; in	i-a-bələŋə	'above'
ki-	to gather; to collect	ki-a-sabiki	'to collect betel'
	Dative Focus	ki-a-laɭa	'to hear'
	to dig	ki-urasi	'to dig sweet potato'
ku-	to remove	ku-a-ŋitsu	'to peel'
	Free Pronoun	ku-su	'you'

	Past	ku-mauŋu	'last night'
la-	Plural	la-bəəkə	'hogs'
lu-	Future	lu-iya	'tomorrow'
ma-	Stative Verb	ma-ɭupi	'weak'
	reciprocal	ma-ɖa-ɖəsəŋə	'to meet'
	two people	ma-taɭagi	'two friends'
mu-	to remove	mu-kipiŋi	'to take off clothing'
	self-motion	mu-a-tsiɭi	'to fall'
muasaka-	ordinal	muasaka-ɖusa	'second'
nai-	have done	nai-kəla	'to have come'
ŋi-	to move in certain	ŋi-a-palay	'to fly'
	direction	ŋi-a-vələ-vələ	'to move'
	-self	ŋi-a-pa-papatsai	'to suicide'
ŋu-	to ride	ŋu-a-rigi	'to ride'
pa-	causative	pa-patsai	'to kill'
paŋu-	by	paŋu-dadavatsə	'by walking'
sa-	body parts	sa-kubu-kubu	'eyelash'
	when	sa-maka-kanə	'when finish eating'
si-	verbal prefix	si-a-uɭi	'to receive'
	to wear	si-a-kipiŋi	'to wear clothing'
sini-	from	sini-vəɖai	'from Budai'
su-	to clean	su-a-ŋuraŋuru	'to snore'
	belong	su-a-vəɖai	'Budaian'
ta-	to feel	ta-katsələ	'feel cold'

taru-	certain	taru-a-ɖau	'rather many'
tu-	to make	tu-a-baava	'to make wine'
tua-	to wash	tua-matsa	'to wash face'
θi-	to release	θi-loro	'to urinate'
u/w	Agent Focus	ua-tinono	'to weave'

5.1.2.2 Suffixes

Diverse grammatical functions of suffixes have been attested in Budai Rukai. One single suffix morpheme may have different grammatical functions and meanings. Suffixes are in the shapes of V, CV and VCV. Suffixing always occurs at the right edge of roots or stems, shown as follows: $[\ldots]_{\text{stem}}$-SUFFIX. Some suffixed morphemes are illustrated in (7).

(7)

Suffixes	Functions	Examples	GLOSS
-a	imperative	kanə-a	'eat!'
	Accusative Case	nai-a	'us'
-ana	still; yet	kaɖua-ana	'have not yet'
-anə	nominalizer	kanə-anə	'food'
-ŋa	completive	u-a-ɖəələ-ŋa	'have seen'
	close to	adəəθə-ŋa	'to get close to'

5.1.2.3 Infixes

Infixes attested in Budai Rukai are all bound morphemes that attach to stems or words. The number of infixes is relatively less. The occurrence of infixes is either at the left edge of stems or embedded in the sequences of prefixes, usually right after the first consonant or vowel of the prefixes. Some of the infixes are allomorphs. Examples are given in (8).

(8)

Infixes	Functions	Examples	GLOSS
-a-	past tense; non-future	u-a-tubi	'to be crying; cried'
	realis	u-a-apətsə	'to be sleeping; slept'
-in-	Goal subject; Past time	t-in-u-baava	'wine that was made'

5.1.2.4 Circumfixes

Circumfixing occurs at the left edge and the right edge of roots or stems. Circumfixes are generally derivational morphemes that are productive and usually attached to roots or stems to form independent words in Budai Rukai. A wide diversity of derivational morphemes was attested. Circumfixes can produce limitless derivation processes in Budai Rukai. A few examples of derivational circumfixed morphemes are illustrated in (9).

(9)

Morphemes	Functions	Examples	GLOSS
a- + -anə	future state	a-ələb-anə	'to be closed'
	nominalizer	a-aga-anə	'to be cooked'
ka-+-anə	real or genuine	ka-baava-anə	'real wine'
		ka-luaŋ-anə	'real cow'
kala-+ -anə	season	kala-kətsəl-anə	'winter'
sa-+-anə	instrument	sa-səvər-anə	'wind'
		sa-ɖukur-anə	'latch'
sanu-+-anə	left-over	sanu-kanə-anə	'food left over'
sanu-+-lə	frequency	sanu-ɭima-lə	'five times'
ta-+-anə	time; location	ta-apə-apəts-anə	'room; time for sleep'

ta-pia-pia-pia-anə	'often'

5.1.2.5 Multiple Affixes

In addition to circumfixes, a few multiple affixes comprised dual or plural affixes are productive as well. They can attach to stems as multiple prefixes, multiple circumfixes, or the combination of prefixes, infixes, suffixes and circumfixes. Some typical examples are shown in (10).

(10)

Morphemes	Functions	Examples	GLOSS
la-ma-	plural marker	la-ma-lalakə	'children'
ḽi-tara-	have to; must	ḽi-tara-kanə	'must eat'
sa-ka-	household	sa-ka-ḓusa	'spouse'
sa-ka-u-… -anə	the whole	sa-ka-u-daanə-anə	'whole family'
sa-ka-si-…l-anə	the…generation	sa-ka-si-tuḽu-l-anə	'the 3rd generation'
ta-ra-	for a period of time	ta-ra-tsaili	'for a year'
	be good at	ta-ra-alupu	'hunter'
t-in-u…-anə	personal relation	t-in-u-agi-agi-anə	'junior'

5.1.2.6 Construction Markers

Construction markers in Budai Rukai are usually syntactic components in either noun phrases or verb phrases, and sentences, similar to agreement markers. Case makers usually occur before nouns. Nouns can be divided into [+animate] and [-animate], whereas visible and invisible nouns have different case markers. The case markers in Budai Rukai are illustrated in Table 5.1.

Table 5.1: Case Markers of Budai Rukai

Case Markers		Visible	Invisible
Nominative		ka	ku
Oblique	[+Animate]	ki	ki
	[-Animate]	ka	ku

Case markers or construction markers are also called ligatures[1] thereafter. Contrastive examples of case markers are given in (11) and (12).

(11) a. wa-apətsə-ŋa ka ɭulai

sleep-past Nom infant

'The infant (this visible infant) slept.'

b. wa-apətsə-ŋa ku ɭulai

sleep-past Nom infant

'The infant (that, invisible infant) slept.'

(12) a. wa-kanə-ŋa ka/ku kaka **ka** bələbələ

eat-past Nom elder brother Obl banana

'Elder brother ate the banana (visible, [-animate]).'

b. wa-kanə-kanə ka/ku kaka **ku** bələbələ

eat Nom elder brother Obl banana

'Elder brother often eats the banana (invisible, [-animate]).'

c. wa-papatsai ka/ku kaka **ki** babui

kill Nom elder brother Obl boar

[1] The term 'case marker' is called 'construction marker' by Ferrell (1979) and is called 'relation marker' by Tsuchida (1976). There are various case marker systems in Formosan languages. Linguists who have been working in the field such as Paul Li and Elizabeth Zeitoun used the conventional term 'ligature' to refer to different syntactic uses of construction markers. As ligature, it links two nouns, verbs or phrases. There is not always a clear distinction between nominative case markers and ligatures. For more discussion on case markers and ligatures, see Li (1996a, 1996b, 1997, 2004).

'Elder brother kills the boar (visible or invisible [+animate]).'

5.1.2.7 Pronouns

Pronouns in Budai Rukai are either bound morphemes or independent personal pronouns. Some bound morphemes behave like construction markers, whereas independent personal pronouns are the combinations of both construction markers and bound morphemes. A complete paradigm of Budai Rukai personal pronouns is illustrated in (13).

(13)	Nominative	Genitive	Accusative
1st person singular	kunaku, -ku -(n)aku, -nau	-li	naku-anə
1st person plural (incl.)	kuta, -ta	-ta, -ita, -mita	mita-anə
1st person plural (excl.)	kunai, -nai	-nai	nai-anə
2nd person singular	kusu, -su	-su	musu-anə
2nd person plural	kunumi, -numi, -nu	-numi	numi-anə
3rd person singular (visible)	kuini	-ini	ini-anə
3rd person singular (invisible)	kuiḓa	—	—
3rd person plural (visible)	kuini	-ini	ini-anə
3rd person plural (invisible)	kuiḓa	—	—

The personal markers never occur in isolation, as most of the markers are dependent on other noun or verb morphemes. Furthermore, nothing can intervene between the personal markers and the noun or verb morphemes, except the completive marker -ŋa, which is also a suffix. For instance, nothing occurs between **lalakə** 'kid' and **–su** 'your' in the example **lalakə-<u>su</u>** 'your kid', but the suffix morpheme **-ŋa** occurs between the verbs and the pronouns in the following examples: **wa-uŋulu-<u>ŋa</u>-<u>ku</u>** 'I drunk', **maka-wa-kanə-<u>ŋa</u>-<u>su</u>** 'you ate'.

5.1.2.8 Focus

Unlike Paiwan and most of the Formosan languages, Budai Rukai does not present particular Agent Focus, Patient Focus, Locative or Instrumental Focus. Instead, only active and passive markers have been attested. The maker morphemes for active and passive verbs are illustrated in (14).

(14) Verbal Markers

a. Active /Agent Focus (AF): prefix u-/w-

b. Passive/ Patient Focus (PF): prefix ki-

The minimal pairs for focus system are given in (15) and (16).

(15) a. **u**-a-kanə-aku ku bələbələ

eat.AF-1sgNom Obl banana

'I eat the banana.'

b. **ki**-a-kanə ku bələbələ

eat.PF Nom banana

'The banana is eaten.'

(16) a. **u**-a-uŋulu-aku ku baava

drink.AF-1sgNom Obl wine

'I drink the wine'

b. **ki**-a-uŋulu ku baava

drink. PF Nom wine

'The wine was drunk.'

5.1.3 Lexical Categories

5.1.3.1 Word Classes

Words are defined as independent forms that are either single independent morphemes such as roots or the combination of independent and bound morphemes. They are independent forms carrying meanings. Words in Budai Rukai can be classified into nouns, verbs, adverbials and particles. Examples of word classes are shown in (17), in which stems are in bold.

(17) a. Nouns: the combination of noun stems and affixes (prefixes, suffixes, or circumfixes)

Stems	Gloss	Words	Gloss
baava	'wine'	ka-**baava**-anə	'real wine'
bətsəŋ	'millet'	kala-**bətsəŋ**-anə	'millet festival'
vavalakə	'kid'	la-**vavalakə**	'kids'
agaga	'to cook'	ta-ra-**agaga**	'cook'

b. Verbs: the combination of verb stems and affixes (prefixes or/and infixes)

Stems	Gloss	Words	Gloss
udalə	'rain'	u-a-**udalə**	'to rain'
savarə	'wind'	ma-**savarə**	'to be windy'
lama	'to burn'	ki-a-**lama**	'is burnt'
apətsə	'to sleep'	api-a-**apətsə**	'want to sleep'

c. Adverbials: the combination of adverbial morphemes and prefixes

Stems	Gloss	Words	Gloss
daanə	'house'	i-a-**daanə**	'in the house'
umauma	'farmland'	sini-**umauma**	'from the farmland'

mauŋu	'night'	ku-**mauŋu**	'last night'
dadavatsə	'to walk'	paŋu-**dadavatsə**	'by walking'
iganə	'time'	ku-**iganə**	'when'

d. Particles: in addition to independent interjection or exclamation particles, quite a few linking particles or conjunctions were also attested in Budai Rukai. Conjunctions must be used in clauses or sentence contexts in combination with the other independent words. In the following examples, particles are in bold.

Particles	Gloss	Example	
si	'and'	vai **si** ɖamarə	'sun and moon'
		maɭagi **si** madau	'long and big'
ai	'but'	maəɭəŋə **ai** mabitulu	'tall but fat'

5.1.3.2 Reduplication

Words in Budai Rukai can be formed by reduplication, without adding any other bound morphemes. Reduplication is a process of repetition of root morphemes, and it occurs not only in noun roots but also in verbs. Full reduplication generally occurs in noun roots or stems, whereas partial reduplication frequently occurs in verbs. Partial reduplication in Budai Rukai can be divided into two types: Ca-reduplication, in which C is the first consonant of the roots or stems, and CV or CVCV reduplication of roots less final syllable. A few examples of Budai Rukai reduplication are illustrated in (18).

(18) Reduplication Process in Budai Rukai

a. Reduplication of noun stems: full reduplication of noun stems indicates a great amount or number, lasting for a period of time. However, the majority of the noun roots in Budai Rukai cannot be reduplicated. Rather, the way to express plural nouns is to add the prefix **la-** before the noun stems. Partial reduplication of the first syllable of the stems may indicate small nouns. The following examples illustrate prefixing reduplication, in which the reduplicants copy one or two syllables from the bases and attach to the left edge of the bases.

Base	Gloss	Reduplication	Gloss
agi	'younger sibling'	agi-agi	'younger siblings'
umasə	'person'	uma-umasə	'many people'
daə	'soil'	daə-daə	'earth, land'
tsaili	'year'	tsai-tsaili	'year after year'
ɖusa	'two'	ɖusa-ɖusa	'to last for two years'
daanə	'house'	da-daanə	'small house'

b. Reduplication of verb stems: reduplication of verb stems usually indicates 'continuous, keep doing, do repeatedly', 'future', or /intensity, comparatively greater'. Reduplicants usually copy one or two syllables, CV or CVCV, from the bases and attach to the left edge of the bases.

Verbs	Gloss	Reduplication	Gloss
ua-tubi	'to cry'	ua-tubi-tubi	'to be crying'
ua-kanə	'to eat'	ua-kanə- kanə	'to be eating'
ua-ɖaɭai	'to dance'	ua-ɖaɭa-ɖaɭai	'to be dancing'
ma-ɖau	'big'	ma-ɖa-ɖau	'rather big'
ma-busuku	'drunk'	ma-busu-busuku	'often drunk'

c. Reduplication of bound stems: reduplicated forms may be derived from bound stems, whose meaning may not be known. In the following examples, reduplication must occur to form independent words. For instance, the meaning of **ɭəgə** is unknown, but the reduplicated form **ɭəgə-ɭəgə** means 'mountain'.

Reduplication	Gloss
ɭəgə-ɭəgə	'mountain'
ɖarə-ɖarə	'light'
ɖərə-ɖərə	'thunder'
ŋisi-ŋisi	'beard'

d. Ca-Reduplication: this type of partial reduplication applies to verbs only. Reduplicants copy the first consonant from the bases and add the vowel **a** to form a fixed Ca-skeleton attached to the left edge of the bases. The new reduplicated forms usually modify the meanings of the bases. When a verb stem does not have a consonantal onset, only the vowel **a** is added. Some examples of Ca-Reduplication are given as follows.

Verbs	Gloss	Reduplication	Gloss
ua-tubi	'to cry'	ma-ta-tubi	'to cry together'
ua-iipi	'to blow'	ma-a-iipa	'to blow together'
ua-ɖəələ	'to see'	ma-ɖa-ɖəələ	'to be careful'
kua-riva	'to talk'	ma-ka-kua-riva	'to talk to each other'

5.1.4 Compounds and Loans

Compounds are restricted in Budai Rukai, and they are more like the combination of roots and affixes or construction markers. Two or more different independent roots or stems cannot come together to form another new independent word without affixes. A few examples are shown in (19).

(19)	Compounding	Words	Gloss
	a. ma-ɖusa-lə ten-two	maɖusalə	'twenty'
	b. ma-vaɭu-lu-si-vəva ten-eight-and-one	mavaɭulusivəva	'eighty-one'
	c. sa-lataɖə-anə tool-outside-nominalizer	salataɖanə	'entrance'
	d. kala-ɖaɭaŋəɖa-anə season-hot-nominalizer	kalaɖaɭaŋəɖanə	'summer'

On the other hand, the number of loans in Budai Rukai is relatively less. Some attested examples are given in (20).

(20)	Loans	Gloss	Origin
	a. sunatə	'paper'	Japanese
	b. tsukui	'table'	Japanese
	c. uɖuŋu	'noodle'	Japanese
	d. paisu	'money'	Spanish
	e. ŋiaw	'cat'	Taiwanese

To summarize, shapes of roots and affixes in Budai Rukai are predictable, usually in the form of V, CV, VC, VCV, CVCV or CVCVCV. No final coda was attested in roots or affixes, independent or bound morphemes.

5.2 Syllable Structure

The minimal Budai Rukai syllable consists of just a vowel, while the maximal syllable structure is CVV, in which VV is a long vowel or a diphthong. When the VV sequence is neither a long vowel nor a diphthong, it is divided into two syllables, e.g., **da.ə** ‘earth’, **pa.ə.nə** ‘bait’. Sequences more than two vowels such as VVV or longer are divided into different syllables. CV-monosyllables are restricted, and they usually represent grammatical words, e.g., **ki** ‘construction marker (Patient Focus)’, **lu** ‘if’.

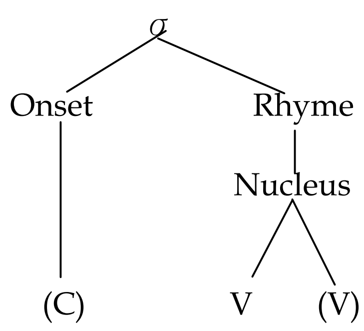
The types of Budai Rukai syllables are exemplified in (21).

(21)

Syllable Type	Budai Rukai	Gloss
V	i	‘at /in’
VV	ai	‘ai (exclamation)’
CV	si	‘and’
CVV	vai	‘sun’
CVV	kuu	‘owl’

The syllable structure of Budai Rukai is illustrated in (22), in which ‘ σ ’ represents a syllable unit. Rhyme is independent, because both V and VV-syllables were found. Onset is not obligatory in Budai Rukai, and there is no word-final coda. Phonetically, however, high vowels in the vowel sequences may be realized as glides in natural speech. The syllable structure shown in (22) represents the canonical syllable in elicitation.

(22)



VV-sequences may be long vowels or diphthongs. Diphthongs such as **au**, **ai**, **ia** and **ua** may be phonetically realized as **aw**, **aj**, **ja** and **wa** at syllable-final or syllable-initial position. Taking the representations of diphthongs into account, surface syllable structure in Budai Rukai includes the following syllable types: V, GV, VG, VV, CV, CVV, and CVG, where G is a glide. No CC onset cluster was found, and no CC cluster at word-internal or word-final position was found.

Most Formosan languages exhibit the PAN canonical CVC syllable structure. As we have seen in Chapter 2, Paiwan has the syllable structure (C)V(C), and onset clusters at word-medial position are allowed. Nevertheless, no surface consonantal coda was found in Budai Rukai. Li (1973, 1995) states that many Rukai words end in a released consonant followed by an optional short vowel similar to the preceding vowel, and he further points out that no true consonant appears in the word-final position in Budai Rukai. In his field reports on Budai Rukai (1977a, 1995), every word ends with a vowel. Consonantal coda is allowed in Tanan Rukai (cf. Li 1973), but not in Budai Rukai. In the current project, on the other hand, a small number of sonorant codas such as nasals and laterals was attested in the fast speech of the Budai Ruaki informants, but a careful reconfirmation with the informants has led to the current proposal of the (C)V syllable structure. In other words, words in Budai always end with a vowel or a glide. Nasal or lateral codas were the perceptual results of words ending with a weak schwa in fast speech. Evidence from the lexical roots and the affixation in Budai Rukai, as shown in section 5.1, has indicated the prohibition of consonantal codas in Budai stems or affixed forms.

All of the possible consonant and vowel arrangements for disyllabic words are given in (23), to show the combination of syllable types in Budai Rukai.

(23) Disyllabic words in Budai Rukai

		σ		σ	
	(C)	V (V)	(C)	V (V)	
V.CV		u	b	u	‘bladder’

V.CV		ə	ts	a	‘husked rice’
V.CVV		i	s	iu	‘hair’
VV.CV		aa	b	u	‘ashes’
VV.CV		ii	p	i	‘to blow’
VV.CVV		ia	k	ai	‘to exist’
CV.V	d	a		ə	‘earth’
CV.VV	k	u		au	‘hawk’
CV.VV	b	a		iu	‘lake’
CV.CV	b	a	ð	a	‘enemy’
CV.CVV	k	ə	ɭ	ai	‘to hang’
CVV.CV	θ	ia	b	ə	‘to chop’
CVV.CV	k	əə	t	ə	‘to cut’
CVV.CVV	l	ia	p	ai	‘light (with *ma-*)’

The examples in (23) have shown that while diphthongs may occur word-medially or word-finally, long vowels such as **aa**, **ii**, or **əə** occur word-medially in these disyllabic words, i.e., penultimate syllables. Long vowels occur not only in disyllabic words but also in monosyllabic and polysyllabic words of Budai Rukai. Monosyllabic roots may bear long vowels. Sporadic long vowels attested in antepenultimate position are stressed.

Echo vowels are synchronically presented in Budai Rukai. Words in Budai Rukai generally end with a vowel. It has been mentioned that many Rukai words end in a released consonant followed by a short vowel similar to the preceding vowel (cf. Li 1973), and the vowel in this position is usually assumed to support a word-final consonant (cf. Tsuchida 1976). Given that the vowel is not only a ‘supporting vowel’ but also identical to the vowel in the preceding syllable, it has been referred as an 'echo vowel' by most of the Formosan linguists. As far as Budai Rukai is concerned, all the words end with a vowel, either a proper vowel or an echo vowel. Echo vowels are present in roots or stems, affixes, and the other independent words. Therefore, they are phonemic and should be included in the underlying representations of Budai Rukai.

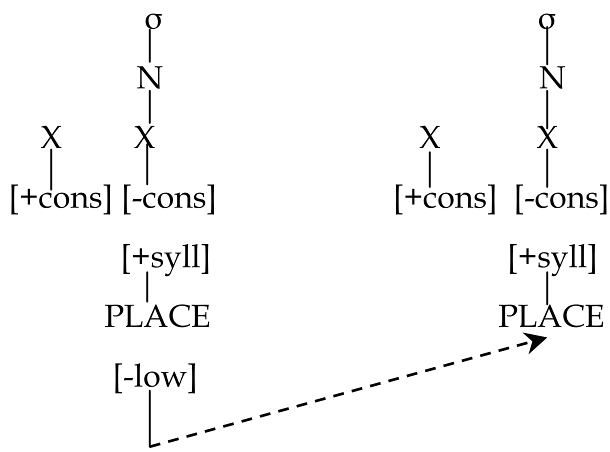
The distribution of echo vowels in Budai Rukai is given in (24). Echo vowels are underlined and in bold.

(24) Echo vowel in Budai Rukai

	Vowel	Budai Rukai	Gloss	Budai Rukai	Gloss
a.	i	bitsiŋ**i**	'skin'	ma-palil**i**	'salty'
b.	u	patsul**u**	'knee'	uŋul**u**	'to drink'
		matuɭul**u**	'thirty'	mapitul**u**	'seventy'
c.	ə	ma-rətəs**ə**	'faint'	ɭəpəŋ**ə**	'to finish'
		masəpatəl**ə**	'forty'	manəməl**ə**	'sixty'
d.	a	ɖamar**ə**	'moon'	ɭidam**ə**	'tongue'
		mapusal**ə**	'twenty'	maɭimal**ə**	'fifty'

Shown in (24), an echo vowel reflects the vowel of its preceding syllable. When the vowel of its preceding syllable is **a**, the echo vowel becomes **ə**. In other words, all the vowels are eligible for echo vowels at word-final position, except the low vowel **a**. This indicates that the feature of [+low] is prohibited from the copying of echo vowels. In addition, the echo vowels in Budai Rukai do not appear after a glide **j** or **w**. Echo vowels appear after a full consonant in word-final position. They have been added to the full consonant to avoid a coda, and they have to follow the restrictions on copying the preceding syllables. The copying process of the echo vowel is expressed in (25).

(25) Copying of echo vowels in Budai: an echo vowel in word-final position copies the place features of the preceding [-low] vowel



When the obligatory feature [-low] in the base vowel for copying is not available, central schwa **ə** is always the best candidate for the constraints on copying. That is, echo vowel **ə** substitutes low vowel **a** in word-final position. Echo vowel **a** is prohibited word-finally. Schwa **ə** could not just be a reduced form of **a** in unstressed position, because it does not occur after the bases having the vowel **i** or **u** in the same phonological condition.

Li (1973) reports in his study that in normal or rapid speech, the echo vowels in Tanan Rukai are much weakened, devoiced, or dropped out, and the preceding consonants are always released. In the current project, however, all the echo vowels in Budai Ruaki were perceived clearly, except schwa **ə**. Echo vowels are not unique in Budai, as they are also attested in the other dialects of Rukai (cf. Li 1977a; Hsin 2000) and Tsou (cf. Tsuchida 1976). Among the Formosan linguists who have ever studied the representations of echo vowels, Li (1973, 1975, 1977a) presents the most insightful discussions on the issue. Based on his investigation on five dialects of Rukai, Li (1977a) argues that echo vowels must be given in the Lower Three Villages of Rukai but may be optional in Tanan dialect.

The distribution and the quality of echo vowels are predictable. Yet, there is still a distinction between a proper vowel and an echo vowel. A proper vowel is always retained, in stems and affixed forms, whereas an echo vowel is dropped when followed by a suffix that begins with a vowel in suffixed forms. Some typical examples of echo vowels are given in (26a), whereas the contrastive examples of proper vowels are shown in (26b). As a result, all the affixed forms or independent words in Budai Rukai end with a vowel.

	<u>Agent Focus</u>	<u>GLOSS</u>	<u>Imperative</u>	<u>GLOSS</u>
(26) a.	wa-uŋulu	'to drink'	uŋul-a	'Drink!'
	wa-ələbə	'to close'	ələb-a	'Close!'
	wa-tətərə	'to kick'	tətər-a	'Kick!'
	wa-səkətə	'to hide'	səkət-a	'Hide!'
	wa-ḽibatə	'to pass'	ḽibat-a	'Pass!'
b.	<u>Agent Focus</u>	<u>GLOSS</u>	<u>Imperative</u>	<u>GLOSS</u>
	wa-kanə	'to eat'	kanə-a	'Eat!'
	wa-piḽi	'to choose'	piḽi-a	'Choose!'
	wa-sauḽi	'to return'	sauḽi-a	'Return!'

Shown in (26a), echo vowels are dropped when followed by the imperative vocalic morpheme **–a**, while proper vowels are retained in the same phonological environments. Echo vowels are dropped in reduplicated forms as well as in the other suffixed forms. For instance, echo vowels are dropped in the following words: **<u>davats</u>-aku** (**< davatsə**) 'I walk' and **ara <u>uŋul</u>-uŋulu** (**<uŋulu**) 'don't drink', but proper vowels are retained when followed by the same suffixes or in reduplicated forms, e.g., **tsabu-aku** (**<tsabu**) 'I wrap' and **ara kanə-kanə** (**<kanə**) 'don't eat'.

The occurrence of echo vowels is related to the syllable type of the following suffixes. In addition to the restriction mentioned above, echo vowels do not occur before a suffix beginning with **a**, but do occur before consonants and a suffix beginning with **i**. Some examples are given in (27). No attested suffix in Budai begins with the other high vowel **u**; it is unknown, therefore, whether echo vowels are dropped when followed by a suffix beginning with **u**.

(27)	Verb	GLOSS	Suffixed Verb	GLOSS
	paθagil-a	'Start!'	paθagili-ŋa	'has started'
	uŋul-a	'Drink!'	uŋulu-ini	'what he drinks'
	kadalam-aku	'I like'	madalamə-li	'my like'

It has been proposed in the current project that echo vowels are treated as epentheses to avoid consonantal coda in Budai Rukai. The occurrence of echo vowels in Budai Rukai has been treated as phonemic and included in the syllable structure of Budai Rukai. As we have seen the Budai syllable structure (C)V(V), in which consonantal coda is forbidden, echo vowels must be present to avoid any consonant coda. The presence of echo vowels has something to do with the avoidance of consonantal codas.

5.3 Consonants

5.3.1 Consonant Inventory

The consonantal phonemic inventory of Budai Rukai is shown in Table 5.2.

Table 5.2: Budai Rukai Consonants

Place	Labial	Interdental	Alveolar	Retroflex	Palatal	Velar
Plosive	p b		t d	ɖ		k g
Fricative	v	θ ð	s			

Affricate			ts			
Trill			r			
Nasal	m		n			ŋ
Lateral			l	ɭ		
Approximant	w				j	

Budai Rukai has twenty consonant phonemes. While both voiceless and voiced phonemes are attested in the interdental place of articulation, only voiceless fricative and affricate are found in the alveolar place of articulation. As loans are relatively less in Budai Rukai, phonemes attested in loans only are not included in the inventory here.

Affricate phoneme /ts/ was attested in both Paiwan and Budai Rukai. The interdental fricative /ð/ was pronounced as [z] by some younger native speakers of Budai Rukai, especially those who have frequent contact with Paiwan speakers or the Chinese people. It has been noted that there are divergences of pronunciation and speech among different age groups in the villages of Budai Rukai. Since the informants participated in the current project are either older speakers who live in the mountain tribes or middle-aged speakers who were born and raised in the tribes, they usually preserve the proper sound patterns of Budai Rukai. Li (1973) points out in his field report that younger speakers of Tanan Rukai make no distinction between /s/ and /θ/ and pronounce both of them as /s/. However, all the older or middle-aged informants of Budai Rukai in the current study distinguish these two phonemes in various phonological environments. In other words, /s/ and /θ/ are clearly two independent phonemes in Budai Rukai.

On the other hand, the orthography adopted for the native language education in the Budai Rukai communities does cause confusion in the learning of the language. The Romanized symbol **z** was used to represent the affricate sound **ts**, and the syllabic symbols **ze** was used to represent the consonantal fricative sound **ð** in the language textbooks of Budai Rukai, published by the Government of Pingtung County. The mismatch between the symbols and the sounds might be a barrier to the understanding of the sound patterns for the Budai Rukai kids and non-native learners.

Words illustrating Budai Rukai consonants are listed in Table 5.3.

Table 5.3: Words illustrating the consonants of Budai Rukai

CONSONANTS	**Budai Rukai**	**GLOSS**
p	pədə	'kidney'
b	babila	'money'
t	tauθu	'tail'
d	daədaə	'ground'
k	kalaθə	'bracelet'
g	garomarasə	'centipede'
v	vagisi	'thigh'
θ	θamikulu	'flea'
ð	aðaaðamə	'bird'
s	silu	'beads'
ts	tsalisi	'rope'
n	nana	'pus'
m	makulai	'slender'

ŋ	ŋuŋuanə	'nose'
r	ruulu	'muscus'
ɖ	ɖakəralə	'river'
l	labiti	'man's skirt'
ɭ	ɭidamə	'tongue'
w	watsə	'artillery'
j	jakai	'to exist'

Budai does not allow consonantal coda, and glide coda was found in fast speech, usually at the end of vowel sequences.

Minimal pairs exhibiting contrasts between the consonant phonemes are given in (28). Subminimal pairs have been given when no minimal pairs exist in the corpus.

(28) /p/	vs	/b/	**p**əəkə	'navel'
			bəəkə	'hog'
		/m/	ɖa**p**alə	'foot'
			ɖa**m**arə	'moon'
/b/	vs	/v/	**b**ai	'millet cake'
			vai	'sun'
		/ɭ/	**b**aava	'wine'
			ɭava	'flying squirrel'
/t/	vs	/d/	**t**ula	'eel'
			dula	'wound'
		/k/	**t**ai	'taro'
			kai	'this'

/θ/	-i**t**a	'we (Gen, inclusive)'
	i**θ**a	'one'
/ɖ/	**ʈ**uɭu	'three'
	ɖusa	'two'
/d/ vs /θ/	i**d**ai	'hundred'
	i**θ**a	'one'
/ɖ/	**d**aə	'earth'
	ma-**ɖ**au	'big'
/k/ vs /g/	pi**k**u	'elbow'
	pa**g**u	'gall'
/ŋ/	**k**isi	'bowl'
	ŋisiŋisi	'beard'
/g/ vs /ts/	pa**g**ai	'rice'
	pa**ts**ai	'to die'
/ŋ/	**g**iŋi**g**iŋi	'longan'
	ŋisi**ŋ**isi	'beard'
/m/ vs /n/	**m**aɭa	'to take'
	nana	'pus'
/n/ vs /ŋ/	daa**n**ə	'house'
	daa**ŋ**ə	'moan'
/s/ vs /ts/	ku**s**u	'thou'
	ku**ts**u	'head louse'
/θ/	a**s**ooɭu	'pestle'
	ma**θ**oolo	'to cough'

/θ/ vs	/ð/	kala**θ**ə	‘bracelet’
		kara**ð**a	‘pangolin’
	/ts/	a**θ**ai	‘liver’
		a**ts**ilai	‘water’
	/l/	**θ**əpə**θ**əpə	‘to suck’
		ləpə**l**əpə	‘beans’
/r/ vs	/l/	vi**r**i	‘left’
		vi**l**i	‘water leech’
/ɖ/ vs	/ɭ/	**ɖ**ərə-ɖərə	‘thunder’
		ɭəsə	‘tears’
/l/ vs	/ɭ/	va**l**u	‘honey’
		va**ɭ**u	‘eight’

In Tanan Rukai, according to Li’s (1973) field report, all the twenty-three consonants occur word-initially and medially, but /ð/ usually occurs only before or after /a/. On the other hand, the surface distribution of the consonants in Maga Rukai (cf. Hsin 2000) are generally free, except /ð/ and /z/, which are not found word-initially. Similarly, in the current project, the distribution of the phoneme /ð/ in Budai Rukai is much more restricted than the other consonantal phonemes, as it occurs word-initially and word-medially before /a/ only.

The distinctive features (cf. Chomsky and Halle, 1968; Halle and Clements, 1983; Sagey 1986) of the Budai consonants are illustrated in Table 5.4.

Table 5.4: Distinctive Features of Budai Rukai Consonants

PLACE	LABIAL					CORONAL												DORSAL		
Feature	p	b	m	v	w	θ	ð	t	d	n	ts	s	l	ɭ	r	ɖ	j	k	g	ŋ
cons	+	+	+	+	–	+	+	+	+	+	+	+	+	+	+	+	–	+	+	+
cont	–	–	–	+	+	+	+	–	–	–	±	+	+	+	+	–	+	–	–	–
son	–	–	+	–	+	–	–	–	–	+	–	–	+	+	+	–	+	–	–	+
ant						+	+	+	+	+	+	+	+	–	–	–	–			
dist						–	–	–	–	–	±	–	–	–	–	–	–			
strid	–	–	–	–	–	–	–	–	–	–	±	+	–	–	–	–	–	–	–	–
voiced	–	+	+	+	+	–	+	–	+	+	–	–	+	+	+	+	+	–	+	+
nasal	–	–	+	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	+

Given that the canonical syllable structure in Budai Rukai does not allow any consonantal coda, no consonantal phonemes occur in word-final position. The surface distribution of the consonants is given in Table 5.5.

Table 5.5: Distribution of Budai Rukai Consonants[2]

Consonants	Word-Initial				Word-Internal
	#___i	#___u	#___a	#___ə	V__V
p	**piɭi** ‘choose’	**punaj** ‘dove’	**palaka** ‘branch’	**pədə** ‘kidney’	**iipi** ‘to blow’
b	**bilibili** ‘to pull’	**bulavanə** ‘copper’	**baləbalə** ‘bamboo’	**bələbələ** ‘banana’	**ubu** ‘bladder’
t	**tikuraj** ‘phrasant’	**tula** ‘eel’	**tavaŋulu** ‘pepper’	**təbəθə** ‘belt’	**kəətə** ‘to cut’
d	**diŋidiŋi**	**dukatsə**	**davatsə**	**(waθadə)**	**maduu** ‘cooked’

[2] Words in parentheses were attested syllable-initially but not word-initially.

	‘spear’	‘mud’	‘to walk’	‘to raise’	
k	**kipiŋi** ‘clothing’	**kutsu** ‘louse’	**kalaθə** ‘bracelet’	**kəla** ‘to arrive’	**ɖakəsə** ‘camphor laurel’
g	**giŋigiŋi** ‘longan’	**(warugu)** ‘to lift’	**garumarasə** ‘centipede’	**gəɭəgəɭə** ‘to cut’	**aga** ‘cooked rice’
v	**vili** ‘water leech’	**(patsavuŋu)** ‘to punish’	**valu** ‘bee’	**vəva** ‘one’	**tʃivarə** ‘head feather’
θ	**θiiri** ‘stalk of taro plant’	**θuθu** ‘breast’	**θadi** ‘female deer’	**θəpəθəpə** ‘suck’	**maθoolo** ‘to cough’
ð			**ðali** ‘Feminine name’		**karaða** ‘pangolin’
s		**supuŋu** ‘leaf’	**saŋuliŋuli** ‘wild orchid’	**səpatə** ‘four’	**mabusuku** ‘drunk’
ts		**tsumaj** ‘bear’	**tsaɭiŋa** ‘ear’	**tsənəkə** ‘thorn’	**matsa** ‘eye’
ʃ	**ʃilo** ‘beads’				**kiʃiʃi** ‘goat’
tʃ	**tʃimi** ‘cheek’				**iɭitʃi** ‘mud/earth’
n	**(ini)** ‘no’	**numi-anə** ‘you’	**nana** ‘pus’	**(danə)** ‘house’	**aganə** ‘grandchild’
m	**mita-anə** ‘us’	**mutsalə** ‘leak’	**maramu** ‘crispy’	**(madalamə)** ‘to love’	**lamu** ‘dew’
ŋ	**ŋiʃiŋiʃi** ‘beard’	**ŋuŋuanə** ‘nose’	**(laŋaj)** ‘to buy’	**ŋəta** ‘raw’	**uŋulu** ‘to drink’
r	**rigi** ‘horse’	**ruulu** ‘mucus’	**rabuku** ‘lime’	**(maridarə)** ‘fast’	**abərə** ‘coconut’
ɖ	**ɖiʃiɖiʃi** ‘to wipe’	**ɖuruɖuru** ‘to push’	**ɖaða** ‘above’	**ɖəɭəkə** ‘back’	**uɖasə** ‘gray hair’
l	**limatəkə** ‘mountain leech’	**luusu** ‘brain’	**laŋaj** ‘to buy’	**ləkə** ‘ear discharge’	**əbələ** ‘fur coat’

ɭ	**ɭiŋaw** ‘face’	**ɭulaj** ‘baby’	**ɭaŋələ** ‘charcoal’	**ɭəpəŋə** ‘finish’	**aɭima** ‘hand’
w	**(anuwidi)** ‘why stand?’	**(kiwupa)** ‘to rob’	**watsə** ‘artillery’		**kaɖowa** ‘not eaist’
j	**(apujini)** ‘his fire’	**(baju)** ‘lake’	**jakai** ‘exist’		**vajanə** ‘lake’

Shown in Table 5.5, most of the consonants occur freely, except the palatalized sounds, glides, and the voiced interdental fricative /ð/. Fricative /s/ and affricate /ts/ are in complementary distribution with their palatalized counterparts. The phoneme /ð/ occurs word-initially or word-medially before the low vowel **a** only. As we have seen earlier, subminimal pairs between the voiced interdental fricative **ð** and its voiceless counterpart were attested. The sound **ð** has been treated as an independent phoneme in Budai Rukai with restricted distribution.

5.3.2 Allophones of Consonants

In this section, both phonological features and phonetic variation of the consonantal segments in Budai Rukai are investigated. Budai Rukai has a set of seven stops, a voiced and a voiceless series at bilabial, alveolar, and velar places of articulation, plus a retroflex plosive. Most of the informants do not produce aspirated sounds in general. In the following sections, allophones of fricatives and the affricate are elaborated and exemplified. Note that some free variations were attested even in an individual speaker’s speech, typically, in younger speaker’s speech. It is worth mentioning that younger speakers would sometimes use an alternative allophone, and sometimes not.

5.3.2.1 Fricatives

Budai has four fricatives /v, /θ/, /ð/ and /s/. The feature [+continuant] distinguishes fricatives from stop segments. Phonological features of each segment and their allophonic alternation are given as follows.

/v/: voiced labiodental fricative, [LABIAL, +consonantal, +voiced, -sonorant, +continuant]. Phonetic allophone [b] usually alternates with [v] at word-initial position. Typical examples are illustrated in (29).

(29) /v/ [v] voiced labiodental fricative.

The sound occurs before and after any vowels word-initially and word-medially only.

It does not occur in word-final position.

/valu/	[valu]	'honey'
/vəva/	[vəva]	'one'
/vəɖai /	[vəɖai]	'Budai'
/valisi/	[valisi]	'tooth'

[b] voiced bilabial stop.

The sound occurs before a schwa nucleus at word-initial position. [b] and [v] are allophones in free variation before a schwa nucleus at word-initial position

/vəva/	[bəva]	'one'
/vəɖai /	[bəɖai]	'Budai'

[w] labial approximant.

The sound occurs before a non-schwa nucleus at word-initial position. [w] and [v] are allophones in free variation before a non-schwa nucleus at word-initial position

/valisi/	[walisi]	'tooth'

/θ/, /ð/: interdental fricatives, [CORONAL, +consonantal, -sonorant, +continuant, -strident, +anterior]. The feature [-strident, +distributed] distinguishes **θ** from strident **s**. Although voiceless fricatives /θ/ and /s/ are two independent phonemes, alternation between **θ** and **s** was attested in younger speaker's speech. The sound **z** was attested as an allophone of the phoneme /ð/. Allophonic examples are shown in (30) and (31).

(30) /θ/ [θ] voiceless interdental fricative.

The sound occurs before and after any vowels word-initially and word-medially only.

/θuθu/	[θuθu]	'breast'
/təbəθə/	[təbəθə]	'belt'
/iθa/	[iθa]	'one'
/θaliagumu/	[θaliagumu]	'ipomiea'

[s] voiceless alveolar fricative.

The sound occurs word-initially and word-medially before /a/ only, and it was attested in younger speaker's speech only. [s] and [θ] are allophones in free variation word-initially and word-medially before [a] in younger speaker's speech.

/iθa/	[isa]	'one'
/θaliagumu/	[saliagumu]	'ipomiea'

(31) /ð/ [ð] voiced interdental fricative.

The sound occurs word-initially and word-medially before the low vowel /a/ only.

/ðali/	[ðali]	'Feminine name'
/baða/	[baða]	'enemy'
/aðaaðamə/	[aðaaðamə]	'bird'
/ma-akaðamə/	[makaðamə]	'thirsty'
/karaða /	[karaða]	'pangolin'

[z] voiced alveolar fricative.

The sound occurs word-initially and word-medially before the low vowel /a/ only, and it was attested in younger speaker's speech. [z] and [ð] are allophones in free variation word-initially and word-medially before [a] in younger speaker's speech.

/ma-akaðamə/	[makazamə]	'thirsty'
/karaða /	[karaza]	'pangolin'

/s/: voiceless alveolar fricative, [CORONAL, +consonantal, -sonorant, +continuant, +strident, +anterior]. Phoneme /s/ differs from /θ/ in its [+strident] feature. Phoneme /s/ has a palatalized allophone [ʃ]. The palatalized allophone occurs before a high front vowel /i/ only. In other words, the allophonic variation is conditional. The feature [-anterior] distinguishes [ʃ] from [s]. Examples of allophones are given in (32).

(32) /s/ [s] voiceless alveolar fricative.

The sound occurs word-initially and word-medially before /a/, /u/ and /ə/ only. It does not occur before /i/.

/sagi-agisi/	[sagiagiʃi]	'boundary'

/supuŋu/	[supuŋu]	'leaf'
/uɖasə/	[uɖasə]	'white hair'

[ʃ] voiceless post-alveolar fricative.

The sound occurs word-initially or word-medially before a the high front vowel /i/ only. [ʃ] and [s] are allophones in complementary distribution.

/silo/	[ʃilo]	'beads'
/isiu/	[iʃiw]	'hair'

5.3.2.2 Affricates

The phoneme /ts/ is the only affricate found in Budai Rukai, as well as in Paiwan. Affricate /ts/ differs from /t/ and /s/, with the features of [CORONAL, +consonantal, -sonorant, +anterior]. It has a palatalized allophone [tʃ]. The feature [-anterior] distinguishes **tʃ** from **ts**. The palatalized allophone occurs only before a high front vowel /i/ in Budai Rukai. Some examples are shown in (33).

(33) /ts/ [ts] voiceless alveolar affricate.

The sound occurs word-initially and word-medially. It does not occur before /i/.

/tsubu/	[tsubu]	'unhusked rice'
/ŋitsu/	[ŋitsu]	'fruit peel'

[tʃ] voiceless post-alveolar affricate.

The sound occurs word-initially and word-medially before a front vowel /i/ only. [tʃ] and [ts] are allophones in complementary distribution categorically.

/tsivarə/	[tʃivarə]	'head feather'

/katsiɲi/	[katʃiɲi]	'trousers'
/tsukutsuku/	[tsukutsuku]	'turtle'
/tsukui/	[tsukui]	'desk'

[z] voiced alveolar fricative.

The sound occurs word-initially and word-medially before /u/ only in younger speaker's speech or loans. [ts] and [z] are allophones in free variation before /u/ in younger speaker's speech or loans.

/tsukutsuku/	[zukuzuku]	'turtle'
/tsukui/	[zukui]	'desk'

On the other hand, Budai has two retroflex phonemes, alveolar /ɖ/ and lateral /ɭ/. Retroflexion is a distinctive feature, whereas palatalized sounds are allophones of the fricative and affricate phonemes in Budai Rukai. No allophones were attested in Budai Rukai nasals, as no consonantal clusters (nasals preceding homorganic stops, for instance) could occur word-internally (§5.2). Neutralization among the nasals in Paiwan does not occur in Budai Rukai.

5.4 Vowels

5.4.1 Vowel Inventory

The vowel inventory of Budai Rukai is shown in (34).

(34)	i	u	ii	uu
	ə		əə	
	a		aa	

Budai Rukai has four aboriginal vowels. As shown in (34), vowels in Budai Rukai have two types of quantity, short and long. Vowel length contrast is generally expressed in penultimate position, though sporadic long vowels were also attested in antepenultimate position and the nucleus of monosyllabic roots. On the other hand, a few cases of mid-high back vowels **o** were attested in earlier fieldwork reports on Budai Rukai (cf. Li 1977a; Zeitoun 2000) and the current project. Yet, no minimal pairs were found for the independent phonemic status of **o**. The phoneme /u/ was read as [o] with or without phonological condition in various contexts, and the alternation between **u** and **o** is not always predictable. Thus, the sound [o] is treated as a free allophone of the phoneme /u/ in Budai Rukai.

In Li's (1977a) reconstruction study, the sound **o** was selected for the phonemic representation in both Budai Rukai and Proto-Rukai. However, Zeitoun (2000) selects /u/ as a vowel phoneme in her preliminary reference grammar, with occasional occurrence of the sound **o** in the wordlist. Given that the phonetic alternation between **u** and **o** has been attested in Paiwan and the other dialects of Rukai, following the practice of most of the Formosan linguists, only four aboriginal vowels **a**, **i**, **u** and **ə** have been selected for the phonemic representation in the current project. However, the sound **o** is phonetically present. The detailed acoustic description, such as formant plot of the vowel phonemes, is found in section 5.5.

Vowel characteristics of Budai Rukai vowels are given in Table 5.6.

Table 5.6: Summary of Budai Rukai Vowel Characteristics

Vowel	Characteristics
i	high front unrounded
u	(mid) high back rounded
ə	mid central unrounded
a	low central unrounded

Words illustrating Budai Rukai vowels are listed in Table 5.7. Long vowels occur in monosyllabic roots, penultimate and antepenultimate position.

Table 5.7: Words illustrating the vowels of Budai Rukai

VOWEL	Budai Rukai	GLOSS
i	isiu	'hair'
ii	iipi	'to blow'
u	ubu	'bladder'
uu	ma-duu	'cooked'
ə	əbələ	'fur coat'
əə	wa-pəə	'to squeeze'
a	abarə	'coconut'
aa	aapətsə	'to sleep'

Minimal pairs or sub-minimal pairs exhibiting contrasts between the vowel phonemes are given in (35).

(35) /i/ vs /u/	t**i**mu	'salt'
	t**u**mu	'grandfather'
/a/	-in**i**	'their'
	in**a**	'mother'
/ə/	p**i**ku	'elbow'
	p**ə**də	'kidney'
/a/ vs /u/	**a**barə	'coconut'
	ubalə	'body hair'
/ə/	b**a**ləb**a**lə	'bamboo'

	b**ə**ləb**ə**lə	'banana'
/aa/ vs /əə/	k**aa**tsə	'to bite'
	k**əə**tə	'to cut'
/u/ vs /ə/	p**u**ku	'to tie'
	p**ə**də	'kidney'
	ɖ**u**r**u**ɖ**u**r**u**	'to push'
	ɖ**ə**r**ə**ɖ**ə**r**ə**	'thunder'
/uu/ vs /əə/	k**uu**pa	'to steal'
	k**əə**tə	'to cut'

The minimal or sub-minimal pairs exhibiting contrasts between short and long vowels are given in (36).

(36) /aa/ vs /a/	d**aa**nə	'house'
	d**a**ə	'earth'
	k**aa**ŋə	'fish'
	k**a**nə	'to eat'
/uu/ vs /u/	k**uu**	'owl'
	k**u**	'construction marker'
oo vs o	ma-θ**oo**lo	'to cough'
	θ**o**θo	'breast'
/ii/ vs /i/	**ii**pi	'to blow'
	s**i**pi	'to dream'
/əə/ vs /ə/	p**əə**kə	'navel'
	p**ə**də	'kidney'

The examples in (36) have shown that vowel length contrast occurs either at penultimate syllable of disyllabic words or monosyllabic roots. Although long vowels were also attested in antepenultimate position, minimal pairs between long and short vowels in antepenultimate position were not found in the corpus. In other words, long vowels occurring at antepenult may be phonetic, as a realization of the prosodic patterns in the language.

The distribution of the vowels in Budai Rukai is rather free. All the vowels in Budai Rukai can occur word-initially, word-medially, and word-finally. There are no sequences of long and short vowels, such as **iia**, **aai**, **uui**, and **əəi**, which must be syllabified into different syllables in utterances.

Vowel clusters in Budai Rukai are shown in (37).

(37) Vowel clusters

a-series	au	ɭ**au**ɖu	‘below’
	ai	ɭ**ai**li	‘arrow’
	aə	t**aə**nə	‘trap’
	aa	k**aa**tsə	‘to bite’
i-series	ia	pip**ia**nə	‘lip’
	iu	is**iu**	‘hair’
	iə	mat**iə**tsu	‘to fear’
	ii	li-s**ii**suku	‘bird nest’
u-series	ua	s**ua**pə	‘broom’
	ui	ap**ui**	‘fire’
	uu	l**uu**su	‘brain’
ə-series	əa	b**əa**tə	‘flesh’
	əə	aɭis**əə**sə	‘nit’

Shown in (37), there are a few restrictions on which vowels may occur together. In a V_1V_2 sequence, if V_1 is a schwa, only the low vowel /a/ can follow the central schwa and appear in the sequence as a V_2. Another distribution gap is the combination of /uə/, which does not occur in the language. Schwa occurs only after **a** and **i** in the V_1V_2 vowel sequence as a V_2.

All the echo vowels in Budai Ruaki were perceived clearly in word-final position, except schwa **ə**. On the other hand, all vowels are eligible for echo vowels in word-final position except the low vowel **a**. It is proposed here that Budai Rukai vowels have a sonority hierarchy as follows: a > i, u > ə. Vowel sequences can be further divided into two groups, according to their respective sonority. A-series vowel clusters are falling-sonority sequences, whereas /ia/ and /ua/ are in rising-sonority sequences, with first vowel less sonorous than the second. Yet, a high vowel preceding or following a schwa cannot be realized as a glide in any phonetic contexts. When the vowels /i/ and /u/ precede the low vowel /a/, the high vowels can be phonetically realized as prevocalic glides, as shown in **ja** and **wa**. When the low vowel /a/ precedes the high vowels /i/ and /u/, vowel sequences may be realized as **aj** and **aw**, in which off-glides occur. Schwa cannot be a component of diphthongs. Two sequential vowels such as /əa/, /aə/, and /iə/ are syllabified into two distinct syllables.

Vowel sonority might have something to do with the quality of echo vowels. Recall the previous discussion in section 5.2 that vowel copying occurs in all the vowels except the low vowel /a/, in which case /ə/ is the substitution. Hsin (2003) argues that an echo vowel tends to be dropped in normal or rapid speech of Maga Rukai, and she further points out that the properties associated with the echo vowels seem to be incompatible with the most sonorous segment

/a/. The weak schwa with low sonority again becomes the best substitution for a sonorous vowel at word-final position in Budai Rukai.

5.4.2 Allophones of Vowels

In this section, allophones of vowels in Budai Rukai are exemplified. Budai Rukai has four vowels /i/, /u/, /a/, and /ə/. All the vowel segments are [+syllabic, -consonantal, +sonorant]. High back rounded vowel /u/ in Budai was transcribed as mid-high /o/ in Li's (1977a) earlier field report. However, phoneme /u/ was selected in Li's (1995) later wordlist of Budai Rukai. Different selection of phoneme representation in Budai Rukai has indicated that the phonetic variation of the phoneme /u/ in different phonetic contexts does cause the confusion of the field workers.

Examples of vowel allophones are given in (38)-(41).

(38) /i/ [i] high front unrounded vowel.

There are no restrictions on the distribution of the sound [i].

/idai/	[idai]	'hundred'
/viri/	[viri]	'left'
/baθiŋi/	[baθiŋi]	'jaw'
/tsaki/	[tsaki]	'excrement'

[e] mid high unrounded vowel.

The sound occurs word-medially or word-finally after a VELAR consonant only. [e] and [i] are allophones in free variation after a VELAR consonant in syllable non-initial position.

/tsaki/	[tsake]	'excrement'
/kiɖəməɖəmə/	[keɖəməɖəmə]	'mind'

(39) /u/ [u] high back rounded vowel.

There are no restrictions on the distribution of [u].

/utalə/	[utalə]	'rain'
/butsu/	[butsu]	'scrotum'
/ŋuŋuanə/	[ŋuŋuanə]	'nose'
/ɖumanə/	[ɖumanə]	'other'
/ma-kiɭuŋu/	[makiɭuŋu]	'curved'

[o] mid-high back rounded vowel.

There are no restrictions on the distribution of [o].

The sound occurs word-medially or word-finally more frequently before or after an interdental or retroflex consonantal segment. [u] and [o] are in free variation in many unpredictable contexts.

/pa-θuθu/	[pa-θoθo]	'to nurse'
/ɖumanə/	[ɖomanə]	'other'
/ma-kiɭuŋu/	[makiɭoŋo]	'curved'

(40) /a/ [a] low central unrounded lax vowel.

There are no restrictions on the distribution of [a].

/aɖisi/	[aɖisi]	'eagle'
/tsapə /	[tsapə]	'seed of fruit'
/ɭava/	[ɭava]	'flying squirrel'
/aga/	[aga]	'cooked rice'
/gatsəgatsə/	[gatsəgatsə]	'scratch'

[ɑ] low back unrounded tense vowel.

The sound occurs word-initially, word-medially or word-finally before or after a VELAR consonant only. [ɑ] and [a] are allophones in free variation before or after a VELAR consonant.

/aga/	[ɑgɑ]	'cooked rice'
/kaaŋə/	[kɑɑŋə]	'fish'
/gatsəgatsə/	[gɑtsəgɑtsə]	'scratch'

(41) /ə/ [ə] central unrounded lax vowel.

There are no restrictions on the distribution of [ə].

/ətsa/	[ətsa]	'husk of rice'
/əapaə/	[əapaə]	'seed of grain'
/əbəɭə/	[əbəɭə]	'smoke'
/ɭikatsə/	[ɭikatsə]	'lightning'
/balatsə/	[balatsə]	'root'

[ɨ] high central unrounded vowel.

The sound occurs after the affricate /ts/ or the sibilant /s/ in word-final position. [ə] and [ɨ] are allophones in free variation word-finally after [ts] or [s].

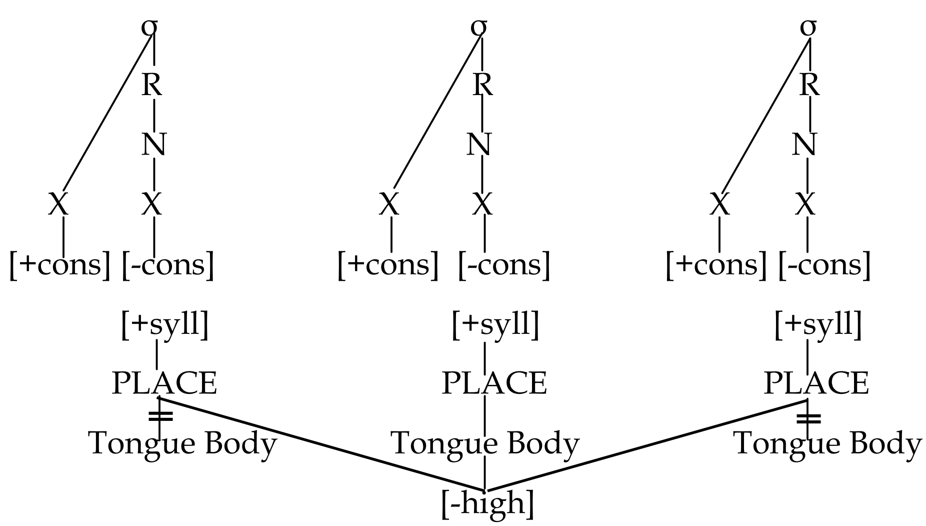
/ɭikatsə/	[ɭikatsɨ]	'lightning'
/balatsə/	[balatsɨ]	'root'

Many cases of the **o** sound occur before or after an interdental or retroflex consonantal segment, e.g., **ɭooθo** 'marrow', **oɭoɖo** 'pillar', **ɭoɭomoko** 'fish cage'. It has been attested in quite a few cases that the high back vowel are assimilated with its preceding or following [-high] vowels in the same words. The assimilation occurs word-initially, word-medially or word-finally before or after a [-high] vowel. The asymmetric assimilation pattern, in which vowel lowering occurs but not raising, is exemplified in (42). [u] and [o] are allophones in free variation in these examples.The formula of feature spreading is expressed in (43).

(42)

Budai Rukai		Vowel Assimilation	GLOSS
[wa-ɭoku]	~	[wa-ɭoko]	'to dig'
[ɭokutsu]	~	[ɭokotso]	'mountain perilla'
[roolu]	~	[roolo]	'urine'
[kuluθo]	~	[koloθo]	'fart'
[taɭopunu]	~	[taɭopono]	'hat'
[tuburo]	~	[toboro]	'bamboo shoot'
[θoθobuŋu]	~	[θoθoboŋo]	'bag'

(43) Assimilation as Feature Spreading



The assimilation as spreading can be progressive or regressive (anticipatory). Either direction of feature spreading occurs in Budai Rukai. Vowel Lowering occurs to make high back vowels become mid-high back vowels, and it has become an important free alternation in Budai. Because of the distribution facts of the vocalic phonemes and the allophones, and because of the minimal pairs attested between /u/ and the other vocalic phonemes, the sound **u** has been considered the representative phoneme in the vowel inventory.

On the other hand, Budai Rukai has two glide segments /w/ and /j/. The status of glides in Budai Rukai is somewhat marginal, given that there is no clear minimal pair showing the contrast between glide approximants and high vowels, and that they do not seem to affect the prosodic patterns of the language. As we have seen that words in Budai end with a vowel, glides usually occurs either at word-final position in rapid speech or at word-initial position within a vowel sequence. Glides, however, are in some way associated with the syllabification in vowel clusters. As the vowel sonority hierarchy in Budai is a > i, u, the outputs of the vowel sequences /au/, /ai/, /ua/ and /ia/ are [aw], [aj], [wa], and [ja] respectively. Onset and coda slots are usually the optimal positions for glides, e.g., *japəlaj* (< *ia-pəlai*) 'to float', *walupu* (< *u-a-lupu*) 'to hunt'.

Glide /j/ alternates with the voiced interdental fricative /ð/ in stem-final position when followed by suffixes beginning with /a/. More discussion on the morphophonemic alternation is found in section 5.7.1. The allophones of the glide /j/ are shown in (44).

(44)	/j/	[j]	palatal glide. It occurs word-initially before [a], word-medially before [a], [u], [i], and word-finally.		
			/kamaja/	[kamaja]	'mango'
			/baju/	[baju]	'lake'
			/jakai/	[jakaj]	'exist'
			/apuj-ini/	[apujini]	'his fire'
		[ð]	voiced interdental fricative.		
			It occurs in stem-final position before suffixes beginning		

with /a/ only. [j] and [ð] are allophones in complementary distribution in stem-final position when followed by suffixes beginning with [a].

/ka-vəɖaj-anə/	[kavəɖa**ð**anə]	'Budai tribe'
/sa-baj-anə/	[saba**ð**anə]	'wedding gift'

To sum up, these two controversial glides are included in the Budai Rukai phonemic inventory. The phonemes /w/ and /j/ are glides with the features of [-consonantal, +continuant, +sonorant, -syllabic, +high]. The feature [-consonantal] distinguishes glide approximants from the other consonantal phonemes, whereas the feature [-syllabic] distinguishes glides from proper vowel phonemes.

5.5 Segmental Phonetics

In this section, phonetic representations of segments are discussed. The articulation of consonants and vowel space are examined here.

5.5.1 Acoustic Description of Voiceless Stops

None of the existing documentation or field report provides empirical evidence for the phonetic properties of Budai Rukai or any of the Rukai dialects. In the current project, Voice Onset Time (VOT) measures were taken for the voiceless non-aspirated stops. There is a general tendency for VOT to be longer when the closure for a stop is articulated further back in the vocal tract (Fischer-Jørgensen, 1954; Peterson & Lehiste, 1960; Cho & Ladefoged, 1999; Taff et al. 2001). VOT has been known to vary with different places of articulation. The differences of VOT have become parameters for the distinction of voiceless stops in laboratories and in the fields. Budai Ruaki has bilabial, alveolar, and velar stops. In other words, the VOT for a Budai velar stop will be the longest among the voiceless stops, i.e., velar > alveolar > bilabial stop, given that the parameter of VOT is straightforward. Although some differences in VOT may be determined by aerodynamic factors, others simply reflect the behavior associated with a particular language, as studies on VOT have revealed the inconsistent variation between the stops (Cho & Ladefoged, 1999; Taff et al. 2001).

The Voice Onset Times (VOTs) of stop consonants were investigated by reference to the words in Table 5.8.

Table 5.8: Words for VOT investigation in Budai Rukai stop consonants

CV	Budai Rukai	Gloss	Budai Rukai	Gloss
pi	pitu	‘seven’	sipi	‘dream’
pu	punai	‘dove’	punu	‘forehead’
pa	patsai	‘to die’	pagu	‘gall’
pə	pədə	‘kidney’	pələŋə	‘spirit’
pəə	pəəkə	‘navel’	pə-pəəkə	‘lizard’
ti	timu	‘salt’	tikiθanə	‘small’
tu	tula	‘eel’	tumu	‘grandfather’
ta	tara	‘ring’	taɭupunu	‘hat’
taa	taaka	‘older siblings’	wa-taaŋəɭə	‘to nod’
tə	təbəθə	‘belt’	təbətəbanə	‘eaves’
ki	kipiŋi	‘clothing’	kisisi	‘goat’
ku	kutsu	‘head louse’	kuɭabau	‘rat’
ka	katsui	‘trousers’	kalaθə	‘bracelet’

kaa	kaatsə	'to bite'	kaaŋə	'fish'
kə	kəlaulau	'finger'	kəla	'to arrive'

The recorded data were sampled at 20,000 Hz using the Praat spectral analysis system. The interval between the onset of the release burst and the first glottal pulse was measured on simultaneous waveform and spectrographic displays. A total of 60 elicitation tokens (30 X 2 speakers, one male and one female) from two Budai Rukai native speakers were measured. The data were statistically analyzed by T-tests and one-factor or two-factor ANOVAs.

The VOTs for labial stops tend to be shorter than the other two stops in Budai Rukai, as shown in Figure 5.2. One-factor analyses of variance have revealed that the effect of place was significant (F [2, 57]=53.75, p<0.0001). In *post hoc* analyses, the labial stops were distinct from alveolar and velar stops at p<0.0001, and there was significant VOT difference (p<0.0001) between alveolar and velar stops. No significant differences were found between the two speakers.

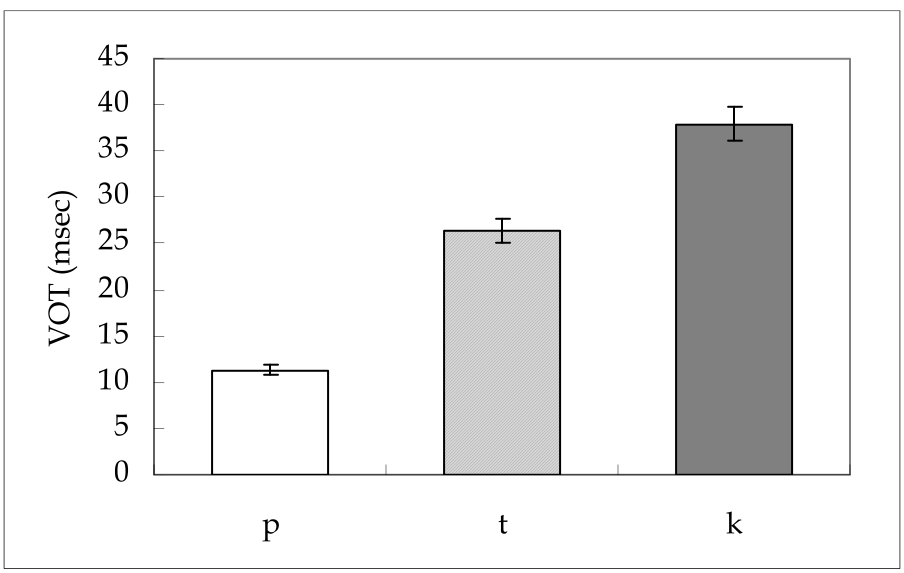


Figure 5.2: Mean VOTs of Budai Rukai Voiceless Stops

Phonetic sounds [p], [t] and [k] have significantly different representations from one another. The results agree with the general observation that stops with back articulated closure such as /t/ and /k/ have longer VOTs than /p/.

5.5.2 Acoustic Description of Vowels

Budai Rukai has a four-vowel system: /i/, /u/, /a/and /ə/. Vowel /i/ has been described as a high front vowel, /u/ as a (mid) high back vowel, /a/ as a low vowel, and /ə/ as a central schwa. As vowels might be perceived as its phonetic allophones in various contexts, empirical examination on vowel distribution provides direct evidence for the vowel inventory constructed in the current study. Words given in Table 5.9 were elicited and recorded by four Budai speakers, two females and two males. For each vowel the data consisted of three examples after a bilabial, alveolar, and velar stops.

Table 5.9: Words exemplifying contrasts among Budai Rukai vowels

Bilabial	**Budai**	**GLOSS**	**Budai**	**GLOSS**	**Budai**	**GLOSS**
pi	pilai	'lame'	iipi	'to blow'	pitu	'seven'
pu	puku	'joint'	wa-lupu	'to hunt'	pu-puli	'white'
pa	pa-θuθu	'to nurse'	sa-pakəpakə	'wing'	pana	'to shoot'
pə	pədə	'kidney'	suapə	'broom'	pələŋə	'spirit'
Alveolar	**Budai**	**GLOSS**	**Budai**	**GLOSS**	**Budai**	**GLOSS**
ti	tikurai	'pheasant'	sititi	'to hit'	tinono	'weave'
tu	tumu	'grandfather'	wa-tuɖu	'leak'	tubi	'weep'
ta	tara	'ring'	ma-ŋəta	'raw'	tapusu	'window'

tə	təsəpə 'in inhale'	bəatə 'flesh'	ɭibatə 'to pass'
Velar	**Budai GLOSS**	**Budai GLOSS**	**Budai GLOSS**
ki	kipiŋi 'clothing'	tsaki 'excrement'	kidiŋi 'spoon'
ku	kutsu 'head louse'	ma-busuku 'drunk'	kurai 'dried taro'
ka	katsipi 'chopsticks'	kaka 'older siblings'	katsiŋi 'trousers'
kə	kəɭai 'to hang'	ləkə 'earwax'	tubakə 'shell'

The phonetic qualities of the Budai Rukai vowels were examined, based on the measurements of the frequencies of the first, second and the third formant values. Recorded data were transferred into the computer at a sampling rate of 22,000 Hz. Vowel midpoints were taken for formant measurements. The formant values were determined from the LPC spectra with a 30ms frame calculation, and a pre-emphasis was applied to the signal prior to calculation, with an additional 512-point FFT calculation check. When the LPC measurement did not coincide with the FFT spectra, formant values were determined from the LPC. A total of 144 tokens (36 X 4) were selected for the principal formant measurements.

Formant plots of Budai female and male main vowels are illustrated in Figure 5.3 and Figure 5.4 respectively. The plots shown were drawn with UCLA JPlotFormants Version 1.4 software. The ellipses were drawn with radii of two standard derivations along the axes of the first and the second principal formants. Each vowel's symbol was drawn at the mean of the vowel's formant plot in large font. The symbol '>' in the figures indicates schwa /ə/.

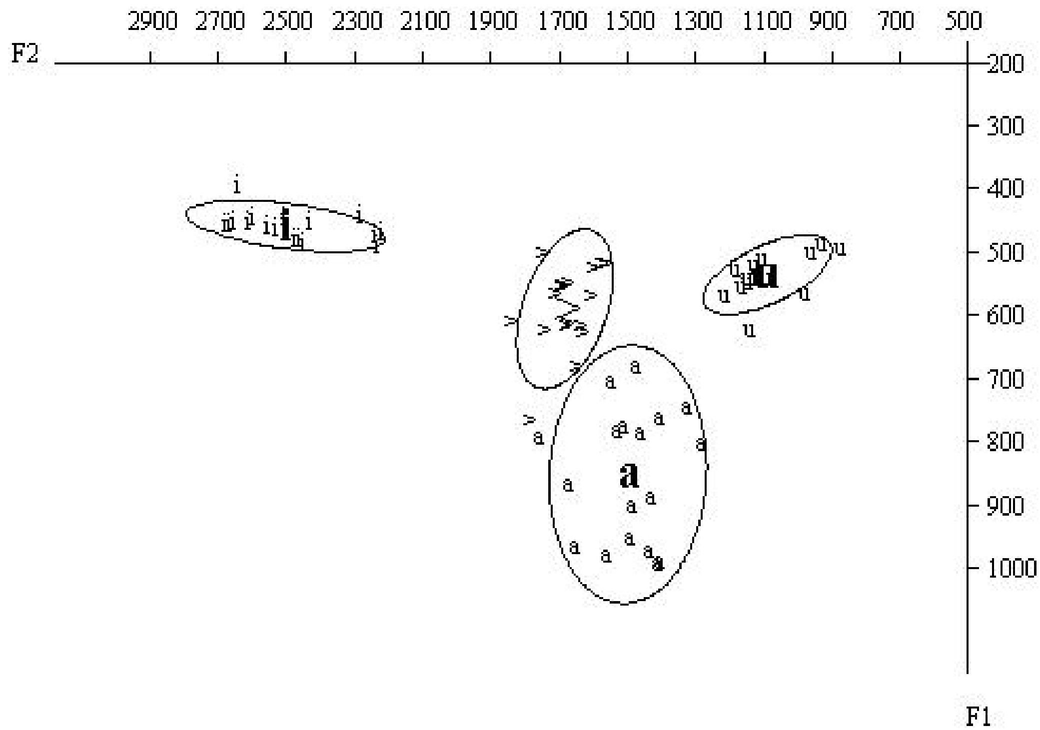


Figure 5.3: Formant Plot for Female Budai Rukai Speakers

The figures provide a phonetic description of the vowel qualities in Budai Rukai vowels. Shown in Figure 5.3 and Figure 5.4, the distribution of the sound [u] is slightly lower than that of [i], though both of /i/ and /u/ have the phonemic feature of [+high]. Both of the mean F1 values in Budai female and male vowel /i/ are lower than those in the vowel /u/, which indicates the tongue position for Budai vowel /i/ is higher than that for the vowel /u/.

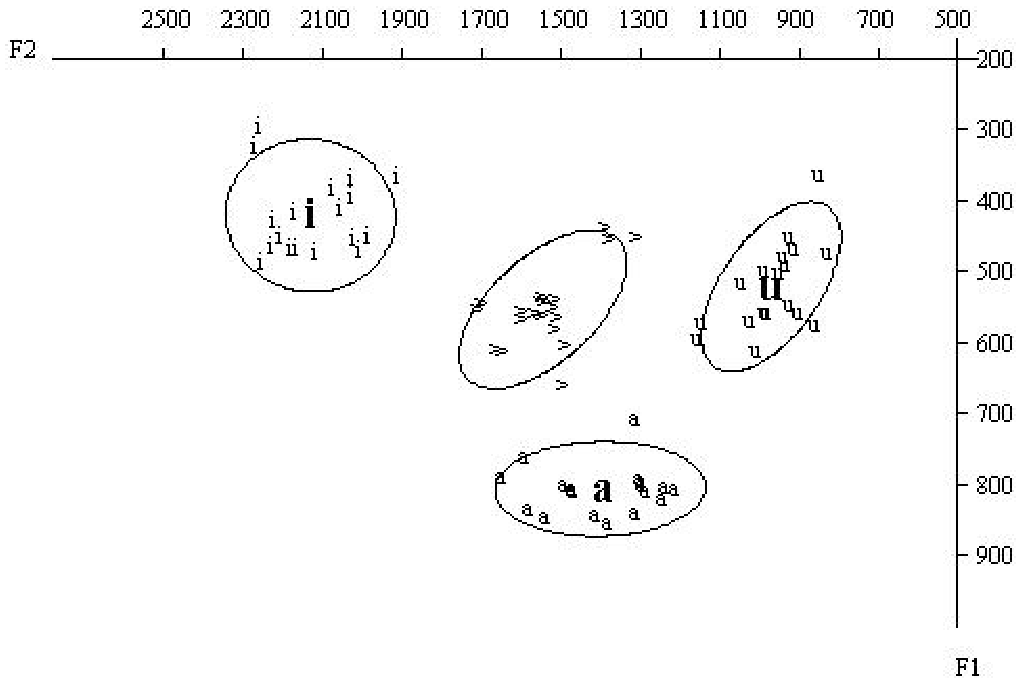


Figure 5.4: Formant Plot for Male Budai Rukai Speakers

The height of the segment /u/ is closer to that of the schwa segment. In other words, the lower part of the /u/-ellipse may be perceived as a phonetic [o] sound. This supports the observation that segment /u/ was perceived as [o] in some contexts, and it also explains why the phoneme /u/ was transcribed as '**u**' in one field report and as '**o**' in another. The distribution of the Budai Rukai vowels generally supports the dispersion theory (Liljencrants and Lindblom, 1972), which predicts that contrastive vowels are spaced with a sufficient contrast, such as /i/ and /u/. There is greater variance, however, in F1 than F2 in the female speaker's schwa and the low vowel tokens. Formant plot for male Budai Rukai speakers, on the other hand, indicates that the low vowel /a/ is more likely to be a back vowel phoneme /ɑ/ when preceded or followed by a back segment. Coarticulation does affect the tongue position of the vowel sounds. Accordingly, the vowel sounds may be perceived as various allophones in different phonetic contexts.

5.6 Stress

Stress in Budai Rukai has been a controversial issue in earlier studies (Li 1977a; Ross 1992; Blust 1997), but none of them offer a proper account for the stress patterns in Budai Rukai. The existing documentation of Budai Rukai is either lack of stress marking or based on second-hand field report. None of the existing studies have made a cautious examination on the stress of Budai Rukai, let alone a theoretical account for the stress patterns.

Li (1973, 1977a) has done a comprehensive study on Tanan Rukai and a reconstruction study of Proto-Rukai, but the data of Budai Rukai, unfortunately, are relatively less and mainly cognates for comparison purpose. Later studies (cf. Ross 1992; Blust 1997) on Budai Rukai stress are based on Li's fieldwork data. Li (1977a) points out that when the historically secondary vowels, echo vowels, were taken into account, stress is seen to fall mainly on the final syllable in Tanan, but on the penult in the other dialects. Blust (1997) states that although Li (1977a) reconstructs Proto-Rukai forms for all cognate sets presented, Li does not include stress contrasts in his reconstructions. Ross (1992) reexamines Li's data and sees a different history in the materials of the Budai dialect. According to Ross (1992), stress is predictable in some phonological environments in Budai, but not in others. Ross (1992) proposes the following patterns in Budai Rukai:

1. Trisyllables: second syllable accented
2. Quadrisyllables: second syllable accented
3. CVCV: penult accented
4. CVCVC: accent unpredictable

However, Blust (1997) points out that Ross's theory yields a correct prediction in about 57% (20/35) of the cases, and an incorrect prediction in about 43%. It thus does not offer a serious alternative to independent development as an explanation for the agreements noted between Budai Rukai and Proto-Philippines. In fact, much more errors have been found in Ross's (1992) proposal here. As we have seen earlier, Budai Ruaki does not allow consonantal coda. Therefore, the account for the CVCVC accent makes no sense for the prediction of stress. In addition, some affixes do not get stress, and syllable weight is not mentioned in Ross's proposal. Budai has two sets of vowels, short and long. Stress in Budai has been attested to be quantity-sensitive in the current study.

Li (1973) notices that the monosyllabic articles [ka], [sa], [ku] and [ki] do not bear stress in Tanan Rukai. The articles mentioned in Li's study are treated as prefixes or construction markers here. As for the stress in Budai Rukai, Li (1995) describes in his wordlist as falling on the penultimate syllable, but less frequently on the final or antepenult. No more information about Budai stress was mentioned anymore. In Zeitoun's (2000) preliminary reference grammar, similarly, stress patterns in Budai are no more than on the penultimate syllable of a word, with a few words on the antepenultimate syllable. The difference between Li's (1995) wordlist and Zeitoun's (2000) description is the existence of final stress. No final stress was attested in Zeitoun's (2000) data. All these mentioned above have shown that an exhaustive investigation on Budai stress is definitely needed.

5.6.1 Distribution of Stress

A Budai Rukai word typically has a primary stress in its elicitation form. Longer sequences, usually five-syllable words or longer, may have a secondary stress. Roots or stems, and derivation forms in Budai Rukai can form a prosodic word to which primary and secondary stress can apply. A prosodic word in Budai Rukai usually carries independent components of meanings. The distribution of stress in Budai Rukai is given in (45).

(45) The distribution of stress in Budai Rukai: main stress in Budai Rukai falls on the rightmost, the penultimate or antepenultimate syllable of each prosodic word. Note that in a disyllabic form, there would be no antepenultimate stress. Prefixes and infixes are excluded from the domain to which primary stress can apply. In the following examples, the single bracket '[' indicates the left edge of the prosodic domain for primary stress.

a. Stress in Roots: in monosyllabic roots, stress falls on the nucleus of the syllable; in disyllabic roots, main stress falls on the penult; in trisyllabic or longer roots, if the penultimate syllable is light, main stress falls on the antepenult; if the penult is heavy, main stress falls on the penult.

Stress	Shape	Root	GLOSS
σ́	CV́:	kúu	'owl'
σ́	CV́:	ɭə́ə	'neck'
σ́ σ	CV́V	dáə	'earth'
σ́ σ	CV́CV	ɭáva	'flying squirrel'
σ́ σ	CV́CV	ɭə́sə	'tears'
σ́ σ	CV́:CV	róolo	'urine'
σ́ σ	CV́VCV	táuθo	'tail'
σ́ σ	V́:CV	íiki	'thatch (thin)'
σ́ σ	CV́CVG	págaj	'rice'
σ́ σ	CV́CVG	ŋúduj	'mouth'

σ́ σ σ	V́CVCV	ə́bəɭə	‘smoke’
σ́ σ σ	CV́CVCV	válisi	‘tooth’
σ́ σ σ	CV́CVCV	túburu	‘bamboo shoot’
σ́ σ σ	CV́CVCVG	ɭíkulaw	‘leopard’
σ σ́ σ	VCV́:CV	okóoɖo	‘crutch’
σ σ́ σ	VCV́:CV	asóoɭo	‘pestle’
σ σ́ σ	VCV́:CVG	abáabaj	‘woman’
σ σ́ σ	CVCV́:CV	karáaða	‘pangolin’
σ σ́ σ	CVCV́:CV	tsaváaɭi	‘roof’
σ σ́ σ σ	CVCV́CVCV	ɭəgə́ɭəgə	‘mountain’
σ σ σ́ σ	VCVCV́:CV	əɭisə́əsə	‘nit’

b. Stress in Suffixed Forms: primary stress falls on the antepenultimate syllable of each suffixed word[3].

Stress	Morpheme	Suffixation	GLOSS
σ σ́ σ σ	kanə-anə$_{suffix}$	kanə́anə	‘food’
σ σ́ σ σ	wa-[ɖəələ -ŋa$_{suffix}$	waɖə́ələŋa	‘saw’
σ σ́ σ σ	ma$_{prefix}$-[pusa-lə$_{suffix}$	mapúsalə	‘twenty’
σ σ σ́ σ σ	a-[ələb-anə$_{suffix}$	aələ́banə	‘to be closed’
σ σ σ́ σ σ	sanu-[tuɭu-lu$_{suffix}$	sanutúɭulu	‘three times’
σ σ σ σ́ σ σ	kala-[bətsəŋ-anə$_{suffix}$	kalabətsə́ŋanə	‘millet festival’

c. Stress in Prefixed or Infixed Forms: primary stress never falls on prefix or infix morphemes. Stress always falls on roots or stems. Stress falls on

[3] Given that the attested monosyllabic roots with long vowels are nouns, no suffixes attach to monosyllabic roots in word level. Primary stress on the heavy penult of the suffixed forms could be presumably possible, but it was not attested in the corpus.

heavy monosyllabic roots, light or heavy penult of disyllabic roots, heavy penult or antepenultimate syllable of trisyllabic or longer roots.

Stress	Morpheme	Prefixation/Infixation	GLOSS
σ σ́	wa$_{prefix}$-[pəə	wapə́ə	‘to squeeze’
σ σ́ σ	la$_{prefix}$-[ɖusa	laɖúsa	‘couple’
σ σ́ σ	si$_{prefix}$-a$_{infix}$-[titi	siatíti	‘to hit’
σ σ́ σ	tu$_{prefix}$-a$_{infix}$-[saapa	tuasáapa	‘to weave a mat’
σ σ́ σ	tu$_{prefix}$-a$_{infix}$-[matsa	tua-mátsa	‘to wash face’
σ σ́ σ σ	wa$_{prefix}$-[tinono	watínono	‘to weave’
σ σ́ σ σ	ma$_{prefix}$-[busuku	mabúsuku	‘drunk’
σ σ́ σ σ	ɭa$_{prefix}$-[ɭavatsə	ɭaɭávatsə	‘spider’
σ σ σ́ σ	ma$_{prefix}$-θa$_{prefix}$-[limu	maθalímu	‘muddy’
σ σ σ́ σ σ	ma$_{prefix}$-sa$_{prefix}$-[sulapə	masasúlapə	‘smooth’
σ σ σ́ σ σ	ma$_{prefix}$-ɖa$_{prefix}$-[ɖəsəŋə	maɖaɖə́səŋə	‘to meet’
σ σ σ́ σ σ	la$_{prefix}$-ma$_{prefix}$-[lalakə	lamalálakə	‘children
σ σ σ́ σ σ	ŋi$_{prefix}$-a$_{infix}$-[vələvələ	ŋiavələ́vələ	‘to move’
σ σ σ σ́ σ σ	paŋu$_{prefix}$-da$_{prefix}$-[davatsə	paŋudadávatsə	‘by walking’

Secondary stress was attested in four-syllable or five-syllable sequences or words longer than five syllables. Secondary stress falls on remaining heavy syllables, and on every other light syllable counting from right to the left. Some examples are illustrated in (46).

(46) Secondary Stress in Budai Rukai

Syllables	Budai Word	Stress	Gloss
σ σ̀ σ σ́ σ	lupakavaalə	lupàkaváalə	‘the day after tomorrow’

σ̀ σ σ́ σ σ	taraɖamarə	tàraɖámarə	‘one month’
σ̀ σ σ́ σ σ	kaikaməanə	kàikamə́anə	‘today’
σ σ̀ σ σ́ σ σ	kalakətsəlanə	kalàkətsə́lanə	‘winter’
σ̀ σ σ̀ σ σ́ σ σ	tatsəkətsəkəlanə	tàtsəkə̀tsəkə́lanə	‘family’
σ σ̀ σ σ̀ σ σ́ σ σ	kalaɖaɭaŋəɖaŋanə	kalàɖaɭàŋəɖáŋanə	‘summer’

The general distribution of Budai Rukai stress is summarized as follows. Primary stress falls on (i) heavy monosyllabic roots; (ii) the penultimate syllable of disyllabic roots; (iii) the heavy penult or the antepenultimate syllable of tri-syllabic or longer roots and suffixed forms. Primary stress always falls on roots or suffixed forms. Prefixes and infixes are excluded from the domain to which primary stress can apply. Secondary stress falls on remaining heavy syllables, and on every other light syllable counting from right to the left.

5.6.2 Stress Patterns in Budai Rukai

Stress patterns in Budai Rukai are quantity-sensitive. Vowel length affects the assignment of stress in Budai. Mora formalization is considered as part of the syllable structure assignment. The distinction between light and heavy syllables is made here for further prosodic analyses and constraints. Since no consonantal coda is allowed in Budai Rukai, CV syllable is light, whereas CVV syllable is heavy. Both of the long vowel and the diphthong in the CVV syllable contain two moras, and the single vowel in the CV syllable consists of one single mora. Mora formation between light and heavy syllables is shown in (47).

(47) a. Light Syllable: V b. Heavy Syllable: VV, VG, GV

σ | μ   σ /\ μ μ

Main stress in Budai Rukai falls on either the heavy penult or the antepenult of a word, depending on the weight of the penult. It is apparent that Budai stress is [+Quantity Sensitive] in the typology of stress. In other words, syllable weight plays a crucial role in the assignment of stress. Word stress never falls on the final syllable in Budai Rukai, except a restricted number of heavy monosyllabic roots. Following Hayes (1995), the traditional symbols macron /—/ and breve /◡/ designate heavy and light syllables respectively. Stress patterns are shown below.

(48)	Syllable	Stress	Gloss
a.	/◡́◡/	ɭə́sə	‘tears’
	/◡́◡◡/	válisi	‘tooth’
	/◡◡́◡◡/	makáðamə	‘thirsty’
	/◡̀◡◡́◡◡/	tàkurápaŋə	‘toad’
	/◡◡̀◡◡́◡◡/	subə̀ləbə́ləŋə	‘sky’
b.	/—́◡/	kúupa	‘to steal’
	/◡—́◡/	karáaða	‘pangolin’
	/◡̀◡—́◡/	ə̀ɭisə́əsə	‘nit’
	/◡◡̀◡—́◡/	matsàtsabíiri	‘to fight’
	/◡̀◡◡̀◡—́◡/	màsaɭə̀məsə́əmə	‘dusk’

The data summarized in (48) indicates the extrametricality of the final syllables in Budai. Hayes (1981) proposes peripherality that a constituent may be extrametrical only if it is at a designated edge of its domain. Final syllables at the right edge of a Budai prosodic word are extrametrical. Primary stress occurs within the domain of a prosodic word. The analysis of Budai Rukai stress involves the construction of ordinary moraic trochees. Footing is iterative, and degenerate feet are allowed only in strong position.

The metrical algorithm set up for Budai Rukai stress is listed in (49).

(49) Stress in Budai Rukai

a. Syllable Extrametricality $\sigma \rightarrow \langle\sigma\rangle$ / ___ $]_{word}$

where σ is not a monosyllabic root

b. Foot Construction: Form moraic trochees from right to left

Degenerate feet are permitted only in strong position

c. Word Layer Construction: End Rule Right

x)		x)
(x .)		.)(x)
…◡́◡⟨σ⟩	or	…◡—́⟨σ⟩

Words in (50) are generated by the rules shown in (49).

(50)	a.	b.	c.	d.
	(x)	(x)	(x)	(x)
	(x)	(x)	(x)	(x)
	—	—⟨◡⟩	◡⟨◡⟩	◡—⟨◡⟩
	vái	dáanə	kútsu	karáaða
	‘sun’	‘house’	‘head louse’	‘pangolin’

e.	f.	g.
(x)	(x)	(x)
(x .)	(x .)	(x .)(x)
◡◡⟨◡⟩	◡◡◡⟨◡⟩	◡◡ – ⟨◡⟩
ɭíkatsə	ɖakə́ralə	əɭisə́əsə
‘lightning’	‘river’	‘nit’

Stress in noun phrases follow the rules stated in (49), as long as the lexical word is a content word. Noun phrases are defined as a domain within which more than two noun morphemes occur. Budai stress does not fall on construction markers or construction markers in noun phrases. Examples are given in (51).

(51) a. (x)
(x .)
◡◡́ ◡⟨◡⟩
la.lá.kə.su
lalakə-su
child-2sgGen
'your child'

b. (x)
(x .)(x .)(x .) (x)
⟨◡⟩ ◡◡ ◡ ◡ ◡◡ ⟨–⟩–⟨–⟩
ku. ka.la.ma.va.ɭu.lu.kua.báa.baj
ku#kala-mavaɭulu# ku#abaabaj
Lig have eighty Lig woman
'eighty-year-old woman'

Long stressed vowels at penultimate position have been widely attested in Budai Rukai. Long vowels at penult in Budai were also found in Li's (1977a) reconstruction study and Zeitoun's (2000) reference grammar. Note that not all penultimate vowels are lengthened in Budai Rukai. A cautious examination on my fieldwork notes and recording has revealed that vowel length contrast is expressed in penultimate position. When long vowels occur at penult, they get main stress. Long vowels in the other positions where they do not receive main stress, they are shortened, as shown in **sa-ka-u-daanə-anə** > **sakaudanə́anə** 'whole family' (**daanə** 'house') and **sa-ka-u-θiiri-anə > sakauθiríanə** 'whole stalk of taro plant (**θiiri** 'stalk of taro plant'). The weight-by-penultimate-position phenomenon results in the skewed distribution of vowel length contrast and stress patterns in Budai Rukai.

Thus far, the analysis provided in this section has shown that Budai stress is predictable at word level. Word stress in Budai Rukai is predictable, with the classification of sequences into stems, prefixed, and suffixed words. Syntactic classes in Budai, as far as I have observed, do not directly affect the assignment of stress, except construction markers. In Tanan Rukai, stress normally falls on the last syllable of a noun or verb, according to Li (1973), but shifts to fall on the personal markers that immediately follow the noun and verb. Final word stress was not attested in disyllabic or longer sequences in Budai Rukai. Rather, a pitch accent is imposed on imperatives. More discussion on imperative accent is found in the next chapter, Chapter 6.

The stress pattern of complex numerals is illustrated in (52). Again, construction markers cannot be footed in complex numerals, i.e., they are extrametrical. Only the sequences within the domain of a content word can be footed and get stress. The content word at the right edge of the complex numeral gets the primary stress, while the remaining content word(s) may get the secondary stress.

(52) Stress in complex numerals

a. 26 (x)

(x .) (x .)

[◡ ◡̀◡<◡>]$_{W1}$ <◡>[◡́◡<◡>]$_{W2}$

[[ma-pusa-lə]$_{W1}$ # si # [ənəma]$_{W2}$]$_{\text{complex numeral}}$

twenty and six

Output: mapùsaləsiə́nəma

'twenty-six'

b. 97 (x)

(x .) (x)

[◡ ◡̀ ◡ <◡>]$_{W1}$<◡>[◡́<◡>]$_{W2}$

[[ma-baŋatə]$_{W1}$ # si # [pitu]$_{W2}$]$_{\text{complex numeral}}$

ninety and seven

Output: mabàŋatəsipítu

‘ninety seven’

As we have seen in section 5.1.2, the number and types of prefixes are much more than that of suffixes. When prefixes attach to disyllabic roots or stems, primary stress always falls to the penult of the root or stem. Word stress in Budai Rukai is predictable, as long as the following factors are taken into account: syllable weight, syllable number, roots and affixed forms.

5.6.3 Implications for PAN Stress

In this section, I wish to review some of the controversial discussion on Budai stress and assess if the patterns described in the current study have implications for the reconstruction of Proto-Austronesian (PAN) stress.

Stress is predictable in Budai. Li (1977a) points out that echo vowels were added in all Rukai dialects. Antepenultimate stress of Budai Rukai was found in Li’s (1995) later wordlist, with the statement of falling mostly on the penultimate syllable, but less frequently on the final or antepenult. The alternative stress pattern seems to indicate the impact of syllable weight.

Based on Li’s (1977a) data, Ross (1992) states that the oxytones (final stress patterns) of Budai are apparently the last remnants of PAN contrastive stress. They generally correspond with Proto-Philippines (PPH) oxytones, and therefore presumably reflect PAN oxytones. He further proposes the relationships between Budai stress and Proto-Philippines (PPH) oxytones, summarized as follows: (a) where a PAN final consonant is lost in Rukai, the Budai form follows the normal pattern for vowel-final disyllables, that is, it is paroxytone (penultimate stress), regardless of whether the PAN form was paroxytone or oxytone; (b) where a PAN final consonant is retained in Rukai (i) a PAN paroxytone is normally reflected as a Budai paroxytone; (ii) a PAN oxytone is reflected, either as a Budai paroxytone or as a Budai oxytone.

Ross (1992) mistakes [-consonantal] glide coda in Li's (1977a) data as a consonantal segment in /…**C**/, and vowel length is not taken into account in his proposal. But his conclusion on Budai stress is inspiring, stating that "Proto-Philippines (PPH) paroxytones corresponding only with Budai paroxytones is evidence that PPH contrastive stress is inherited from PAN".

Nevertheless, Ross also points out that Budai is in the process of going the way of the other Rukai dialects, that is, towards phonological predictable stress. As a result, Budai paroxytones sometimes correspond with PPH paroxytones, and sometimes with PPH oxytones. According to Ross (1992: 50), Austronesian languages made use of morphological accent to distinguish word classes, or lexical subclasses. It is possible that this inherited resource will ultimately be implicated in the rise of lexical stress contrasts in Philippine languages, and that the agreement of accent in cognate forms will provide another piece of evidence for a Philippine subgroup.

Ross's (1992) argument is somewhat correct in distinguishing morphological accent, as we have seen that construction markers in Budai Rukai usually do not bear stress and disyllabic roots or stems retain primary stress. The syllable weight and quantity-sensitive stress preserved in Budai Rukai seem to indicate the existence of the contrastive stress in PAN. However, word stress in Budai does not distinguish nouns from verbs. The oxytones in Ross's (1992) argument should be counted as pragmatic accent in contexts or address forms, as they have nothing to do with footing and quantity-sensitive parameters.

Li (1977a) is the first one to claim that stress is phonemic in all the dialects of Rukai except Mantauran. He argues that stress would be predictable in the dialect of Tanan Rukai, if the final echo vowel is not represented in the phonemic transcriptions. On the other hand, Li (1973, 1977a) also argues there is little justification for not representing the echo vowels in the other dialects except for Tanan. It would be difficult to account for historical derivations of many forms if the final echo vowels were not treated as phonemic.

Wolff (1993) proposes that PAN roots had a stress contrast in the final two syllables of the root. In Budai Rukai, however, stress contrast was attested in the antepenult and the penult of trisyllabic or longer roots, as echo vowels are represented. On the other hand, Wolff (1993) argues that in PAN the stress patterns fell on the penult of the root if it was long and on the final syllable of the root if the penult was short. Although Wolff's data comprise stress patterns in Formosa and the Philippines, Budai stress is not depicted clearly. It has been proved in the current project that vowel length is phonemic in Budai Rukai. Syllable weight does affect the assignment of stress.

To sum up, stress contrast in Budai is the most interesting point for the reconstruction of PAN stress. The interaction between phonemic vowel length and stress provides evidence for the argument of contrastive stress in PAN roots. Yet, precise transcription and abundant field data from the other dialects of Rukai are still needed for a further reconstruction of Proto-Rukai stress.

5.7 Morphophonemics

In this section, two types of morphophonemics are described: alterations between approximants and fricatives, and reduplication.

5.7.1 Alternations between Glides and Fricatives

The alternations between glides and fricatives have been attested in quite a few Formosan languages, such as Tsou and Paiwan, and in the other dialects of Rukai (cf. Li 1974, 1977b). Recall the similar alternation in Paiwan, as shown in Chapter 2. The alternation between /w/ and /v/ takes place before a morpheme boundary in Paiwan. Similarly, the glide phoneme /j/ alternates with fricative /ð/ at the designated position with some restrictions in Budai Rukai.

The distribution of the phoneme /ð/ in Budai is relatively restricted, as it occurs before the low vowel /a/ only. Some words containing the phoneme /ð/ and /j/ are given in (53).

(53)

Budai Rukai	GLOSS	Budai Rukai	GLOSS
ðali	'Feminine name'	karaða	'pangolin'
aðaaðamə	'bird'	ɖaða	'above'
kavaðanə	'type of bamboo'	baða	'enemy'
kamaja	'mango'	baju	'lake'
ja-kai	'exist'	kuija	'yesterday'

Shown in (53), the sound [ð] occurs word-initially and word-medially before [a] only, whereas the sound [j] occurs word-initially and word-medially before [a] and word-medially before [u]. The data in (53) have shown that /ð/ and /j/ should be treated as two independent phonemes. There are no morphemes that have non-alternating stem-final /ð/. However, glide coda /j/

becomes fricative /ð/ when followed by suffixes beginning with a low vowel **a** in stem-final position. Examples of morphophonemic alternation between segments /j/ and /ð/ are illustrated in (54).

(54)

	Stems	GLOSS	Affixed Forms	GLOSS
a.	apuj	'fire'	sa-tu-apu**ð**-anə	'material for fire'
b.	vəɖaj	'Budai'	ka-vəɖa**ð**-anə	'Budai tribe'
c.	baj	'to give'	sa-ba**ð**-anə	'wedding gift'
d.	ɭumaj	'to hit'	wa-ɭuma**ð**-aku	'I hit'
e.	patsaj	'to kill'	wa-papatsa**ð**-aku	'I kill'
f.	apuj	'fire'	apuj-ini	'his fire'
g.	patsaj	'to kill'	papatsaj-ŋa	'has killed'
h.	kəɭaj	'to hang'	kəɭaj-numi	'you hang'

The contrastive pairs are found between (54a-e) and (54f-h). Glide /j/ occurs both stem-finally and before suffixes beginning with a consonant or a high vowel **i**, whereas fricative /ð/ occurs before suffixes beginning with /a/ only, as shown in (54a-e). Given that the forms with **j** are treated as the base and those with **ð** as the derived, a phonological rule is given as follows.

(55) Alternation between **j** and **ð**: glide /j/ becomes fricative /ð/ before a suffix beginning with /a/ in stem-final position

$$j \rightarrow ð \ / \ \underline{\quad\quad} \ - \begin{bmatrix} -\text{cons} \\ +\text{syll} \\ +\text{low} \end{bmatrix}$$

where '-' is a morpheme boundary

It is proposed here that the alternation between glides and fricatives is to prevent the final glide from forming a diphthong with the following suffix beginning with /a/, which may result in a vowel sequence such as /aja/ or /uja/ at word-medial position. In other words, the phonological formation of diphthongs across morpheme boundaries is more restricted than within stems or roots. The syllable shape of GV is more restricted than the canonical CV shape at word-medial position.

Li (1973) points out the same morphophonemic alternations are common in Tsou. It is of interest that Tanan Rukai, among the Paiwanic languages, shares this rule with the Tsouic languages. Though the alternation between **j** and **ð** was not attested in Paiwan, the alternation pattern between **w** and **v** attested in Paiwan does occur in Budai Rukai, as shown in the followinig words: **wa-ɖaɖaw** 'to wait' and **ɖaɖav-a** 'Wait!'. It is apparent that Paiwan and Budai Rukai also share some phonological features.

5.7.2 Reduplication

Reduplication has been briefly discussed in section 5.1.3.2. This section focuses upon the syllable types of reduplicants and the interaction between reduplication and stress. Two distinct types of reduplication in Budai Rukai are described here: root reduplication and Ca-reduplication. Root reduplication includes lexicalized reduplication, full reduplication and partial reduplication. Lexicalized reduplication undergoes both CVCV- and Ca-reduplication, whereas full-reduplication applies to disyllabic stems. On the other hand, Ca-reduplication comprises one consonant of the base plus a designated vowel –**a**, and it must co-occur with a prefix that determines the meaning of the whole component. As far as semantic functions are concerned, root reduplication signals the progressive aspect of verbs, intensifies the degree of stative verbs, or yields a collective denotation. However, most of the plural nouns in Budai Rukai are indicated by the prefix **la-**, rather than full reduplication of stems. Examples of different types of reduplication are given in this section. Root reduplication is illustrated in (56) and (57), whereas Ca-reduplication is shown in (58).

(56) Full Reduplication of Root in Budai

i. Lexicalized Reduplication: reduplication of a CVCV-stem is derived from a bound stem, whose meaning may be unknown. Main stress falls regularly on the antepenult of the output form, given that no heavy penults are present.

	Reduplication	Stress	Gloss
a.	bələ-bələ	bələ́bələ	‘banana’
b.	ɖərə-ɖərə	ɖərə́ɖərə	‘thunder’
c.	ɭəgə-ɭəgə	ɭəgə́ɭəgə	‘mountain’
d.	ləpə-ləpə	ləpə́ləpə	‘beans’
e.	gatsə-gatsə	gatsə́gatsə	‘to scratch’
f.	ɖoro-ɖoro	ɖoróɖoro	‘to push’
g.	θəpə-θəpə	θəpə́θəpə	‘to suck’
h.	aŋə-aŋə	aŋə́aŋə	‘to hurt’

ii. Reduplication of noun or verb stems: reduplication of a full (C)V(C)V-base. Main stress remains in the disyllabic bases.

	Base	Gloss	Reduplication	Gloss
a.	kánə	‘eat’	wa-kanə$_{\text{Red}}$-kánə	‘to be eating’
b.	dáə	‘soil’	daə$_{\text{Red}}$-dáə	‘earth, land’
c.	ági	‘younger sibling’	agi$_{\text{Red}}$-ági	‘younger siblings’
d.	píɭi	‘choose’	wa-piɭi$_{\text{Red}}$-píɭi	‘to be choosing’

(57) Partial Reduplication of Root in Budai: reduplicants copy CV or CVCV syllables from the bases. Main stress remains in the bases of the output. Reduplicants do not copy vowel sequences or long vowels.

	Base	Gloss	Reduplication	Gloss
a.	míkatsə	'blink'	mika$_{\text{Red}}$-míkatsə	'to blink'
b.	ɖáɭai	'dance'	wa-ɖaɭa$_{\text{Red}}$-ɖáɭai	'to be dancing'
c.	káatsə	'bite'	wa-ka$_{\text{Red}}$-káatsə	'to be biting'
d.	dávatsə	'walk'	wa-da$_{\text{Red}}$-da$_{\text{Red}}$-dávatsə	'to be walking'
e.	dáanə	'house'	da$_{\text{Red}}$-dáanə	'small house'
f.	pə́əkə	'navel'	pə$_{\text{Red}}$-pə́əkə	'lizard'

(58) Ca-Reduplication in Budai: reduplicants copy one consonant of the bases plus a designated vowel –**a**, and they usually attach to the left edge of the bases. Primary stress falls on the bases of the reduplication output. In the following examples, reduplicants are underlined.

	Lexicon	Gloss	Reduplication	Gloss
a.	wa-pána	'to shoot'	ma-pa$_{\text{Red}}$-pána	'to shoot each other'
b.	wa-ɖə́ələ	'to see'	wa-ɖa$_{\text{Red}}$-ɖə́ələ	'to look out'
c.	wa-pátsaj	'to die'	ŋi-a-pa$_{\text{Red}}$-pa$_{\text{Red}}$pátsaj	'to suicide'
d.	wa-túbi	'to cry'	ma-ta$_{\text{Red}}$-túbi	'to cry to each other'

The regular stress pattern in lexicalized full reduplication indicates the well-formed property of a prosodic word. Reduplicants do not affect the assignment of main stress. When reduplicants are treated as prefixed sequences in full or partial reduplication, stress remains in stems or bases. On the other hand, reduplicants do not copy the syllable weight of the bases, as shown in (57c), (57e) and (57f). It is consistent in the Ca-Reduplication cases that reduplicants attach to the left edge of the bases, and the main stress falls to the disyllabic bases. The prosodic patterns in partial reduplication indicate that primary stress in Budai Rukai remains in the bases after reduplication.

The syllable structure of a reduplicant plays a crucial role in partial reduplication. Reduplicants in partial reduplication usually copy CV- or CVCV-syllables from the bases and attach to the left edge of the bases. This confirms the general principles of the syllable structure in Budai Rukai that CV is the canonical syllable type. Reduplicants usually do not copy a heavy syllable from a CVVCV-base. Reduplication in Budai Rukai preserves full phonological identity of the base in full reduplication, as it copies the syllable structure of the bases and the restriction on the syllable types. Loss of syllable weight in reduplicants is due to the position in the prosodic words. Vowel length contrast is expressed in penultimate position.

To sum up, reduplication in Budai Rukai generally follows the stress patterns in roots, stems, and affixed words, but the syllable number and the syllable types of the bases have to decide the most prominent position for the primary stress after reduplication.

5.8 Orthography and Transcription

As the Rukai language has been studied in Li (1973, 1975, 1977a, 1977b, 1995), Zeitoun (2000) and Hsin (2000), different orthography systems have been adopted for different dialects. Hsin's (2000) phonological study on Maga Rukai completely follows the IPA transcription, while a Romanized conventional written system published either by Catholic and Protestant churches or the county government does not match the principles of syllabic or phonetic transcription. The different transcription symbols for consonantal phonemes attested in Li's (1995) and Zeioun's (2000) studies on Budai Rukai, the Romanized writing system published by the Catholic and Protestant Churches, and IPA are compared in (59).

(59) The Comparison of Transcription Symbols

Li (1995)	Zeitoun (2000)	Romanized	IPA
p	p	p	p
b	b	b	b
t	t	t	t
d	d	d	d
ɖ	D [ɖ]	rh	ɖ
¢	c	c	ts
k	k	k	k
g	g	g	g
v	v	v	v
θ	th [θ]	th	θ
ð	z [ð]	z	ð
s	s	s	s
m	m	m	m
n	n	n	n
ŋ	ng [ŋ]	ng	ŋ
l	l	l	l
ɭ	L [ɭ]	lh	ɭ
r	r	r	r
w	w	w	w
y	y	y	y

Shown in (59), the primary difference of the transcription lies in the retroflex segments **ɖ** and **ɭ**, the interdental segments **θ** and **ð**, the affricate **ts**, and the velar nasal **ŋ**.

Lately, Council of Indigenous Peoples, Executive Yuan of Taiwan, has published a written system (2005) for the Rukai aborigines, as shown in Table 5.10 and Table 5.11. The symbols include the varieties attested in Budai, Tanan, Labuan, Tona, Mantauran, and Maga Rukai. It has been suggested that the written system will be popularized among the Rukai aborigines in the future. Note that the consonantal phoneme /z/ is included in the writing system, as shown in Table 5.10. However, the sound [z] was attested as an allophone of the phoneme /ð/ and /ts/ or occurring in loans in the current study. The fieldwork conducted in the current project has revealed that the symbol **z** should represent the sound **ð** in the speech of Budai Rukai.

Table 5.10: Consonants of the Rukai Written System

(1) Budai Ruaki; (2) Eastern Rukai; (3) Labuan Rukai; (4) Tona Rukai;

(5) Mantauran Rukai; (6) Maga Rukai

Orthographic Symbol	IPA	1	2	3	4	5	6
p	p	✓	✓	✓	✓	✓	✓
b	b	✓	✓	✓	✓	––	✓
t	t	✓	✓	✓	✓	✓	✓
d	d	✓	✓	✓	✓	––	✓
k	k	✓	✓	✓	✓	✓	✓
g	g	✓	✓	✓	✓	––	✓
ʼ	ʔ	––	––	––	✓	✓	––
tr	ʈ	––	✓	––	––	––	––
dr	ɖ	✓	✓	✓	✓	––	✓
c	ts	✓	✓	✓	✓	✓	✓
v	v	✓	✓	✓	✓	✓	✓

th	θ	✓	✓	✓	✓	––	✓
dh	ð	✓	✓	✓	✓	✓	✓
s	s	✓	✓	✓	✓	✓	✓
z	z	✓	(✓)	(✓)	(✓)	✓	✓
h	h	(✓)	(✓)	✓	(✓)	✓	(✓)
m	m	✓	✓	✓	✓	✓	✓
n	n	✓	✓	✓	✓	✓	✓
ng	ŋ	✓	✓	✓	✓	✓	✓
l	l	✓	✓	✓	✓	✓	✓
lr	ɭ	✓	✓	✓	✓	✓	(✓)
r	r	✓	✓	✓	––	✓	✓
w	w	✓	✓	✓	✓	✓	✓
y	j	✓	✓	✓	✓	✓	✓
Total: 24	24	22	23	22	22	18	22

Table 5.11: Vowels of the Rukai Written System

(1) Budai Ruaki; (2) Eastern Rukai; (3) Labuan Rukai; (4) Tona Rukai;

(5) Mantauran Rukai; (6) Maga Rukai

Orthographic Symbol	IPA	1	2	3	4	5	6
i	i	✓	✓	✓	✓	✓	✓
é	e	––	––	––	––	––	✓
ɨ	ɨ	––	––	––	––	––	✓
e	ə	✓	✓	✓	✓	✓	✓
a	a	✓	✓	✓	✓	✓	✓
u	u	✓	––	✓	––	––	✓
o	o	––	✓	––	✓	✓	✓
Total: 7	7	4	4	4	4	4	7

Shown in Table 5.11, four orthographic symbols are chosen for Budai Rukai vowels: i, ə, a, u. This confirms that only four vowels are attested in Budai Rukai, and that the sound **o** is an allophone of the phoneme /u/.

CHAPTER SIX
PROSODY OF BUDAI RUKAI

This chapter is a brief sketch of the prosodic components of Budai Rukai. Prosodic aspects of Rukai have rarely been investigated in earlier studies, let alone sentence-level prosody. In addition to word stress, accent also plays a crucial role in words or sentence formation. Identical syntactic phrases represent distinct semantic meanings simply by changing the prosodic components in the phrases. I have shown different types of prosodic components of Paiwan, such as pitch accent, intonation, and prosody beyond sentence in Chapter 4. This chapter, however, focuses upon three major prosodic aspects: stress, pitch accent, and intonation. The prosodic components of Budai prosody to be described and analyzed are illustrated in (1).

(1) Prosodic Components of Budai Rukai

Grammar of Budai Rukai

⋮

Phonological Stress Variation

$\boxed{\text{LEXICAL REPRESENTATION}}$

Accent, Intonation

$\boxed{\text{SURFACE REPRESENTATION}}$

Phonetic Representations of Stress,

Phonetic Implementations of Accent and Intonation

$\boxed{\text{ACOUSTIC SIGNAL}}$

Section 6.1 describes both phonological variation of word stress and phonetic representations of word stress in Budai Rukai. A list of prosodic words with stress variation is compiled for the generalization and the argument for contact stress patterns. Section 6.2 describes and analyzes two types of word-level pitch accent in Budai Rukai: regional and imperative. Sentence-level prosody of intonation and its phonetic representations are found in section 6.3.

6.1 Word Stress of Budai Rukai

Canonical stress patterns in Budai Rukai have been described in Chapter 5. In tri-syllabic and quadric-syllabic sequences, if the penultimate syllable is light, main stress falls on the antepenult; if the penultimate syllable is heavy, main stress falls on the penult. The extrametricality of final syllables has been set up prior to foot construction of moraic trochees from right to left. In this section, variation of word stress in Budai Rukai is described. Stress variation was attested in villages where Budai Rukai speakers have frequent contact with Northern Paiwan speakers. Section 6.1.1 focuses on the descriptive contact stress patterns attested in Budai Rukai, and section 6.1.2 provides empirical evidence for the representations of Budai Rukai stress.

6.1.1 Contact Stress Patterns

As we have seen in Chapter 5 that mutual language contact and frequent intertribal marriage have been attested in the newly settlements, such as the villages in the Majia township, Rukai speakers in the Southern Sanhe Village are able to speak the Paiwan language and communicate with Northern Paiwan speakers. Although influence from Paiwan is inevitable, Budai is considered the most representative Rukai dialect, according to Li's (1995) observation. Nevertheless, it was found in my fieldwork that Budai speakers who live in the Southern Sanhe Village or have frequent contact with the Paiwan speakers tend to produce the Paiwan stress patterns. It was also found that some middle-aged Rukai speakers who live in the Budai Village and have contact with Paiwan speakers have acquired a Paiwan type of stress patterns in their Rukai speech.

In the Southern Sanhe Village, Budai Rukai speakers can produce both Rukai and Paiwan stress patterns, and either stress pattern is acceptable. In the mountain area Budai and Haocha Villages, however, canonical Rukai stress patterns are retained in older speaker's utterance. The following data of contact stress patterns were drawn from a middle-aged informant, who was born and raised in the mountain Budai Village and has frequent contact with Northern Paiwan speakers. In his elicitation tokens, word stress usually falls to the penult of the tri-syllabic and quadric-syllabic words, regardless of the quantity of the penultimate vowels. In words longer than five syllables, the final schwa is extremely weak in his utterance, sometimes hard to perceive. Canonical Budai stress patterns were not completely lost in his Rukai speech, as they were attested in natural discourse or longer utterances. The contact stress patterns are shown in (2).

(2) a. Three-syllable words

Budai Stress	Stress Variation	GLOSS
válisi	valísi	'tooth'
ə́bəḽə	əbə́ḽə	'smoke'
túburu	tobóro	'bamboo shoot'
vágisi	vagísi	'thigh'
ḓə́kəḽə	ḓəkə́ḽə	'buttocks'
ápasə	apásə	'crab'
úbulu	ubúlu	'grass'
tínono	tinóno	'to weave'

látsəŋə	latsə́ŋə	‘vegetables’

b. Four-syllable words

Budai Stress	Stress Variation	GLOSS
ɖərə́ɖərə	ɖərəɖə́rə	‘thunder’
ɭəɖə́ɭəɖə	ɭəɖəɭə́ɖə	‘tender’

c. Five-syllable words

Budai Stress	Stress Variation	GLOSS
aɭaɭə́gələ	aɭaɭəgə́lə	‘fly’
takurápaŋə	takurapáŋə	‘toad’
kalapúsanə	kalapusánə	‘autumn’

Shown in (2), antepenultimate stress in three-syllable, four-syllable, and five-syllable Budai words shifts to the penultimate position in stress variation. The pattern in variation violates the general principle of Budai stress: if the penultimate syllable is light, main stress falls on the antepenult. It is apparent that extrametricality in Budai stress is violated in the pattern of variation. Note that the pattern was attested in the speech of the Budai speakers who have contact with the Northern Paiwan speakers. It occurs in elicitation or narrative. Antepenultimate stress becomes penultimate stress in prosodic words, with the release from extrametricality. The contact stress pattern is formulated in (3).

(3) Release from Extrametricality:

(x) → (x)

…◡◡<◡ > …◡◡◡

There are some cognates shared by both Northern Paiwan and Budai Rukai, as they have been so close to each other geographically, but the semantic meaning of some cognates may transform from one language to the other. Examples of cognates with stress assignment are given in (4).

(4)

	Budai Rukai		Northern Paiwan[1]	GLOSS
a.	tsáki		tsáʔi	'excrement'
b.	válisi		ális	'tooth'
c.	luáŋə		ɭuáŋ	'cattle'
d.	káatsə		k-əm-áts	'to bite'
e.	kánə		k-əm-án	'to eat'
f.	kuáŋə		kuáŋ	'gun'
g.	kútsu		kútsu	'head louse'
h.	ɭə́sə		ɭə́səʔ	'tears'
i.	látsəŋə		látsəŋ	'vegetables'
j.	máatsa		mátsa	'eye'
k.	págaj		pádaj	'rice'
l.	paŋúɖalə		paŋúɖal	'pineapple'
m.	ŋisíŋisi		ŋísŋis	'beard'
n.	**atsíilaj**	**'water'**	**ʔatsíɭaj**	**'stone'**
o.	pə́də		púɖu	'kidney'
p.	áθaj		ʔátsaj	'liver'
q.	údalə		ʔúdal	'rain'
r.	údasə		ʔúdas	'white hair'
s.	ápuj		sápuj	'fire'

[1] As we have seen in Chapter 2, main stress in Paiwan falls on the second-right or the rightmost syllable of each prosodic word, in which prefixes and infixes are excluded from the domain of a prosodic word. Penultimate schwa nucleus does not affect the stress assignment in Northern Paiwan.

t.	tátsu	tátsu	‘clothing louse’
u.	túla	túla	‘eel’
v.	kúuŋu	kúŋ	‘skirt’
w.	báali	váli	‘board’
x.	ɭáva	ɭáva	‘flying squirrel’
y.	bábuj	vávuj	‘boar’
z.	bitsúuka	vitsúka	‘stomach’

Shown in (4), both segments and stress patterns in the cognates are very similar to each other, especially in two-syllable cognates. Because of the cognates shared with Northern Paiwan, and because of being surrounded by the Northern Paiwan speakers in the plain areas, stress patterns in Budai Rukai were affected by Northern Paiwan stress.

6.1.2 Phonetic Representations of Budai Stress

As we have noted in Chapter 5, vowel length does affect the assignment of stress in Budai Rukai (§ 5.6.1). Budai Rukai has a quantity-sensitive stress system. In this section, an attempt is made to sketch how Budai stress is represented in terms of its phonetic correlates. On the other hand, it has been observed that final lengthening may occur in Paiwan to mask the phonetic correlate of stressed vowels. I have argued that phonological long vowel contrast occurs at penultimate position in Budai Rukai, but whether or not phonetic final lengthening occurs in Budai needs to be examined here. In the following instrumental studies, three major correlates, vowel length, pitch, and intensity are to be measured in stressed and unstressed vowels of Budai Rukai, and vowel length of the final syllables and the penultimate syllables is also investigated.

The measured tokens were drawn from male informants who did not show stress variation in their utterances. As consonants may affect the duration of their following vowels, consonants preceding stressed and unstressed vowels are controlled. In addition, vowel quality such as low or high is controlled, as it may affect the pitch realization of stress. Stressed low and high vowels are compared with unstressed low and high vowels respectively. As a result, only the following tokens are eligible for measurements, as shown in (5). Four types of measurement were distinguished for comparison: stressed penult and unstressed final (Type I), stressed antepenult and unstressed penult (Type II), stressed antepenult and unstressed final (Type III), stressed antepenult and unstressed initial (Type IV). Measured syllables in bold are compared.

(5)	Budai Rukai	Measured syllables (in bold)	GLOSS
a.	káka	**káka** (Type I)	'elder siblings'
b.	rúulu	**rúulu** (Type I)	'urine'
c.	pə́əkə	**pə́əkə** (Type I)	'navel'
d.	túuku	**túuku** (Type I)	'chest'
e.	tapə́kəɭə	ta**pə́kə**ɭə (Type II)	'few (people)
f.	aðáðamə	a**ðáða**mə (Type II)	'bird'
g.	atsəkə́tsəkə	atsə**kə́**tsə**kə** (Type III)	'to stand'
h.	aɭaləgələ	aɭa**lə́**gə**lə** (Type III)	'fly'
i.	bilíbili	bi**lí**bi**li** (Type III)	'to pull'
j.	bələ́bələ	bə**lə́**bə**lə** (Type III)	'banana'
k.	varúguru	va**rú**gu**ru** (Type III)	'boat'
l.	pəkə́lanə	**pəkə́**lanə (Type IV)	'few (things)'
m.	vaválakə	**vavá**lakə (Type IV)	'children'

n. ɭóɭodo **ɭóɭo**do (Type IV) 'hole (on the wall)'

A total of 28 elicitation tokens (14 X 2 speakers) from two male speakers of Budai Rukai were measured. The tokens were recorded in continuous elicitation, one repetition per item. A very short pause was inserted between items. None of the word-final vowels were also phrase-final. Tokens recorded from the female speakers were excluded from the measurements due to sudden background noise. Vowel durations of the target syllables were measured from 300 Hz bandwidth spectrograms, including the portion from the burst of the initial consonant to the cessation of high frequency energy. An estimate of the value of the first formant was done, and the fundamental frequency at the midpoint of each vowel was also measured. Vowel length of stressed non-final vowels (i.e., stressed penults or antepenults) and unstressed final vowels were measured to examine the effect of final lengthening or shortening, and stressed penults were measured to see if phonological long vowel contrast at penultimate position has its corresponding phonetic representation. Due to the limited number of the tokens, no statistical test was conducted to show the significant difference between the groups. The results of stressed and unstressed contrast are illustrated in Figure 6.1, Figure 6.2, Figure 6.3 and Figure 6.4. Each bar in the figures represents the group mean.

Shown in Figure 6.1, stressed penultimate vowels always have longer vowel duration and higher pitch than unstressed final vowels, whereas not much intensity difference was found between stressed and unstressed vowels. Final lengthening does not seem to occur in Budai Rukai, as unstressed final vowels are much shorter than stressed penultimate vowels.

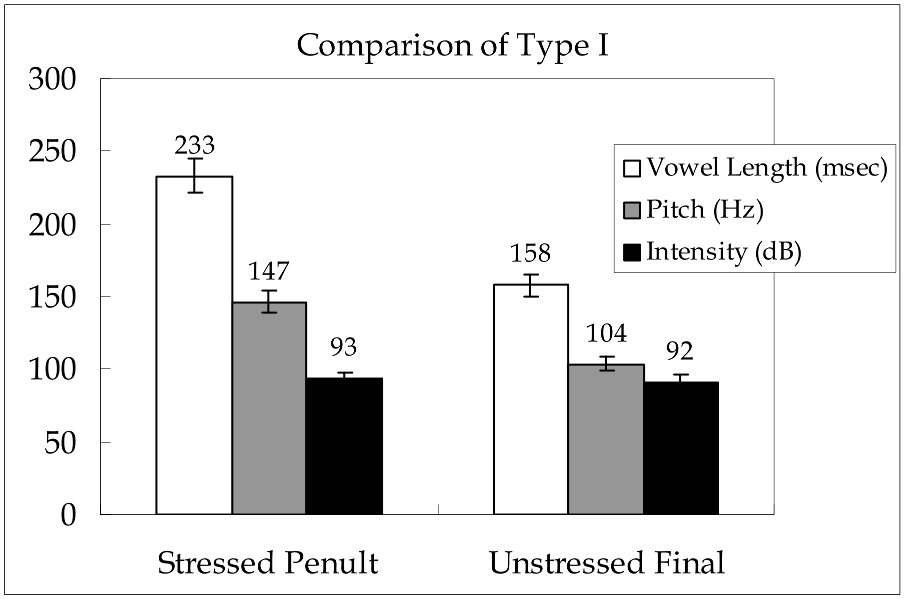


Figure 6.1: Comparison of Stressed Penult and Unstressed Final

On the other hand, three out of four measured words of Type I are with penultimate long vowels. The ratio contrast of the phonetic vowel length means between long vowels and short vowels is given in (6).

(6)

Budai Words	Stressed Penult: Unstressed Final (ratio)		
káka	1.08	:	1
rúulu	1.27	:	1
pə́əkə	1.81	:	1
túuku	2.08	:	1

The comparison of vowel length shown in (6) provides evidence for the description and perception of long vowels in Budai, for the duration of stressed long vowels at penult may be as long as 2.08 times maximum that of unstressed short vowels at final. In words with short vowels at both penult and final, such as **káka** 'elder siblings', pitch becomes a robust cue for stress, because vowel length between stressed and unstressed syllables did not show much difference.

Stressed long vowels at penult show not only much longer vowel length but also higher pitch than unstressed short vowels. The phonetic representation of vowel length supports the observation on the vowel contrast at penultimate position.

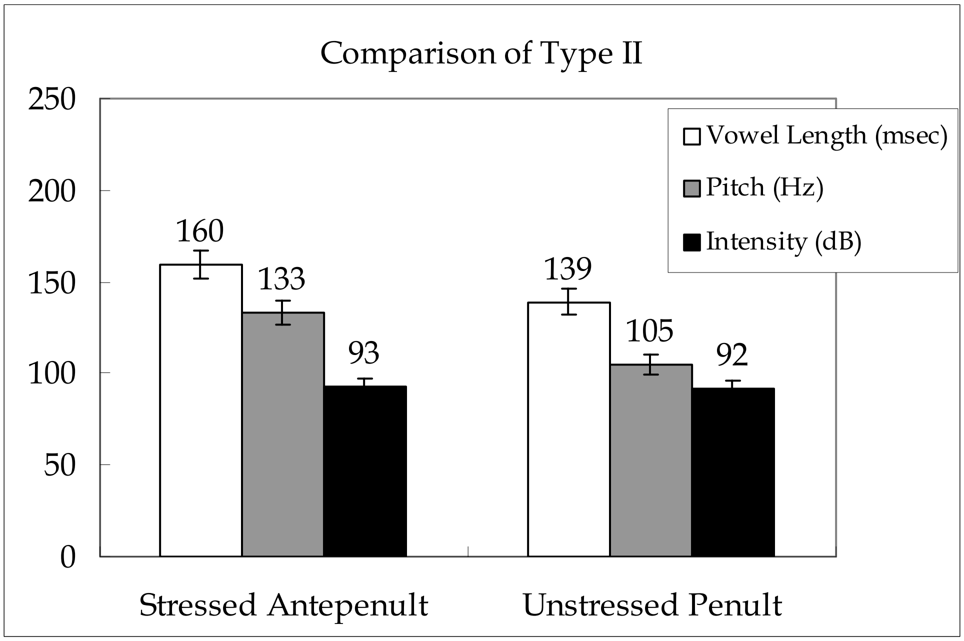


Figure 6.2: Comparison of Stressed Antepenult and Unstressed Penult

Shown in Figure 6.2, stressed antepenultimate syllables have longer vowel duration and higher pitch than unstressed penultimate syllables, but the difference of vowel length between stressed and unstressed syllables is not as much as that of Type I, stressed penult and unstressed final. The mean duration of stressed vowels at antepenult is only 1.15 times that of unstressed vowels at penult. In other words, vowel lengthening does not seem to occur at stressed antepenultimate position.

Shown in Figure 6.3, stressed antepenultimate syllables have slightly longer vowel duration but much higher pitch and greater amplitude than unstressed final syllables. On the other hand, stressed antepenultimate syllables have longer vowel duration and higher pitch than unstressed initial syllables, as shown in Figure 6.4. Unstressed initial syllables tend to have higher pitch than unstressed penultimate and final syllables.

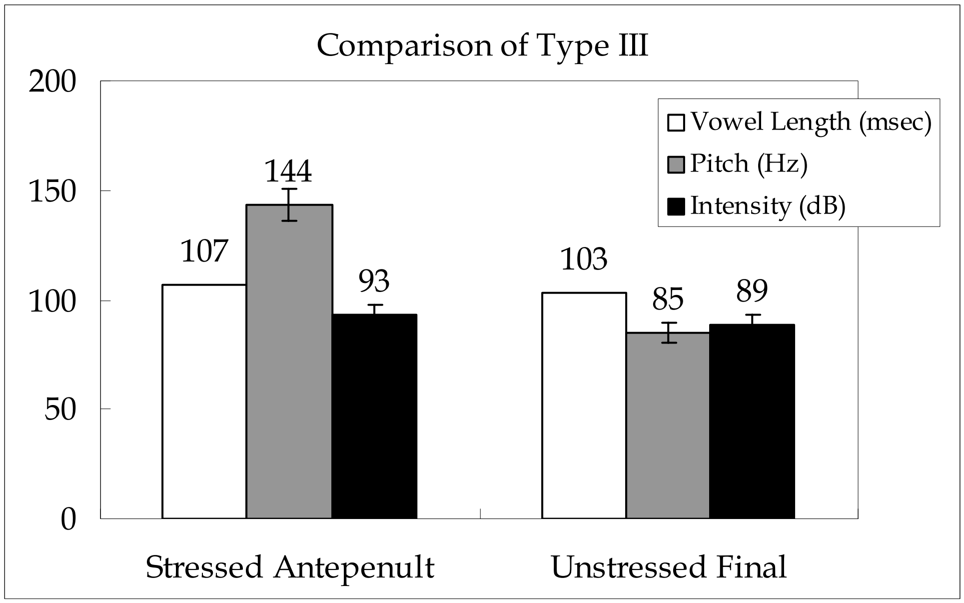


Figure 6.3: Comparison of Stressed Antepenult and Unstressed Final

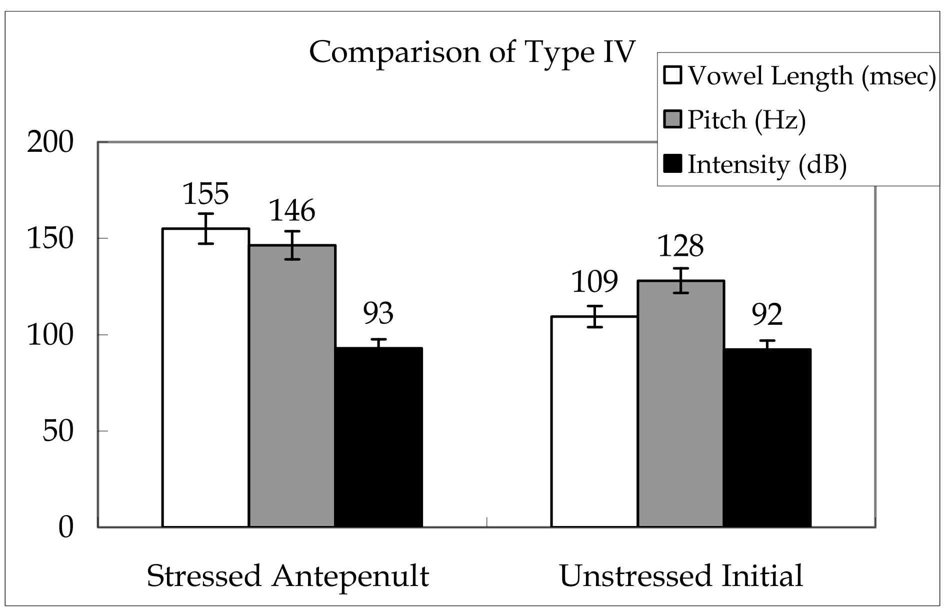


Figure 6.4: Comparison of Stressed Antepenult and Unstressed Initial

It is quite clear from the figures that pitch is the most robust phonetic correlate in Budai stress, as more differences were observed between stressed and unstressed syllables in different types of syllable and position-in-word. Phonetic correlate of vowel length is somewhat sensitive to position-in-word, as it is prominent at penult but not as much prominent at antepenult. It is apparent that higher pitch is always associated with stressed syllables in Budai Rukai, whereas vowel length is subject to its position in words. Phonetic correlate of amplitude is more prominent in Type III, stressed antepenult and unstressed final, but not elsewhere. Long vowel contrast at penultimate position was verified, while neither final lengthening nor shortening was attested in the measurements.

The robust correlate of pitch in Budai Rukai stress is also supported by the pitch tracks of stress variation tokens, as shown in Figure 6.5.

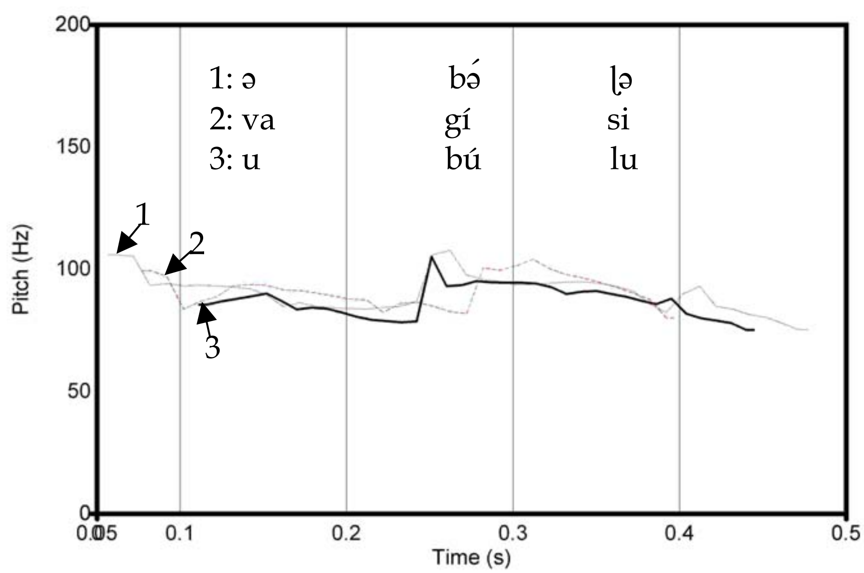


Figure 6.5: Pitch tracks of three stress variation tokens in Budai Rukai

The voice tokens were recorded from a middle-aged male Budai speaker who lived in the Northern Paiwan village for a long time. The tokens for pitch tracks were **əbə́ɭə** 'smoke', **vagísi** 'thigh' and **ubúlu** 'grass'. The F0 peak in these tokens falls to the penult, rather than the antepenult. Nevertheless, no long vowels occur at penult to trigger penultimate stress. Peak prominence in the pitch tracks verifies the presence of phonological stress variation in these tokens.

The preliminary measurements made here are to support the description in the previous chapter. Much more empirical studies are still needed for the investigation of the correlation between stress and its phonetic representations.

6.2 Word-Level Pitch Accent in Budai Rukai

Ross (1992: 50) reexamines Li's (1977a) data of Budai Rukai and states that the final stress of Budai is apparently the last remnants of PAN contrastive stress. Final stress was not attested in Budai Rukai in the current study. Rather, pitch accent captures the grammar of Budai imperatives and the face-to-face discourse context in which both speakers and listeners have to participate. Therefore, the imperative accent was not counted as a word stress here. In this section, two types of pitch accent are described. Section 6.2.1 depicts regional pitch accent attested in Budai Rukai, and section 6.2.2 provides a phonological account for the imperative accent of Budai Rukai.

6.2.1 Regional Pitch Accent

It has been reported in the current project that Budai Rukai is a stress language (§5.6). However, it was also reported by the informants that Budai Rukai has its regional accent. I have observed that those who live in the mountain area have their "Budai mountain accent", characterized by a High-Low falling tone, like the fourth tone (HL) in Mandarin, according to the informant's interpretation. Those who live in the plain area, however, might have lost their original mountain tone. A cautious examination on the Budai prosodic words has revealed that the so-called regional accent is a type of pitch accent imposed on long vowels, not short vowels. In other words, the pitch accent is predictable. The melody is always aligned with penultimate long vowels. As we have seen in Chapter 5, vowel length contrast is expressed at penult (§ 5.6.2). There is usually one long vowel in a word, and the long vowel occurs at penult. A few prosodic words produced by a female speaker in elicitation with regional accent are illustrated in (7).

(7) a. Pitch accent on long vowels

Budai Rukai	Lexical Accent	GLOSS
túuku	tú u ku	'chest'
	H L	
ɭóoθo	ɭó o θo	'marrow'
	H L	
pə́əkə	pə́ ə kə	'navel'
	H L	

b. Pitch accent on short vowels

Budai Rukai	Lexical Accent	GLOSS
kútsu	kútsu	'head louse'
	H	
tátsu	tátsu	'clothing louse'
	H	

Shown in (7), the first mora of the long vowel is aligned with a high pitch tone, while the second mora is aligned with a low tone. The two accented moras composite is the native "Budai mountain accent", termed regional accent HL here. Lexical pitch accent consists of an independent and specific F0 pattern (Remijsen 2003). A pitch track of the prosodic word **túuku** 'chest' is illustrated in Figure 6.6.

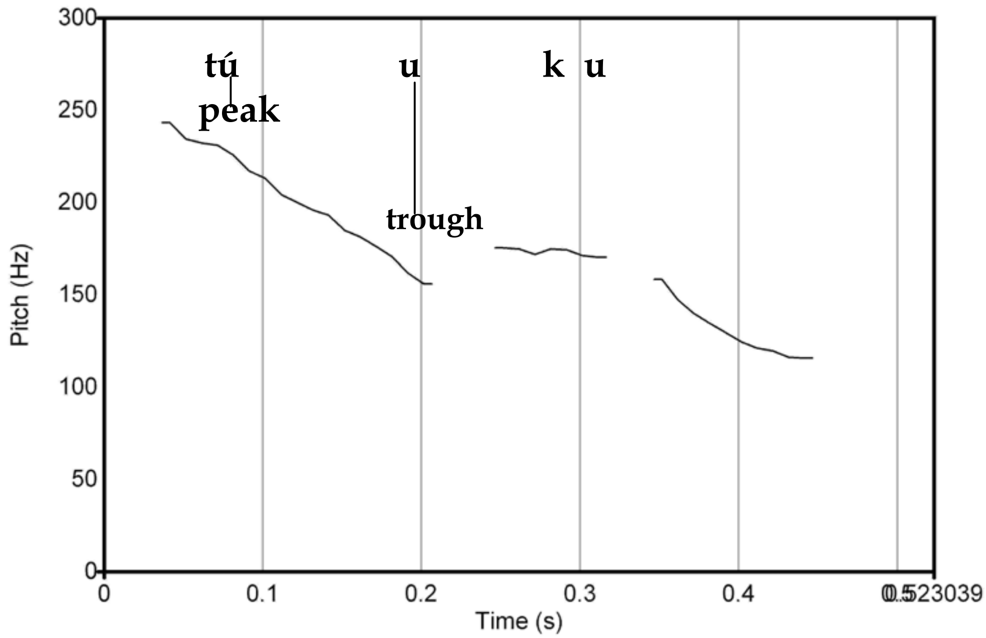


Figure 6.6: Pitch track of the regional accent HL in *túuku* 'chest'

On the other hand, not every stressed vowel is aligned with HL lexical pitch accent. Stressed short vowels are aligned with a high tone only, as shown in (7b). Regional accent HL has become another index for the distinction between long and short vowels in prosodic words of Budai Rukai.

As for the genesis of the tonality in Budai, I interviewed two female speakers ages over eighty in the mountain Budai Village. Both of them could speak neither Mandarin nor Japanese, and they did not speak or understand the Paiwan language either, but they had very strong and frequent regional mountain accent HL in their Rukai speech. In fact, most of the older speakers in the Budai mountain area still hold the HL falling tone, but those who are younger, living in the plain area, and having frequent contact with outsiders may lose this type of pitch accent in their utterances.

6.2.2 Imperative Pitch Accent

The imperative structure in Budai Rukai is formed by adding a vocalic morpheme **–a** to the right edge of a verb stem. If the preceding stem ends with an echo vowel, the echo vowel must be deleted before the imperative formation, i.e., elision occurs before suffixation. Some examples already shown in Chapter 5 are repeated here in (8).

(8)	Agent Focus	GLOSS	Imperative	GLOSS
	wa-uŋulu	'to drink'	uŋul-a	'Drink!'
	wa-ələbə	'to close'	ələb-a	'Close!'
b.	Agent Focus	GLOSS	Imperative	GLOSS
	wa-kanə	'to eat'	kanə-a	'Eat!'
	wa-piḽi	'to choose'	piḽi-a	'Choose!'

Following the canonical stress patterns in Budai Rukai, stress falls on the antepenultimate syllable if no long vowels occur at penult. However, the peak prominence attested in the imperative structure is aligned regularly with the penult, regardless of the quantity of the vowels. Echo vowels are not real vowels and do not count for stress, while the vowels in suffixation do count for stress. A few verb examples are illustrated in (9). In the following examples, 'H' indicates a phonetic pitch peak.

(9)	Budai Verbs	Imperative Verbs	GLOSS
a.	úŋulu	uŋula	‘Drink!’
	H	H	
b.	káatsə	kaatsa	‘Bite!’
	H	H	
c.	ámətsə	amətsa	‘Bring’
	H	H	
d.	ásipi	asipa	‘Count!’
	H	H	
e.	bilíbili	bilibíla	‘Pull!’
	H	H	
f.	dúkuɭu	dukuɭa	‘Throw!’
	H	H	
g.	laválava	lavalava	‘Try!’
	H	H	
h.	ɖápalə	ɖapala	‘Wash (foot)!’
	H	H	
i.	páɭitsi	paɭitsa	‘Turn (around)!’
	H	H	
j.	dávatsə	davatsa	‘Walk!’
	H	H	

Imperative accent is not sensitive to vowel quantity. In the two-syllable word, both pitch peaks in the verb and the imperative are aligned with the stressed syllables, as shown in (9b). In three-syllable or four-syllable words, on the other hand, word stress falls to the antepenultimate syllable, whereas the pitch peaks in the imperatives are aligned with the penultimate syllables. Peak alignment with the penult in imperatives is counted as imperative pitch accent.

Imperative pitch accent in Budai occurs regularly at the penult, regardless of the number of the syllables in the imperative verbs. It would be odd if the imperative accent were treated as word stress. The final syllable is always extrametrical in canonical Budai stress, and most of the penultimate vowels in these prosodic words shown in (9) are short. Regular foot construction to form moraic trochees does not occur in the imperatives. It is not proper yet to propose word stress shift, because the shift does occur in the other similar phonological environments. Suffixation does not change the canonical stress patterns in words, for example, the antepenultimate stress in words **kanə́-anə** 'food', **aələ́b-anə** 'to be closed' and **kala-bətsə́ŋ-anə** 'millet festival'. A proper analysis is to treat the pitch accent in the imperative construction as a phonetic implementation of the syntactic structure or grammar category, taking place between lexical and surface representations in the grammar of Budai Rukai.

6.3 Intonational Phonology of Budai Rukai

I have shown that identical syntactic phrases can represent distinct semantic meanings in Paiwan, a declarative denotation and a yes-no question, simply by the alignment of a high tone and a low tone at the right edge of an intonational phrase. To better capture the typology of intonational phonology in Budai Rukai, a set of contrastive syntactic phrases was investigated. The intonation types are described in terms of peak alignments and prosodic features.

The prosodic domain of intonational phrases (IPs) consists of at least one prosodic word. The immediate constituents of an intonational phrase must form a sense unit. The most distinctive feature in the intonational phonology of Budai Rukai is the degree of peak prominence at the penultimate or antepenultimate position of an IP, depending on the quantity of the penultimate syllable of the prosodic word at the right edge of the IP. If the penult of the rightmost word is heavy, peak prominence occurs at the penultimate syllable of the IP; if the penult of the rightmost word is light, peak prominence occurs at the antepenultimate syllable of the IP. Both declarative sentences and yes/no questions are aligned with a low tone at their right edge of intonational phrases. However, the penult, the second right edge syllable of an intonational phrase, or the antepenult, the third right edge syllable, is aligned with a high tone. The distinction between declarative intonation and yes/no intonation in Budai Rukai is the alignment of upstepped high accent or downstepped high accent. Upstepped high accent refers to an F0 peak that is raised relative to a preceding high accent peak, i.e., it is the most significant peak prominence in an intonational phrase. On the other hand, downstepped high accent refers to an F0 peak that is relative lowered to a preceding high accent peak. Yes-no questions in Budai are aligned with upstepped high accent at their second-right or third-right edge, depending on the quantity of the penultimate syllables of the IPs, whereas declarative sentences are aligned with downstepped high accent at the same positions.

In the IPs of Budai Rukai, yes-no questions always have higher peak and overall wider pitch range than declarative sentences. Upstepped high accent always has higher pitch peak than downstepped high accent within the domain of an IP. A pair of contrastive IPs with identical syntactic form is shown in (10).

(10) a. ka-la-su talialaalaj

Nom.vis-he chieftain

'He is a chieftain.'

b. ka-la-su talialaalaj

Nom.vis-he chieftain

'Is he a chieftain?'

Sentences in (10a) and (10b) have identical lexical representations, but the alignment of intonational accent differentiates one from the other. Pitch tracks of the two sentences are illustrated in Figure 6.7. The pitch track of the declarative intonation is represented as the solid line, whereas the pitch track of the yes/no question intonation is represented as the dashed light line.

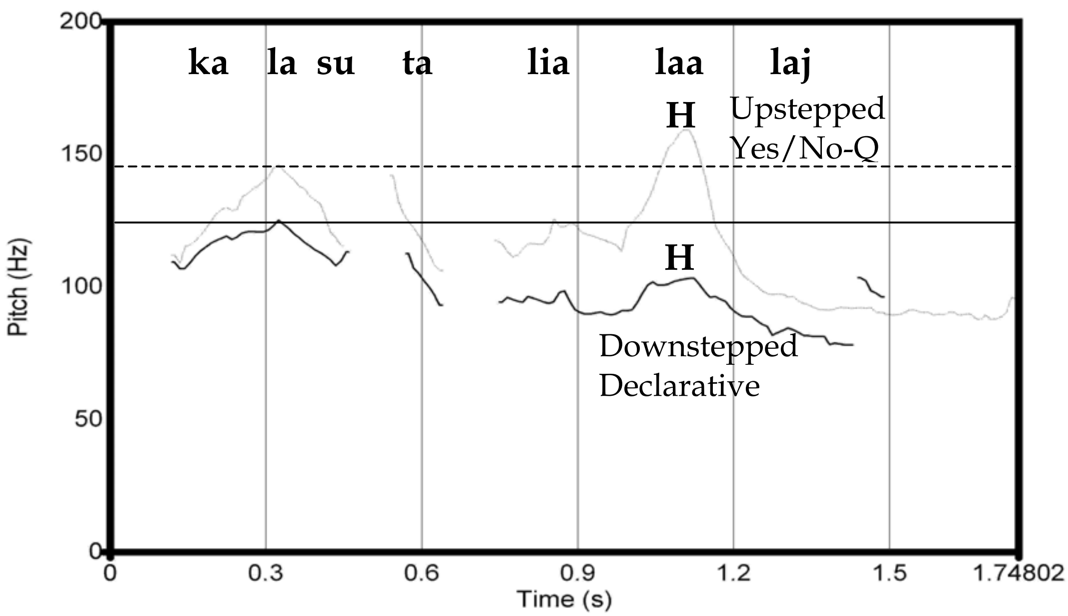


Figure 6.7: Pitch tracks of Budai declarative and interrogative 'he is a chieftain'

Shown in Figure 6.7, both declarative and interrogative sentences have an initial peak at the second syllable **la** of the phrase, and another peak at the second-right edge syllable **laa** of the phrase. However, the F0 peak of the upstepped high accent is above 160Hz, higher than its preceding high accent peak, while the F0 peak of the downstepped high accent is around 100Hz, lower than its preceding high accent peak. Moreover, the interrogative yes-no question has wider pitch range of 72Hz, whereas the declarative sentence has narrower pitch range of 53 Hz. Both of the sentences end with a low tone at their right edge of intonational phrases.

More minimal pairs of intonational phrases (IPs) are given in (11)-(12). In these pairs, syntactic phrases are numbered as letters, whereas their prosodic intonational representations are marked with diacritics. For example, **a′** is the prosodic representation of the syntactic phrase **a**.

(11) a. Syntactic Phrase

ku tara-mə-vaɭulu ku abaabaj tara-ənəmə-lalakə-ini

Nom.invis AF-eighty Lig woman AF-six-child-Gen.3sg

'The eighty-year-old woman has six children.'

a′ **Intonation Representation**

ku tara-mə-vaɭulu ku abaabaj tara-ənəmə-lalakə-ini

H H L

Downstepped Peak

b. Syntactic Phrase

ku tara-mə-vaɭulu ku abaabaj tara-ənəmə-lalakə-ini

Nom.invis AF-eighty Lig woman AF-six-child-Gen.3sg

'Does the eighty-year-old woman have six children?'

b′ **Intonation Representation**

ku tara-mə-vaɭulu ku abaabaj tara-ənəmə-lalakə-ini

H H L

Upstepped Peak

Shown in (11), upstepped and downstepped pitch peaks capture the prosodic distinction between the declarative and the yes-no syntactic phrases.

(12) a. Syntactic Phrase

kuini tara-mə-vaɭulu ka tsaili ka abaabaj maθarili

Nom.3sg.vis AF-eighty Lig year Lig woman pretty

'The eighty-year-old woman is pretty.'

a′ **Intonation Representation**

kuini tara-mə-vaɭulu ka tsaili ka abaabaj maθarili

H H L

Downstepped Peak

b. Syntactic Phrase

kuini tara-mə-vaɭulu ka tsaili ka abaabaj maθarili

Nom.3sg.vis AF-eighty Lig year Lig woman pretty

'Is the eighty-year-old woman pretty?'

b′ **Intonation Representation**

kuini tara-mə-vaɭulu ka tsaili ka abaabaj maθarili

H H H L

Upstepped Peak

In the example of (12b′), a pitch peak occurs at the end of the word **tsaili** 'year'. Intonational peak at sentence-medial position in Budai Rukai usually signals the presence of more than one prosodic word in the sentence, followed by a short pause, whereas the rightmost edge of the IP is aligned with a low tone to signal the end of the sentence.

(13) Syntactic Phrase

kuini tara-mə-vaɭulu ka tsaili ka abaabaj ja-i-maθarili ja-i-si-a-anə

Nom.3sg.vis AF-eighty Lig year Lig woman AF-pretty AF-yet

'Is the eighty-year-old woman pretty or ugly?'

Intonation Representation

kuini tara-mə-vaɭulu ka tsaili ka abaabaj ja-i-maθarili ja-i-sianə

H H H H L

Upstepped Peak

Shown in (13), the content words **maθarili** 'pretty' and the alternative word **si-a-anə** 'yet' are aligned with upstepped pitch peaks at their third-right edge, the antepenultimate position of the prosodic words. Prosodic representations of alternative questions in Budai Rukai are characterized by upstepped pitch peaks on the alternative words and a low boundary tone at the right edge of the IPs.

Thus far, the prosodic features of the declarative and interrogative IPs have been investigated. The distinctive features between declarative and interrogative phrases in Budai Rukai are summarized as follows: (i) the alignments of the upstepped peak or downstepped peak at the second or third-right edge of an intonational phrase, depending on the quantity of the penultimate syllables of the rightmost words; (ii) overall higher pitch; (iii) wider pitch range. The intonation template of Budai Rukai is somewhat similar to the contrast between declarative sentences and yes-no questions in Paiwan, when extrametricality is taken into account. Peak alignment in Paiwan yes-no questions is at the rightmost edge, whereas the peak is aligned with the second or third-right edge of yes-no questions in Budai Rukai. It is apparent that extrametricality plays a crucial role in the intonational phonology of Budai Rukai. The similarity between Budai Rukai and Paiwan yes-no IPs is illustrated in (14).

(14) a. Yes-no Intonational Phrases (IPs) in Budai Rukai

Upstepped Peak

$[(\ldots\ldots\ldots\ldots..\ldots.<.>)_{IP}]_{IP\text{-yes/no interrogative}}$

b. Yes-no Intonational Phrases (IPs) in Paiwan

Peak

[(………..……….)$_{IP}$] $_{IP\text{-yes/no interrogative}}$

In Paiwan, yes-no interrogative sentences end with a high pitch peak, while the yes-no questions in Budai Rukai end with a low tone, with a up-stepped pitch peak occurring at the second-right heavy or third-right light syllable of the IPs.

Are all the interrogative sentences in Budai Rukai aligned with an upstepped peak at their second or third-right edge of the IPs? For instance, are all the WH-questions in Budai Rukai aligned with a pitch peak at the second-right heavy or third-right light syllable of the IPs? There are some WH-words in Budai Rukai, such as *anəanə* 'who', *manəmanə* 'what', *inu* 'where', *ainu* 'which', *kuiganə* 'when (past)', *luiganə* 'when (future)' *tapia* 'how many (+human)', *piia* 'how many (-human)', *a-* 'why'. In the following examples, intonation of WH-Questions is illustrated. WH-words are underlined. Again, **a'** is the prosodic intonation representation of the syntactic phrase **a**.

(15) a. <u>Syntactic Phrase</u>

kuini tara-mə-vaɭulu ka tsaili ka abaabaj si-a-<u>anəanə</u>?

Nom.3sg.vis AF-eighty Lig year Lig woman AF.Poss-who

'What is the eighty-year-old woman's name?'

a' **<u>Intonation Representation</u>**

kuini tara-mə-vaɭulu ka tsaiili ka abaabaj si-a-<u>anəanə</u>?

H H H L

Downstepped Peak

b. Syntactic Phrase

kuini tara-mə-vaɭulu ka tsaili ka abaabaj ja-inu?

Nom.3sg.vis AF-eighty Lig year Lig woman AF-where

'Where is the eighty-year-old woman?'

b′ **Intonation Representation**

kuini tara-mə-vaɭulu ka tsaiili ka abaabaj ja-inu?

H H H L

Downstepped Peak

c. Syntactic Phrase

kuini tara-mə-vaɭulu ka tsaili ka abaabaj tapia ku lalakə-ini?

Nom.3sg.vis AF-eighty Lig year Lig woman how many Lig child-Gen.3sg

'How many children does the eighty-year-old woman have?'

c′ **Intonation Representation**

kuini tara-mə-vaɭulu ka tsaili ka abaabaj tapi a ku lalakə-ini?

H L H L

Downstepped Peak

It is apparent that WH-Questions in Budai end with a low boundary tone at their right edge, with downstepped peaks aligned with the WH-words. Shown in (15c′), a pitch through occurs at the end of the word **abaabaj** 'woman'. The low tone may be placed sentence-medially to signal the end of an internal intonational phrase, followed by a short pause.

d. Syntactic Phrase

tara-mə-vaɭulu ka tsaili ka abaabaj u-daanə luiganə?

AF-eighty Lig year Lig woman AF-house when.future

'When will the eighty-year-old woman go home?'

d′ **Intonation Representation**

tara-mə-vaɭulu ka tsaili ka abaabaj u-daanə luiganə?

H H L

Downstepped Peak

The examples of WH-Questions in (15) have shown that downstepped peaks are aligned with the second or third-right edge of the WH-words, regardless of the position of the WH-words within the IPs. In other words, the prosodic representations of WH-Questions are different from those of yes-no questions in Budai Rukai.

All the interrogative sentences in Budai Rukai end with a low boundary. The major difference between yes-no questions and WH-Questions is the alignment with different degree of peak prominence, i.e., upstepped high tone in yes-no questions and downstepped high tone in WH-questions. The intonational boundary tones of WH-questions are very similar to those of declarative sentences in Budai Rukai, but the position of downstepped peak alignment within the domain of the WH-Questions is consistently at the WH-words.

The typological description of interrogative intonation in Budai Rukai is summarized in (16).

(16) a. Types of questions aligned with upstepped peak prominence at second or third-right edge of the IP:

(i) Yes/No: 'Is the eighty-year-old woman pretty?'

(ii) Alternative: 'Is the eighty-year-old woman pretty or ugly?'

b. Types of questions aligned with downstepped peak prominence at second or third-right edge of WH-words (Where, When, What, Who, How, Why): WH-Questions

The contrast between yes-no questions and WH-questions is given in (17).

(17) a. <u>Syntactic Phrase</u> <u>Prosodic Representation</u>

a-pia-kanə-su manəmanə
AF-like-eat.Nom.2sg what
'What do you like to eat?'

a′ **a-pia-kanə-su manəmanə**
H H L
Downstepped Peak

b. <u>Syntactic Phrase</u> <u>Prosodic Representation</u>

a-pia-kanə-su tai
AF-like-eat.Nom.2sg taro
'Do you like to eat taro?'

b′ **a-pia-kanə-su tai**
H L
Upstepped Peak

Negation in Budai Rukai has the type of intonation similar to declarative IPs, except its initial boundary high tone at the left edge of the IP. A pitch track of the imperative negation *ara si-asipi* 'don't count!' is illustrated in Figure 6.8.

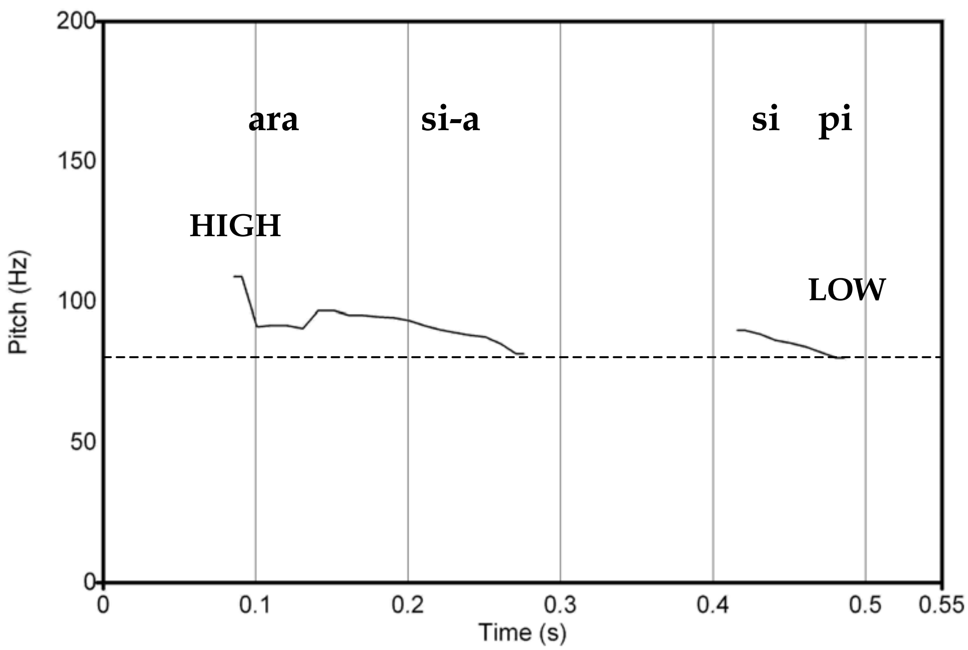


Figure 6.8: Pitch track of the imperative negation *ara si-asipi*

Shown in Figure 6.8, the negation word **ara** 'not' at the initial position of the IP triggers a high boundary tone at its left edge, and the IP ends with a low boundary tone at its right edge, the end of the imperative negation.

In summary, intonation in Budai Rukai has been categorized into two types, with an upstepped pitch peak and a downstepped pitch peak. Types of interrogative sentences with upstepped peak alignment at their second or third-right edge of IPs include yes-no questions and alternative questions. WH-Questions are characterized by the alignment of downstepped peak prominence at its second or third-right edge of WH-words. Both declarative and negation sentences have a low boundary tone, but the IPs with negation words at their initial position are aligned with a high boundary tone at their left edge of the IPs. On the other hand, the transparency[2] of syllable extrametricality is verified in the intonational phonology of Budai Rukai. Pitch accent or any peak prominence is never aligned with the right edge of any prosodic words or intonational phrases in Budai Rukai, except a restricted number of heavy monosyllabic roots.

The chapter has provided a description and analysis of three major types of Budai prosody: stress variation, word-level prosody, and sentence-level prosody. Phonetic implementations of upstepped and downstepped high tones and low tones are important indices for the prosodic representations of Budai Rukai. Prosodic variation, accent and intonation have been successfully modeled in terms of the f0 realization.

[2] The rule of syllable extrametricality built up prior to foot construction is transparent in the sense that it states a generalization that holds over the phonetic representation (cf. Kenstowicz 1994). Oppositely, opacity refers to the phenomenon that output forms are shaped by generalizations that are not surface-true.

CHAPTER SEVEN

THE RELATIONSHIP BETWEEN PAIWAN AND BUDAI RUKAI

The majority of comparative studies on languages aim to serve for the historical reconstruction of the proto-languages. As the classification of Formosan languages has been an issue, I wish to make a connection between linguistic characteristics and the historical development, to draw out the implications of the findings in the current project for the theories of Paiwan and Budai Rukai linguistic prehistory from the Proto-Austonesian (PAN) stage to the present. An attempt is made to support the idea that the common innovations shared by Paiwan and Budai Rukai are due to recent contact, and the evidence from synchronic linguistic features, cognates, and loans are also presented.

Formosan languages have been generally classified into Atayalic, Tsouic and Paiwanic on lexical and syntactic grounds (Dyen 1963, 1965; Ferrell 1969). The Ataylic subgroup includes Atayal and Sediq; the Tsouic subgroup includes Tsou, Kanakanavu and Saaroa; and the Paiwanic includes all the rest. The Rukai language belongs to the Paiwanic in the classification. Ferrell (1969) further subdivided Paiwanic into two branches, Paiwanic I and Paiwanic II. According to Ferrell's (1980) elucidation, Paiwanic is a 'nongroup' comprised of all Formosan languages not falling into the other two subgroups. Later, Blust (1996) has pointed out that the term 'Paiwanic' was more a temporary convenience than the label for a defended hypothesis about linguistic history.

Tsuchida (1976) proposes the hypothesis of Tsouic and Rukai as a subgroup, as shown in Figure 7.1. Ferrell (1980) further points out that Tsouic and Rukai tend to split and merge in the same direction. Both Tsouic and Rukai show very complex reflexes of PAN segments, and the phonological complexities of Tsouic and Rukai require careful studies in the future (cf. Ferrell, 1980). On the other hand, Ho (1983) argues that Rukai had a closer genetic relationship with the Paiwanic rather than with the Tsouic languages, after the examination of fourteen phonological and syntactic features among Formosan languages.

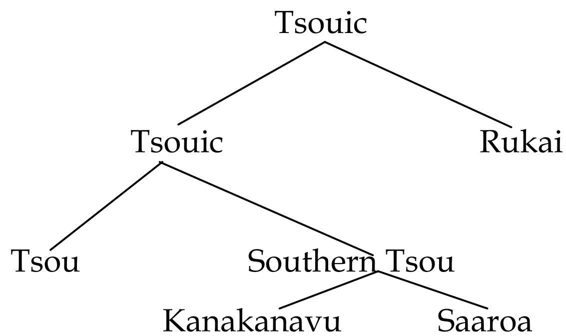


Figure 7.1: Tsuchida's (1976) proposal of the genetic relationship between Rukai and Tsou

Although Ferrell (1969) expressed his reservation about the reality of Paiwanic as a genetic unit, his tripartite classification of the Formosan languages has served as a convenient model until 1990. Li (1990) proposes a comprehensive subgrouping of the extant Formosan languages. The classification of Southern Formosan languages in Li's (1990) conclusion is illustrated in Figure 7.2.

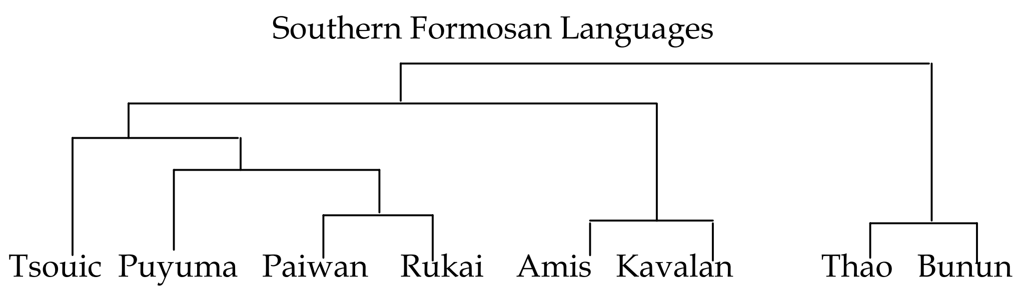


Figure 7.2: A Classification of Southern Formosan Languages (After Li 1990)

One of the big advances in Li's (1990) classification is to give many Formosan languages independent branches, separating from the traditional Atayalic, Tsouic and Paiwanic. His method helps us diagnose some of the borrowings that must have affected Rukai and Tsouic. Li (1990) points out that it makes a real difference in classification whether we treat Rukai as a single language or not. Rukai is more closely related to Paiwan when only Budai Rukai is represented, as geographically adjacency is another factor that affects the number of cognates shared by each pair of languages. Li (1990) also admits that Ruaki has also been geographically located close to the Tsouic languages, for instance, a lot of borrowing between Mantauran Rukai and Saaroa of the Tsouic. Hsin (2000) conducts a phonological study of Maga Rukai and observes that Tsou and Maga Rukai display many common features. On the other hand, Li (1990) also agrees that it is sometimes difficult to separate between historical inheritances and borrowing, especially in early stages before sound changes take place.

Ho and Yang (2000) divide Formosan language into six subgroups, I, II, III, IV, V and VI. Paiwan and Rukai belong the Subgroup V and Subgroup III respectively, as shown in Figure 7.3.

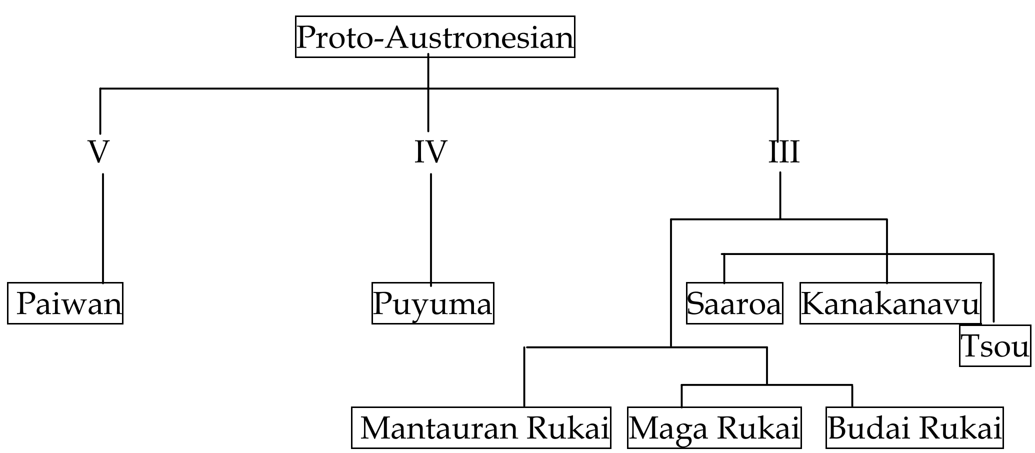


Figure 7.3: Paiwan and Rukai in the Austronesian Family Tree

(After Ho and Yang, 2000)

Ho and Yang (2000) classify Budai Rukai and Tsou into the same subgroup, with independent branches in the subgroup, and Paiwan is an independent branch of PAN in their proposal. They leave many problems unsolved, such as the possibility of merger among the six subgroups, the relationship of the languages in each subgroup. Although different classification methods may stand for different hypotheses, it is apparent that recent proposals (cf. Li 1990; Ho and Yang, 2000) tend to support the independent branch of each language in the family tree.

In the chapter, I am not substituting areal typology for historical or genetic subgrouping. Rather, phonetic observations are made in addition to the basic historical issues, which may or may not reflect the subgrouping directly. Section 7.1 provides evidence from the segments in Paiwan and Budai Rukai. Characteristics of consonants, vowels and syllable structure of Paiwan and Budai Rukai are presented and compared. The segmental characteristics of the two languages have a bearing on the historical reconstruction of Proto-Austronesian (PAN) language. Section 7.2 is the evidence from prosody, including the prosodic representations of stress and pitch accent in Paiwan and Budai Rukai. As I have proposed at the beginning of the project, accentual patterns from Formosan languages are essential for the reconstruction of PAN stress. Peak prominences and accentuation of Paiwan and Budai Rukai have implications for the historical development of prosody in PAN. Section 7.3 describes the phonological features in cognates and loans, as the evidence for the relationship between Paiwan and Budai Rukai and the independent development in each language. Section 7.4 draws the issues of language contact in the Paiwan and Budai Rukai tribes. Some of the phonological features shared by Paiwan and Budai Rukai are due to recent contact. The section also summarizes the types of contact phonology in Paiwan and Budai Rukai.

7.1 Evidence from Segments

7.1.1 Consonants

Budai Rukai consonants differ from Paiwan consonants in their presence of interdental fricatives and the lack of palatal and uvular stops. As mentioned earlier, Paiwan is notable for its large sum of consonantal phonemes, compared with the other Formosan languages. Yet, the merger of consonants has occurred in Northern Paiwan, particularly, the area with contact with Budai Rukai or the other Rukai dialects. Palatalization, a process to turn anterior fricative segments into non-anterior fricative segments before a high front vowel, occurs in both Paiwan and Rukai. Both of the two languages have stops, fricatives, an affricate, a trill, nasals, laterals, and glides. Place of articulation, on the other hand, is the distinctive feature among the Paiwan dialects and Budai Rukai. The place of articulation of the stop and fricative consonants in the examined languages is compared, as illustrated in Table 7.1.

Table 7.1: Place of articulation of stops and fricative in Paiwan and Budai Rukai
✓=attested; Gray background=unattested

Place of articulation	**Budai Ruaki**	**Northern Paiwan**	**Central Paiwan**	**Southern Paiwan**
Labial	✓	✓	✓	✓
Interdental	✓			
Alveolar	✓	✓	✓	✓
Retroflex	✓	✓	✓	✓
Palatal			✓	✓

Velar	✓	✓	✓	✓
Uvular			✓	✓
Glottal		✓	✓	✓

Interdental, palatal, uvular and glottal segments in Paiwan and Budai Rukai are more restricted than segments with the other place features. Consequently, unrestricted segments occur more frequently and have wider distribution than restricted segments. Segments attested in the two languages are more likely to be attested in the other Formosan languages. In fact, palatal stops /c/ and /ɟ/ are not attested in the other Formosan languages.

Ho (1983) claims that the number and types of Rukai consonants had many Paiwanic phonological features. Rukai retained the distinction between **k** and **g** in PAN, which is one of the phonological features of the Paiwanic. It is not clear, however, what exactly the Paiwanic or Rukai phonological features are in Ho's (1983) study.

On the other hand, the phonological feature shared by Northern Paiwan and Budai Rukai is the absence of palatal and uvular stops, whereas all the Paiwan languages are short of interdental fricatives. Many Formosan languages do not have palatal stops. The observation leads to my proposal that the merger between alveolar and palatal segments in Northern Paiwan may be diachronically or synchronically motivated by language contact with Budai Rukai or the other languages adjacent to Paiwan. None of the Rukai dialects have palatal segments or uvular stops. Frequent contact with the other unrestricted phonological features may lead to segmental merger or loss of phonemic distinction. In the case of Northern Paiwan, for instance, the merger might be triggered by both internal and external factors.

Many Formosan languages do not have the interdental segments, and the distinction between **θ** and **c** is one of the phonological features of PAN (cf. Ho, 1983). Interdental fricative /ð/ was pronounced as [z] by some younger native speakers of Budai Rukai. Younger generation in the tribes is bilingual or multilingual, with the tribal language as the native language and Mandarin as the first language. Many Budai Rukai speakers also speak the Paiwan language. Interdental feature is rather restricted in Formosan languages, and it is absent in Mandarin and Paiwan. The shift from interdental **ð** to alveolar **z** has become an inevitable outcome. Alveolar **z** is attested in all the dialects of Paiwan. Consequently, allophones or sound change may occur in the Rukai speech of the tribal younger speakers due to recent contact.

An interesting phenomenon attested in both Paiwan and Budai Rukai is the morphophonemic alternation between glides and fricatives. Li (1974) argues that reflexes of Formosan and Philippine languages for PAN *y and *w in the word-final position are mostly *y* and *w* respectively, while in the non-final positions their reflexes vary from glides to fricatives or liquids. Following his argument, the underlying phonemic status of glides in PAN is ascertained, but the phonemic representation of glides in the daughter languages is somewhat marginal. *Morphophonemic Alternation Rule* between /w/ and /v/ in Paiwan indicates that alternation occurs within a prosodic word, across a morpheme boundary but not across a lexical word boundary. The similar alternation between glides and fricatives was also attested in Budai Rukai. Alternation between /j/ and /ð/ occurs at morpheme-boundary position only before suffixes beginning with **-a**.

The observation on the two languages leads to the generalization that both Paiwan and Budai Rukai retained the glide feature in PAN. Alternation between glides and fricatives in Paiwan and Budai Rukai has something to do with the syllable structure in a prosodic word. According to Blust's (1988) Austronesian root theory, roots have the phonemic shape CV(C), where the last consonant is rarely absent and occurs morpheme-finally only. Following his root theory, the syllables in Paiwan and Budai Rukai prefer to begin with a consonant. In other words, a canonical syllable should have an onset. Therefore, stem-final glides become consonantal fricatives when followed by a vocalic suffixed morpheme. However, Budai Rukai generally does not allow the last consonant morpheme-finally, which is rather different from the syllable structure of Paiwan. More syllabic distinction between Paiwan and Budai Rukai is found in section 7.1.3.

7.1.2 Vowel Distribution

I have shown respectively Paiwan vowel inventory in Chapter 2 (§ 2.2) and Budai Rukai vowels in Chapter 5 (§ 5.2). The inventories of the two languages are summarized in (1).

(1) a. Paiwan vowel inventory b. Budai Rukai vowel inventory

i	u	i	u	ii	uu
ə (o)		ə		əə	
a		a		a	

Vowel inventory in Paiwan and Budai Rukai agrees with the notion that just four Proto-Austronesian vowels a, ə, i, and u are admitted (cf. Blust, 1988). However, Budai Rukai differs from Paiwan in its vowel length at penult. Phonetic vowel length in a language may vary depending on its position in a prosodic word. Final vowels could be lengthened in Paiwan, whereas vowel length contrast at penultimate position in Budai Rukai was verified.

Phonetic mid-high vowel **o** was attested in both Budai Rukai and Paiwan. Vowel **o** was found in loanwords as a marginal phoneme in Paiwan. Phoneme /o/ was selected for the representation of both Budai Rukai and Proto-Rukai in Li's (1977a) reconstruction study, whereas /u/ was documented in Zeitoun's (2000) preliminary reference grammar. Though the phoneme /u/ was presented in the current project, I have noted and admitted the occurrence of the **o** sound in Budai Rukai. Based on acoustic measurements, I have shown that the height of the segment /u/ is closer to that of the schwa segment, and that the lower allophones of the phoneme /u/ were perceived as the phonetic [o] sound. Recall that tongue position for the vowel /i/ is higher than that for the vowel /u/ in Paiwan and Budai Rukai. The observations on the two languages indicate the lower distribution of the vowel /u/ in the Paiwan and Budai Rukai languages.

The evidence for the prominent hierarchy of vowels in Paiwan comes from the stress-bearing units, particularly, the prominence distinction in Central Paiwan. Peripheral vowels are more prominent stress-bearing units than central vowel in Central Piuma Paiwan. In Budai Rukai, low vowel is more sonorant or prominent than high vowels, and peripheral vowels are more sonorant than the central vowel. The similarity between Paiwan and Budai Rukai is the lowest vowel prominence of central schwa /ə/ in the hierarchy or sonority scale, which has been observed in many of the world's languages. Because of the wider distribution of the vowels /i/, /u/ and /a/, and because the vowels /i/, /u/ and /a/ are more frequently attested in many other Formosan languages than the mid schwa, /ə/is restricted. The restriction of the weak schwa can be found in segmental sequences, echo vowels, syllable structure, and prosodic prominence. Schwa /ə/ is more restricted in Central Paiwan than in the other dialects of Paiwan, whereas it exhibits more freedom in Budai Rukai. The restriction of the schwa in the dialects of Paiwan and Budai Rukai is summarized in Table 7.2, in which the asterisk '*' indicates prohibited or no occurrence.

Table 7.2: Restriction of Weak Schwa in Paiwan and Budai Rukai

Budai Rukai	Northern Paiwan	Central Paiwan	Southern Paiwan
*Diphthong	*Diphthong *#V, *V#	Stressless at penult *Diphthong *#V, *V#	*Diphthong *#V, *V#

In both Paiwan and Budai Rukai, vowel sequences may be realized as diphthongs depending on their relative sonority and position-in-words. Generally, diphthongs occur more frequently in word-final position than in word-medial position. A schwa is never realized as a diphthong with the other vowel in vowel sequences. It never occurs in vowel sequences of Paiwan, and it may occur in vowel sequences (other than long vowels) of Budai Rukai but must be divided into different syllables.

It has been pointed out that a schwa is preferred in vowel epenthesis. Vowel copying occurs in all the vowels at word-final position in Budai Rukai, except the most sonorant /a/. When the obligatory feature [-low] in the base vowel for copying is not available, central schwa **ə** is always the best candidate for the constraints on copying. Vowel epenthesis has a bearing on the syllable structure in Budai Rukai, whereas the preference of the weak schwa at word-final position is due to its phonetic weak property.

The distribution of vowels in the two languages indicates that the general principles of vowel sonority in Paiwan and Budai Rukai can be found in many of the world's languages. Phonetic **o** sound in Paiwan is due to language contact, and the confusion of /u/ and /o/ segments in the field reports of Budai Rukai is due to the lower distribution of /u/. Vowel distribution in the two languages cannot stand for the account that Paiwan or Budai Rukai belongs to the same subgroup of PAN. Neither can it account for the proposal of Rukai with any other subgroup of PAN.

7.1.3 Phonological Constraints on the Two Languages

The definition of constraints, under the framework of Optimality Theory (Kager 1999), is a structural requirement that may be either satisfied or violated by an output form. OT recognizes two types of constraints, faithfulness constraints and markedness constraints (Kager, 1999). Faithfulness constraints require that outputs preserve the properties of their basic forms, while markedness constraints require that output forms meet some criterion of structural well-formedness. As I have discussed the pros and cons of Optimality Theory in Chapter 1, the theory allows us to relate the patterns in a language to patterns across languages, which is appropriate for the comparison of Paiwan and Budai Rukai here. Optimality Theory assumes that all the languages have the same set of ranking, and the difference among languages lies in the ranking of the constraints. For instance, typological studies of syllable structure (cf. Blevins 1995) have suggested that syllables prefer to begin with a consonant but end in a vowel. Onset (Prince and Smolensky 1993) is a structural well-formedness constraint, based on the typological results. Languages that avoid codas suggest that the situation is for syllables to have codas. The restricted situation is thus encoded in the well-formedness constraint.

Now, consider the cognates in Paiwan and Budai Rukai, as shown in (2).

(2)	<u>Paiwan</u>	<u>Budai Rukai</u>	<u>GLOSS</u>
	ʔúdal	údalə	'rain'

luáŋ	luáŋə	'cattle'
ális	válisi	'tooth'
ŋísŋis	ŋisíŋisi	'beard'
váva	báava	'wine'

Canonical syllable structure of Paiwan and Budai Rukai is detected in the shape of these cognates. It is apparent that the major distinction between Paiwan and Budai Rukai syllable structures is the permission of the final consonantal coda in Paiwan. Both Paiwan and Budai Rukai syllables are with or without onset, while coda is allowed in Paiwan only. All the well-formed prosodic words in Budai Rukai end in a vowel.

A number of constraints are proposed to capture the syllable structure in Paiwan and Budai Rukai. Constraints in (3) are correspondence constraints, whereas constraints in (4) are syllable-related constraints.

(3) Correspondence constraints

a. MAX-IO: Input segments must have output correspondents (No deletion)

b. DEP-IO: Output segments must have input correspondents (No epenthesis)

(4) Typological syllable constraints

a. Onset $*[_{\sigma}V$: syllables must have onsets

b. No-Coda $*C]_{\sigma}$: syllables are open

A comparison of margin complexity in Paiwan and Budai Rukai is illustrated in Table 7.3. Distinctive syllable types are in bold. Syllable types not attested in the two languages are marked by an asterisk '*' with gray background.

Table 7.3: Margin complexity in Paiwan and Budai Rukai

Comparison	No Coda	Simple codas only	Complex codas
No Onset	V, VV	VC	*VCC
Simple onsets only	**CV, CVV** **Budai Rukai**	**CVC, CVVC** **Paiwan**	*CVCC
Complex onsets	*CCV	*CCVC	*CCVCC

The crucial constraint in Budai Rukai syllables is **No-Coda**. Both complex onsets and complex codas have nothing to do with the syllable structure of Paiwan and Budai Rukai, because they are absolutely prohibited in the languages. This is the strong evidence that Budai Rukai should be not grouped with the Tsouic languages, which allow consonantal clusters in both word initial and internal positions (cf. Tung 1964; Ho 1976; Wright 1997, 1999). Based on the prohibition of onset clusters in Budai Rukai and the segmental features, I argue that the hypothesis of the Tsouic and Budai Rukai as a subgroup is not reliable.

Echo vowel in Budai Rukai raises an issue of phonological constraints on syllable structure. It has been proposed in Chapter 5 (§ 5.2) that echo vowels are treated as epentheses to avoid consonantal coda in the surface forms of Budai Rukai. The following ranking in Budai Rukai must be set up to distinguish the syllable types of the two languages, as shown in (5).

(5) Vowel epenthesis triggered to avoid coda margins in Budai Rukai

No-Coda >> DEP-IO

The ranking is held not only at margins of a word but also at word-medial position in Budai Rukai. In Paiwan, **No-Coda** should be ranked below either **DEP-IO** or **MAX-IO**, as final coda is allowed without any other phonological condition. Consonantal clusters, though not allowed at onset and coda position in both Paiwan and Budai Rukai, occur at word-medial position in Paiwan.

In summary, phonological constraints in OT relate the patterns of Paiwan and Budai Rukai to the patterns across languages. Ranking of the constraints captures the features in Paiwan and Budai Rukai that distinguish one from the other. The critical constraints related to the syllable structure in Budai Rukai are **No-Coda >> DEP-IO**. The constraint ranking indicates the independent branches of Paiwan and Budai Rukai, as the two languages demonstrate distinctive phonological features and constraints. Most Formosan languages exhibit the PAN canonical CVC syllable structure. Ross (1992), from an outsider's view, argues that the Formosan data indicate that the canonical shape of PAN bases was CVCVC. However, there are a number of Formosan languages in which a vowel is added after an earlier final consonant, for instance, Mantauran Rukai and Kanakanavu. He raises the example of the reduplicated monosyllable *ged$_1$géd$_1$ in PAN, in which vowel appears after each occurrence of the reduplicated monosyllable. Budai Rukai should have been categorized into the Formosan languages in which a vowel is added after an earlier final consonant. Echo vowel reflects the preservation of the syllable structure of Proto-Rukai, given that Budai Rukai is the proper and the most conservative dialect. Yet, it is not clear in Ross's (1992) statement what triggered vowel epenthesis and when the epenthesis occurred historically in the language. A more reasonable account seems to assume Rukai as an independent branch of PAN, from which epenthesis of vowels and innovations of the syllable structure occurred.

7.1.4 Implications for Historical Reconstruction

Sound change has occurred in both Paiwan and Budai Rukai. Synchronic phonetic and phonological varieties attested in the speech communities have a bearing on the diachronic reconstruction of sound patterns. Generally speaking, Budai Rukai preserves most of the sounds in Proto-Rukai, and Central Paiwan preserved most of the sounds in Proto-Paiwan. No phonological merger was attested in Budai Rukai and Central Paiwan. The observations on the two languages indicate that Budai Rukai and Central Paiwan are the most conservative forms among their dialects. The major sound change attested in Paiwan and Budai Rukai is summarized in Table 7.4. In the table, segments with an asterisk '*' indicate the proto-forms.

Table 7.4: Major sound change in Paiwan and Budai Rukai

Budai Rukai	Northern Paiwan	Central Paiwan	Southern Paiwan
*v > ø *ð > j *ʔ > ø	*c > t *ɟ > d *q > ʔ *ʎ > l	*w > v (word-finally only)	*k > ʔ *r > ɣ

To better illustrate the distinctive sound patterns in the two languages, the consonantal segments of PAN (cf. Dyen, 1965; Tsuchida, 1976; Ho, 1983; Wolff, 1988; Blust, 1990; Ross, 1992) are paralleled with those of Proto-Paiwan (Ho, 1978) and Proto-Rukai (Li, 1977a), as shown in (6). Note not all consonantal segments in PAN are presented. Phonemes not attested in both Proto-Paiwan and Proto-Rukai languages are in bold and marked with gray background.

(6) PAN Proto-Paiwan Proto-Rukai

PAN	Proto-Paiwan	Proto-Rukai
*p	*p	*p

*b	*b	*b
*t_1	*t	*t
*c	***c**	
*d_1	*d	*d
*Z	***ɟ**	
*d_3	*ɖ	*ɖ
*k	*k	*k
*g	*g	*g
*q	***q**	
*ʔ		
*R		***ʔ**
*b	*v	*v
*S_1	*s	*s
*s	*t	***θ**
*d_2	*z	***ð**
*C	*ts	*ts
*m	*m	*m
*n	*n	*n
*ŋ	*ŋ	*ŋ
*r	*r	
*R		*r
*l	*ɭ	*ɭ
*L	***ʎ**	***l**
*w	*w	***w**
*j	*j	*j

Shown in (6), the merger of palatal sounds in Proto-Rukai applies to the sound change from Proto-Paiwan to Northern Paiwan. The proposal of Rukai as the subgroup of the Paiwanic cannot account for the reflexes in Proto-Paiwan and Proto-Rukai, for instance, the development of the interdental segments, and the merger or loss of phonemes. The sound patterns in the proto-languages capture the derivation and reflection in each sub-dialect. It provides evidence not only for historical sound change but also for synchronic language contact between Northern Paiwan and Budai Rukai. The reconstructed phonemes in PAN, Proto-Paiwan and Proto-Rukai support the argument that Paiwan or Budai Rukai is an independent branch of PAN. The similarities between Northern Paiwan and Budai Rukai are due to recent contact.

7.2 Evidence from Prosody

7.2.1 Stress Patterns

Stress patterns in Paiwan are quantity-insensitive. I have proposed the metrical parameters for Paiwan stress as follows: form syllabic trochees from right to left and end rule right. Final stress subject to schwa penult $[\ldots \sigma\, \text{ə}\, \acute{\sigma}]_{\text{Prwd}}$ was also proposed to account for the distribution of stress in Central Paiwan. Stress in Northern and Southern Paiwan does not seem to seek out the most prominent vowel. On the other hand, the metrical parameters in Budai Rukai stress were proposed as follows: syllable extrametricality must be set up prior to forming moraic trochees from right to left and end rule right. When long vowels occur at penult, they get main stress. Long vowels in the other positions where they do not receive main stress, they are shortened. Moreover, secondary stress was attested in Budai Rukai, on remaining heavy syllables, and on every other light syllable counting from right to the left.

The major differences between Paiwan and Budai Rukai stress patterns are the quantity-sensitive and extrametrical property in Budai Rukai. Main stress in Budai Rukai falls on either the heavy penult or the antepenult of a word, depending on the weight of the penult. In other words, syllable weight plays a crucial role in the assignment of stress. Vowel length contrast is expressed at penult in Budai Rukai.

Roots or stems in a prosodic word are always the optimal stress-bearing units in Paiwan and Budai Rukai. Depending on the position to which the morphemes are attached and the number of syllables, suffixes may be stressed or unstressed. Ligatures, however, tend to be stressless in both Paiwan and Budai Rukai. Vocalic ligatures or CV-construction markers are treated as extrametrical. Final lengthening in Paiwan is a phonetic representation, whereas long vowel contrast at penultimate position in Budai Rukai is a phonological representation.

On the other hand, final syllables in Budai Rukai must be stressless, when the syllables are not monosyllabic stems. Monosyllabic stems in Budai Rukai are restricted. A prosodic word in Budai Rukai generally cannot end in a stressed syllable, regardless of the quantity of the syllable. The following constraint captures the property of Budai Rukai stress, which is the counterpart of 'extrametricality', as shown in (7).

(7) NONFINALITY (Prince and Smolensky 1993)

No prosodic head is final in PrWd

On the contrary, a prosodic word in Central Paiwan receives stress at the final syllable if it has a schwa penult. It is apparent that the constraint NONFINALITY must be violated in Central Paiwan but obeyed in Budai Rukai.

Neither does Paiwan nor Budai Rukai has initial main stress in prosodic words longer than four syllables. A cross-linguistic preference is for stress to fall at edges of the domain. The pair of metrical alignment constraints is LEFTMOST and RIGHTMOST (Prince and Smolensky 1993), as shown in (8).

(8) a. LEFTMOST: Align (Hd-Ft, Left, PrWd, Left)

The head foot is leftmost in PrWd

b. RIGHTMOST: Align (Hd-Ft, Right, PrWd, Right)

The head foot is rightmost in PrWd

Given that both Paiwan stress and Budai Rukai stress obey the constraint RIGHTMOST, the constraint NONFINALITY distinguishes the right edge prominence in Budai moraic trochee stress from that in Paiwan syllabic trochee stress. The constraint ranking of edge alignment prominence is illustrated in Table 7.5.

Table 7.5: Constraint ranking for edge alignment in Paiwan and Budai Rukai

Constraint Ranking	Result	Language
NONFINALITY>> RIGHTMOST >> LEFTMOST	Antepenultimate stress	**Budai Rukai**
RIGHTMOST >> LEFTMOST, NONFINALITY	Penultimate stress	**Paiwan**

However, penultimate stress was also attested in Budai Rukai, in heavy penults. Stress in Budai Rukai falls on the penult if the penultimate syllable is heavy. Quantity-sensitive stress is the matching of syllable weight and prominence. Weight-to-Stress Principle is the most important constraint in this type of stress, as shown in (9).

(9) WSP: Heavy syllables are stressed (Prince and Smolensky 1993)

The constraint WSP distinguishes the penultimate stress in Budai Rukai from that in Paiwan. The constraint ranking of the penultimate stress in the two languages is illustrated in Table 7.6.

Table 7.6: Constraint ranking for penultimate stress in Paiwan and Budai Rukai

Constraint Ranking	Result	Language
NONFINALITY>> WSP, RIGHTMOST >> LEFTMOST	Penultimate stress (Heavy penults)	**Budai Rukai**
RIGHTMOST >> LEFTMOST, NONFINALITY, WSP	Penultimate stress	**Paiwan**

The critical constraints related to the prosodic prominence in Budai Rukai are summarized in (10).

(10) Critical constraints in Budai Rukai

NONFINALITY>> RIGHTMOST, WSP >> LEFTMOST

It is apparent that the syllabic trochee stress in Paiwan is different from the moraic trochee stress in Budai Rukai. Final syllables as extrametrical and Weight-by-penultimate-position in Budai Rukai are important indicators that the development of prosody in Rukai or its proto-language was not under the subgroup of the Paiwanic. While stress variation attested in Budai Rukai villages is due to recent contact (§ 6.1.1), the canonical stress patterns in the language support the argument that Budai Rukai is an independent branch of PAN.

7.2.2 Pitch Accent

Pitch accent in Paiwan and Budai Rukai occurs in prosodic words. Although no distinctive lexical accent was attested in Paiwan, regional pitch accent in Budai Rukai is associated with long vowels, with the first mora of the long vowel aligned with a high pitch tone and the second mora aligned with a low tone. Regional pitch accent HL in Budai Rukai has become another index for the distinction between long and short vowels in Budai Rukai.

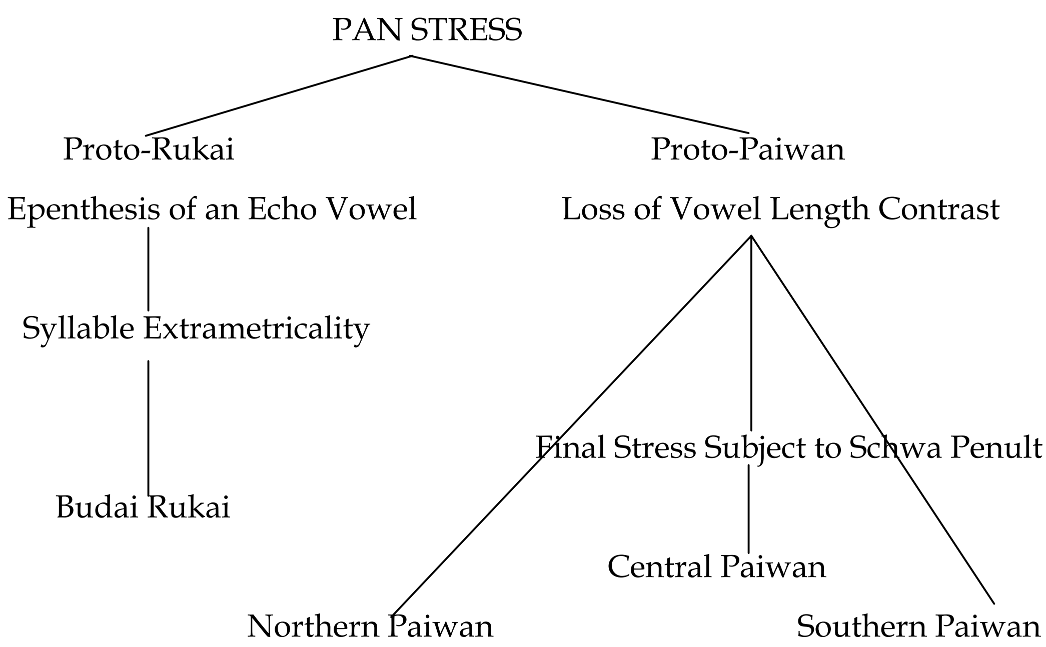
As far as imperative accent is concerned, the formation of imperatives in Paiwan and Budai Rukai shares the similarity of the following vocalic morpheme, **-u** or **–i** in Paiwan, and **–a** in Budai Rukai. I have claimed that imperative accent in the two languages is predictable. However, imperatives of Budai Rukai differ from those of Paiwan in their elision of the echo vowels and final extrametrical syllables. Not every Paiwan imperative ends with a high pitch accent at the right edge of a prosodic word, and only stems or verbs ending with the same vowel of the imperative vocalic morpheme, i.e., **u** or **i**, are aligned with a high pitch imperative accent at the right edge of the imperatives. In Budai Rukai, the peak prominence attested in the imperative structure is at penult, regardless of the quantity of the vowels. In Paiwan, accent attested in address forms is at the right edge of the prosodic words.

As for the tonality in the languages, regional pitch accent HL in Budai Rukai is usually aligned with long vowels only, and it has a bearing on the contrastive stress of Proto-Rukai, as well as on PAN stress. Pitch accent in Paiwan cannot account for the prosodic patterns attested in Budai Rukai. Again, this is another evidence for the argument that the development of prosody in Budai Rukai and Proto-Rukai was not under the subgroup of the Paiwanic.

7.2.3 Implications for Proto-Austronesian Stress

Historical reconstruction studies on Proto-Austronesian (PAN) language have focused on segmental reconstruction. Prosodic components, such as PAN stress or accent are not clear yet. The data drawn from Wolff (1993) have lead to the generalization that PAN roots had a stress contrast in the final two syllables of the root. The vowel length contrast at penult and stress distribution in Budai Rukai seem to conform Wolff's (1993) claim, except the synchronic syllable extrametricality attested in the current project. On the other hand, vowel length is not phonemic in Paiwan, and stress in Paiwan is generally position-dominated. Wolff's (1993) proposal on PAN stress entails three assumptions: (i) second-right edge or right edge of PAN root is the optimal position for stress; (ii) vowels of PAN root have long and short contrast; (iii) PAN stress is quantity-sensitive. Based on these assumptions and the findings in the current project, the historical development of stress from PAN to modern Paiwan and Budai Rukai is reconstructed, as shown in (11).

(11)



Shown in (11), syllable extrametricality in Budai Rukai seems to be an indicator for the canonical stress in PAN, reflecting a later epenthesis of an echo vowel in the historical development of stress. The historical reconstruction illustrated in (11) is apparently against the proposals that have claimed the sub-grouping of Rukai with the Tsouic or with the Paiwanic. Taking echo vowels and syllable extrametricality into account, the stress patterns in Budai Rukai exactly reflect the PAN stress patterns reconstructed by Wolff (1993). Extrametricality in Budai Rukai is a reflex of the historical development of echo vowels. On the other hand, contrast of vowel length is lost in Proto-Paiwan. Final stress subject to schwa penult in Central Paiwan is very likely to be the remnant of the contrastive stress in PAN.

Among the languages and dialects investigated in the current project, Budai Rukai is the only one that exhibits contrast of vowel length at penult. In fact, many languages of the Philippines show contrasts between long and short vowels. In Proto-Philippines (PPH), a penultimate *ə was always short, but *a, *i, or *u could be either long or short. Zorc (1993) points out that although there is no Formosan language corresponding in a completely systematic manner with the oxytone/paroxytone contrast of PPH, there are indicators in Formosan languages that such a contrast is reconstructable for PAN and is fragmentarily reflected in these languages. The current project has provided two more indicators in the Formosan languages that reflect the contrastive stress in PAN: syllable extrametricality in Budai Rukai and final stress subject to schwa penult in Central Paiwan. In addition, imperative and pragmatic accents in Paiwan and Budai Rukai are the new evidence counter to Zorc's (1993) syntactic classification on final accent. Imperative accent does not always fall to the final syllables in Paiwan, and it never falls to the final syllables in Budai Rukai.

Stress contrast in Budai is the most interesting point for the reconstruction of PAN stress. The interaction between phonemic vowel length at penult and stress provides evidence for the argument of contrastive stress in PAN roots. The stress patterns of Budai Rukai described in the current project not only provide new evidence for the reconstruction of PAN stress but also elucidate Ross's (1992) proposal that the oxytones of Budai are apparently the last remnants of PAN contrastive stress, with an account of syllable extrametricality. Following Ross (1992), the so-called oxytones of Budai generally correspond with Proto-Philippines (PPH) oxytones, and therefore presumably reflect PAN oxytones. Finally, the reconstruction of historical development of PAN stress in this section has supported the idea that Paiwan and Budai Rukai is each an entirely independent branch of PAN.

7.3 Cognates and Loans

Phonological innovations exclusively shared by two languages have been taken as evidence for a close genetic relationship between the languages (cf. Li 1990). Cognates have become the most important indices for the historical reconstruction and the relationship between Paiwan and Budai Rukai. I have argued that Paiwan and Budai Rukai are the independent branches of PAN, and that some similarities shared by the two languages are due to recent contact. In this section, cognates are presented for the verification of sound change from PAN to the modern languages. Loans, on the other hand, provide evidence for language contact and the synchronic phonological adaptation in each language.

Cognates attested in PAN (cf. Ross, 1992), Proto-Rukai (Li, 1977a) and Proto-Paiwan (Ho 1983; Ho and Yang 2000) are illustrated in (12). In the following examples, the asterisk '*' indicates the proto-forms.

(12)	PAN	GLOSS	Proto-Rukai	Proto-Paiwan
a.	*babuy	'boar'	*baboy	*vavuy

b. *qayam	'bird'	*a-ða-aðamə	*qayaqayam
c. *tuLa	'eel'	*tola	*cuʎa
d. *laŋaw	'big fly'	*aɭaŋaw	*ɭaɭaŋaw
e. *maCa	'eye'	*maca	*maca
f. *qaCəy	'liver'	*aθay	*qacay
g. *liqəR	'neck'	*ɭəʔə	*ɭiqə
h. *luSəq	'tears'	*ɭəsə	*ɭusəq
i. *Sapuy	'fire'	*apoy	*sapuy
j. *quZaL	'rain'	*odalə	*quɟaʎ
k. *təbuS	'sugarcane'	*coboso	*Cəvus
l. *quay	'rattan'	*ovay	*quay
m. *qubuh	'ash'	*abo	*qavu
n. *pajay	'rice plant'	*pagay	*paday
o. * kuCuh	'louse'	*koco	*kucu
p. *CaliŋaR	'ear'	*caɭiŋa	*caɭiŋa
q. *kaSuy	'tree'	*ʔaŋato	*kasiw
r. *biCuka	'stomach'	*bicoka	*vicuka
s. *susuh	'breast'	*θoθo	*tutu
t. *Səpat	'four'	*səpatə	*səpac
u. *lima	'five'	*ɭima	*ɭima
v. *unəm	'six'	*ənəmə	*unəm
w. *pitu	'seven'	*pito	*pitu
x. *Siwa	'nine'	*baŋatə	*siva
y. *Zalan	'road'	*daɭanə	*ɟalan

z. *bəgay ‘to give’ *baʔay *pavai

Shown in (12), Proto-Paiwan retained the CV(C) syllable structure in PAN, while vowel epenthesis at word-final position occurred in Proto-Rukai. Syllables in Proto-Rukai did not end with a real consonant. It is apparent that both Proto-Rukai and Proto-Paiwan are the daughter languages of PAN, as most of the cognates in PAN have their corresponding reflexes in the daughter languages. Uvular consonant ***q** in PAN at word-initial position was generally deleted in Proto-Rukai, and some cognates in Proto-Rukai reflected their innovations, as shown in (12q) and (12x). This is the direct evidence for the independent development of Proto-Rukai in historical reconstruction. On the other hand, Proto-Paiwan retained not only the syllable structure but also most of the phonemic segments in PAN. This explains why earlier studies have claimed that Taiwan may be the oldest area where the PAN forms are preserved (cf. Blust 1977, 1999; Ross 2002) and the phoneme inventory in Paiwan directly comparable to the PAN inventory (Ferrell, 1982). It also explains why the Paiwanic was an independent branch of PAN in earlier classification (cf. Dyen 1963, 1965; Ferrell 1969, 1980; Tsuchida, 1976).

As we have seen in Chapter 6 (§ 6.1.1), Budai speakers who have frequent contact with Northern Paiwan speakers may have acquired the stress patterns of Northern Paiwan. Some cognates presented in Chapter 6 are repeated here with the corresponding forms in Central and Southern Paiwan (PW), as shown in (13). The segmental distinction between Northern and Central/Southern Paiwan (PW) is in bold.

(13) <u>Budai Rukai</u> <u>Northern Paiwan</u> <u>Central/Southern PW</u> <u>GLOSS</u>

a. válisi á**l**is á**ʎ**is ‘tooth’

b.	tsáki	tsá**ʔ**i	tsá**q**i	‘excrement’
c.	ɭə́sə	ɭə́sə**ʔ**	ɭəsə́**q** / ɭə́sə**q**	‘tear’
d.	látsəŋə	**l**átsəŋ	**ʎ**átsəŋ	‘vegetables’
e.	paŋúɖalə	paŋúɖa**l**	paŋúɖa**ʎ**	‘pineapple’
f.	válakə	á**l**ak	á**ʎ**ak	‘kid’
g.	áθaj	**ʔ**átsaj	**q**átsaj	‘liver’
h.	údalə	**ʔ**ú**d**al	**q**ú**ɟ**al	‘rain’
i.	údasə	**ʔ**údas	**q**údas	‘white hair’
j.	túla	**t**ú**l**a	**c**ú**ʎ**a	‘eel’
k.	báali	vá**l**i	vá**ʎ**i	‘board’
l.	tsúbusu	**t**ə́vus	**c**əvús/**c**ə́vus	‘sugarcane’

Shown in (13), the canonical syllable structure of Paiwan is preserved in Northern Paiwan, but the merger of consonantal segments or phoneme shift occurs in several cases. For instance, uvular **q** is attested in Central and Southern Paiwan but lost in Northern Paiwan. This is the evidence that sound change occurs in Northern Paiwan, and the change may be due to the language contact with Budai Rukai. No uvular stop occurs in Budai, and the Northern Paiwan speakers live geographically adjacent to the Budai speakers. All the Paiwan speakers also speak Mandarin, but Central and Southern Paiwan speakers still preserve the uvular stop sound. A more reasonable account for the phoneme shift from uvular stop **q** to the glottal stop **ʔ** in Northern Paiwan is the direct contact with Budai Rukai. Similarly, palatal sounds /c/, /ɟ/ and /ʎ/ become alveolar sounds /t/, /d/ and /l/ in Northern Paiwan, but those palatal sounds are preserved in Central and Southern Paiwan, which is another direct evidence that sound change attested in Northern Paiwan is due to recent contact with Budai Rukai. Other languages such as Mandarin and Taiwanese may play a role in the phoneme shift or sound merger, but the primary factor to trigger the change in Northern Paiwan is the absence of the sounds in Budai Rukai and the frequent contact between Northern Paiwan and Budai Rukai speakers.

On the other hand, the loan words attested in Paiwan are from a wide variety of languages, including Japanese, Mandarin, Taiwanese (Southern Min), and the other Formosan languages. Paiwan speakers have a long period of contact with the speakers of Chinese and Taiwanese, and the language contact is still ongoing. Paiwan was under the effective control of Japanese from 1895 to 1945, and this fact is reflected in the large number of terms borrowed from Japanese, particularly in the fields of education, administrative organization, and electronics. According to Ferrell's (1982) description, Japanese was widely used as a contact language for missionary work, and many terms having to do with church or proselytizing came to be used in Paiwan after World War II. Ever since Mandarin has replaced Japanese as the official contact language, Mandarin loans have been gradually increasing. The majority of older Paiwan speakers are Japanese and Paiwan bilinguals or Paiwan monolinguals with at least elementary listening comprehension of Mandarin, while the speakers under the age of fifty are Mandarin and Paiwan bilinguals.

The Japanese loans collected in Central Piuma Paiwan are shown in (14). Donor Japanese words are placed in the parentheses.

(14) Japanese Loans in Paiwan

Paiwan	Gloss (Japanese Origin)
a. íka	'TV, movie' (< eega 'movie')

b. básu 'bus' (< basu 'bus')

c. gakú 'school' (< gakkoo 'school')

d. biúyin 'hospital' (< byuuyin 'hospital')

e. kisátsu 'policeman' (< keisatsu 'policeman')

f. a.mí.ɭi.ka 'American, Europeans' (< amerika 'America')

g. sisín[1] 'teacher' (< sensee 'teacher')

h. itʃíba 'market' (< itʃiba 'market')

i. dinwá 'telephone' (< denwa 'telephone')

j. mízi 'road' (< mitʃi 'road')

k. ʔotúbay 'motorcycle' (<ootobai 'autubicycle')

l. sásiŋ 'to photograph' (< shashin 'photography')

Quite a few phonological changes have been made for the incorporation of the loans. The detailed changes are given in (15).

(15) Phonological Change in Japanese Loans

(a) Vowel Adaptation: Paiwan does not borrow the mid-high vowel /e/ from Japanese but raises the /e/ vowel in Japanese to /i/ (/e/> /i/), as shown in (14a, e, f, g, i). Phoneme substitution has been found to be the most frequent adaptation when a foreign sound in loanwords does not exist in the receiving language. The Paiwan phoneme /i/ has become the equivalent of Japanese /e/ in loanwords.

(b) Loss of Long Vowels: loanwords borrowed from Japanese usually do not retain the vowel length distinction, as illustrated in (14c, d, g, k).

(c) Unpredictable Stress Assignment: vowels originally long in Japanese may get stressed in Paiwan, which violates the general principles for stress

[1] Paiwan speakers have their aboriginal word *rutuʎutuʎu* for 'teacher'. But they usually call the teachers in the local schools '*sisín*'.

assignment, as shown in (14c) and (14g). Japanese is a pitch accent (High/Low) language, whereas Paiwan has word stress and phrasal stress. All the loans in (14) have their primary stress, but the stress patterns in loans are not predictable.

(d) No Geminate Consonants: geminate consonants do not occur in Paiwan. CC clusters at word-medial position are usually with phonological restrictions, and *kk sequences are prohibited in Paiwan. The geminate consonants in Japanese *gakkoo* have become a single consonant, as shown in (14c). Yet, compensatory length does not occur after the degemination.

Nowadays Paiwan speakers switch to the Mandarin language code much more frequently, rather than borrowing loanwords from Mandarin. In other words, code-switching between Mandarin and Paiwan has become a typical model for communication among Paiwan speakers under the age of fifty.

On the other hand, Paiwan speakers also have frequent contact with Taiwanese people. Loans borrowed from Taiwanese cover a variety of fields. A few examples of Taiwanese loans are illustrated in (16).

(16) Taiwanese Loans in Paiwan

	Paiwan	Gloss
a.	káku	‘frame’
b.	ísiŋ[2]	‘doctor’
c.	isisíu	‘ public health office'
d.	tsimitsimi	‘blind’
e.	ʃiúbai	‘vendor; grocery store’

[2] Paiwan speakers also have an aboriginal word *ruputsəmətsəmər* ‘witch doctor’ for ‘doctor’ in the tribal society, in contrast to the doctor with modern medication training.

f. ciam/dimpu ‘store’

g. pairáŋ ‘Taiwanese people (bad people)’

h. kúŋ ‘skirt’

i. síbin ‘towel’

Phoneme substitution, of course, also occurs in the Taiwanese loans. Note that Taiwanese is a tone language, while Paiwan is a stress language. All the tones in the donor language have become invisible in the loanwords. The most salient phonological change in Taiwanese loans, in addition to the segmental adaptation, is the prosodic pattern with unpredictable stress and the lost of distinctive tonal features.

Loans attested in the Paiwan villages were sometimes used and understood in Budai Rukai villages. However, the number of loans in Budai Rukai is relatively less (§ 5.1.4). Monolingual Budai speakers could be found in mountain areas. The majority of the loans in Budai Rukai are from Japanese, and the Japanese loans are related to foreign food and living materials, such as noodles, tables, and papers. Due to the geographical location of the Budai speakers, terms with reference to the ocean, fishing, seafood, or animals in the plain area are borrowed from the other languages, such as Paiwan or Mandarin.

Loans are the direct evidence for language contact. Loans drawn from the Paiwan village support for the argument that language contact may cause phonological adaptation or even sound change.

7.4 Language Contact in the Tribes

Contact among the Paiwan aborigines occurs most frequently between Northern and Central areas, because they are geographically adjacent to each other. As I have mentioned a case of immigration from Northern Paiwan to the

Central in Chapter 2, the speaker has acquired the patterns of final stress subject to schwa penult. Language contact, again, occurs between Northern Paiwan and Budai Rukai. In both Northern Paiwan and Budai Rukai tribes, most of the speakers are bilingual or multilingual. The second language within the communities is either Mandarin (middle-aged or younger speakers) or Japanese (elder speakers), or the other Formosan languages. Middle-aged Paiwan speakers have reported that they are not able to understand the 'classical' Paiwan language spoken by their grandparents and great grandparents or some generation even older. It is the political or social factor that influences the motivation of the speakers to learn the other languages or abandon their indigenous languages.

Thomason and Kaufman (1988) have noted that constraints of structural diffusion fit well with the notion connected with ease of learning. Psychological factors or economy preference may contribute to sound preservation and language maintenance. Winford (2003) examines a wide range of language contact cases and states that the motivation for lexical borrowing depends on a range of social factors that vary from one contact situation to another. Most of the borrowing associated with distant contact, according to Winford (2003), seems to be motivated by the need to designate new things. I have shown a list of Japanese and Taiwanese loans in section 7.3. The speech communities of Paiwan have experienced the need to modernize their tribal life, which motivates the borrowing from Japanese to Paiwan. Japanese loans in Budai Rukai are comparatively less. Yet, quite a few older speakers of Budai Rukai are capable of speaking Japanese. The contact languages attested in the tribal communities of Paiwan and Budai Rukai are shown in Table 7.7.

Table 7.7: Contact languages in the tribal communities

Paiwan Tribes	Budai Rukai Tribes
Mandarin	Mandarin
Japanese	Japanese
Paiwan dialects	Northern Paiwan
Budai Rukai	Rukai dialects
Other Formosan languages	Other Formosan languages

On the other hand, the most significant consequence of borrowing is the adaptation of phonological features of the donor language. In the Southern Sanhe Village, where both the Northern Paiwan and Budai Rukai speakers are living, Budai Rukai speakers can produce both Rukai and Paiwan stress patterns, and either stress pattern is acceptable. In the mountain area such as Budai and Haocha Villages, however, canonical Rukai stress patterns are retained in elder speaker's utterance. While many varieties attested in the tribal communities are free variation or allophones, the merger of alveolar and palatal sounds in Northern Paiwan is phonemic, which causes the loss of distinctiveness.

Thus far, different types of contact phonology attested in the Paiwan and Budai Rukai tribal communities have been investigated. Cognates, loans and prosodic patterns have provided direct evidence for the language contact between Paiwan and Budai Rukai. The results are summarized in Table 7.8.

Table 7.8: Types of contact phonology in Paiwan and Budai Rukai

Features borrowed	Examples	Mechanism
Introduction of new sounds	Vowel phoneme /o/ in Paiwan	Direct contact with Japanese
Loss of phonemic	Merger of alveolar stops to	Direct contact with

distinction	palatal stops (/c/> /t/ and /ɟ/>/d/) in Northern Paiwan	Budai Rukai (primary factor)
Phoneme shift	Uvular stop /q/ in Paiwan becomes glottal stop /ʔ/ in Northern Paiwan	Direct contact with Budai Rukai
Phoneme shift	Palatal /ʎ/ becomes alveolar /l/ in Northern Paiwan	Direct contact with Budai Rukai (primary)
Penultimate Stress	Release from extrametricality In Budai Rukai	Direct contact with Northern Paiwan

It is clear that the language contact between Northern Paiwan and Budai Rukai is bidirectional. Either Northern Paiwan or Budai Rukai can be the donor language. Phonological change of segments occurs in Northern Paiwan, and the variation of stress patterns occurs in Budai Rukai. Geographically adjacency is the primary factor that affects the number of cognates and the phonological similarities shared by Paiwan and Budai Rukai. Phonetic observations have been made in addition to the basic historical issues, which may or may not reflect the subgrouping directly. Historical reconstruction of cognates and synchronic phonological features have provided evidence for the independent development of Paiwan and Budai Rukai from PAN, and the innovations shared by the two languages are due to recent contact.

CHAPTER EIGHT
CONCLUDING REMARKS

8.1 Significance of the Study

The most significant contribution of the current project is to provide the description, analysis and empirical measurements of prosody in the two Formosan languages, which have never been found in any earlier theoretical study or field report. The majority of field reports on Formosan languages give rather minimal details on their prosodic properties, usually one or two lines of vague description, not to mention the number of field reports on Formosan languages is rather small.

The documentation of prosody of an unknown language would never be accomplished without an exhaustive segmental phonology of the language. Analysis of prosodic patterns in both Paiwan and Budai Rukai would be incomplete without distinctive features of segments, and the distribution of phonological patterns at word-level. Dialectal variation among the Paiwan dialects has been noted. Prosody of Paiwan and Budai Rukai is built on solid phonological patterns of the languages. With syllabic or moraic trochees of foot construction in a prosodic word, canonical stress patterns in Paiwan and Budai Rukai have been disclosed. With the distribution of free and bound morphemes in a prosodic word and phonological phrase, stressless morphemes have been accounted for. A cautious examination on word-level pitch accent and intonational phrases has revealed the distinctive prosodic components in Paiwan and Budai Rukai, which are related to the historical development of the accentual patterns in their proto-languages.

The prosodic structure in Paiwan comprises syllables, feet, prosodic words, phonological phrases, accentual phrases, and intonational phrases. Overlapping between prosodic levels may occur in a wide diversity of syntactic phrases and discourse contexts. The distribution of pitch accent in imperative construction and the use of accents to convey various types of semantic and pragmatic information have been investigated. Accent associated with address forms and social relationship may be retained in natural discourse. Tone or intonational variation was best modeled in terms of the f0 realization. Boundary tones are important indices for the syntactic types of sentences in Paiwan.

On the other hand, three major prosodic aspects of Budai Rukai have been described and analyzed: stress, pitch accent, and intonation. Stress contrast in Budai is the most interesting point for the reconstruction of PAN stress. The interaction between vowel length at penult and stress provides evidence for the argument of contrastive stress in PAN roots. Regional pitch accent HL in Budai Rukai is associated with stressed long vowels and contrastive to the peak prominence on stressed short vowels. Stress variation of Budai Rukai reported in the current study has provided direct evidence for language contact.

Besides, empirical studies have been conducted to verify the phonological and phonetic variation in the speech communities and the descriptive segmental and prosodic features of the two languages. The few phonetic records of the Formosan languages that do exist will have to serve as the basis for further research. Phonetic correlates of stress in the two languages have been investigated. Stressed syllables consistently have higher pitch than the other unstressed syllables. The position in a prosodic word may determine the vowel length of a syllable, for instance, phonetic final lengthening in Paiwan. Vowel length contrast expressed at penult in Budai Rukai have been described and verified. The transparency of syllable extrametricality in word-level and sentence-level of prosodic representations must be part of the Budai grammar.

Furthermore, the current project has provided two more indicators in the Formosan languages that reflect the contrastive stress in PAN: syllable extrametricality in Budai Rukai and final stress subject to schwa penult in Central Paiwan. Prosodic patterns of Paiwan and Budai Rukai have implications for the reconstruction of stress in the proto-languages. The historical reconstruction of PAN stress and the prosodic patterns in Paiwan and Budai Rukai are apparently against the proposals that have claimed the subgrouping of Rukai with the Tsouic or with the Paiwanic. Extrametricality in Budai Rukai is a reflex of the historical development of echo vowels. Final stress subject to schwa penult in Central Paiwan is very likely to be the remnant of the contrastive stress in PAN. The reconstructed phonemes in PAN, Proto-Paiwan and Proto-Rukai support the argument that Paiwan or Budai Rukai is an independent branch of PAN. The current project has provided evidence for the claims that Taiwan may be the oldest area where the PAN forms are preserved (cf. Blust 1977, 1999; Ross 2002) and the phoneme inventory in Paiwan directly comparable to the PAN inventory (Ferrell, 1982). Proto-Paiwan retained not only the syllable structure but also most of the phonemic segments in PAN. On the other hand, loans are the direct evidence for language contact. Loans drawn from the Paiwan village support for the argument that language contact may cause phonological adaptation or even sound change. The language contact between Northern Paiwan and Budai Rukai is bidirectional. Historical reconstruction of cognates and synchronic phonological features have provided evidence for the independent development of Paiwan and Budai Rukai from PAN, and the innovations shared by the two languages are due to recent contact.

8.2 Language Continuum

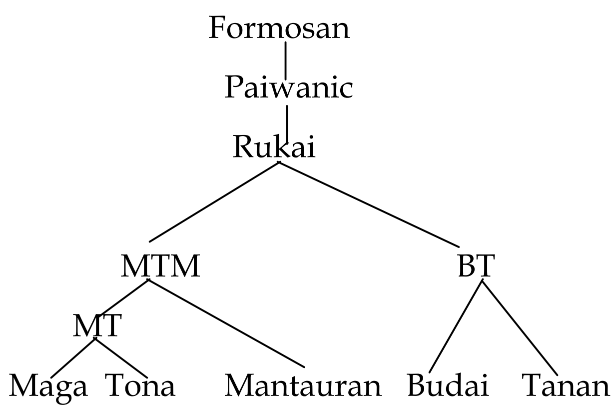
Paiwan and Budai Rukai are geographically adjacent to each other. While the "Lower Three Villages" of Rukai (Maga, Tona and Mantauran) located to the north are adjacent to Tsou, Budai Rukai is surrounded and heavily influenced by Paiwan. Much more studies (cf. Dyen 1963, 1965; Ferrell 1969; Tsuchida, 1976; Li 1977a; Ho 1983) have focused on whether Rukai is closer to the Tsouic or Paiwanic branch. Onset clusters shared between Maga Rukai and Tsou have led some Formosan specialists to propose that Rukai and Tsou belong to a subgroup in the Formosan family. On the other hand, I have shown that both complex onsets and complex codas have nothing to do with the syllable structure of Paiwan and Budai Rukai. This is the strong evidence that Budai Rukai should be not grouped with the Tsouic languages. I have argued that the hypothesis of the Tsouic and Budai Rukai as a subgroup is not reliable.

Li (1992) draws from lexical evidence to conclude that Rukai is most closely related to Paiwan when each language is represented by only a single dialect. It makes a difference in classification whether we treat Rukai as a single language or not. Budai is chosen as the most representative in Li's (1995) wordlist for the Rukai language, because it is the most conservative Rukai dialect. I have proposed the idea that Paiwan and Budai Rukai is each an entirely independent branch of PAN. Some innovations shared by the dialects of Rukai and their adjacent languages are due to recent contact. Here comes the question: how can we define the position of Budai Rukai within the Rukai language family? Do all the dialects of Rukai share the innovations with the Paiwanic or Tsouic group? If Rukai belongs to the Tsouic, why is the onset cluster absent in Budai Rukai? If Rukai belongs to the Paiwanic, why does the echo vowel occur in Budai

Rukai? Is there a possibility that one branch of Rukai shares the innovations with the Tsouic, whereas the other shares the innovations with the Paiwanic?

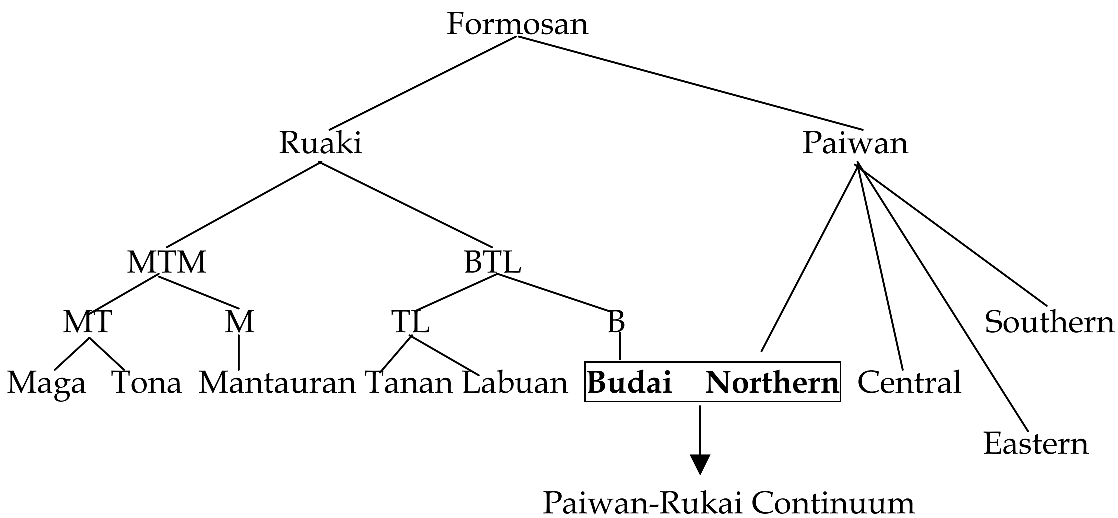
It is not surprising to the local aborigines that middle-aged Budai Rukai speakers are able to communicate with Northern Paiwan speakers, but not the speakers from the other dialects of Rukai, for instance, Mantauran Rukai. Li (1977a) claims that although sound changes are drastic in Mantaurana, it has exclusively shared many cognates with Maga and Tona than with Budai and Tanan. A family tree of the Rukai language proposed by Li (1977a) is represented as follows.

(1) Family Tree of the Rukai Language (Li 1977a)



Under the family tree illustrated in (1), both of the two main branches of Rukai, MTM and BT, belong to the Paiwanic group. However, onset clusters attested in Maga Rukai and echo vowels in many Rukai dialects seem to indicate the close relationship with the Tsouic group. Given that frequent language contact has occurred in the tribal communities, the number of contact varieties is growing much faster than the past decades. Synchronic and diachronic phonological patterns may have shown drastic sound change in each dialect. I agree that six dialects of Rukai are the bases for the reconstruction of Proto-Rukai, but the concern for language diversity has motivated the proposal of *Paiwan-Rukai Continuum* in the daughter language. Within a particular language family domain, daughter language X of Proto-Rukai and daughter language Y of Proto-Paiwan have frequent contact, and language X has been influenced by language Y or vice versa. The linguistic features shared by the two languages, X and Y, have formed the regional characteristics that distinguish the languages from the other dialects of Paiwan and Rukai. The proposal of Paiwan-Rukai Continuum is illustrated in (2).

(2) Paiwan-Rukai Continuum



The term of Paiwan-Rukai Continuum has assumed the closer relationship between Northern Paiwan and Budai Rukai. Consequently, Budai Rukai share more innovations with the Paiwanic group than the other dialects of Rukai. On the other hand, the similar continuum domain could be established for the other dialects of Rukai and Tsou, for instance, the Maga Rukai and Tsou continuum, as far as sufficient evidence for language contact is provided. Language continuum is not contradictory to the proposal of the independent development of Paiwan and Budai Rukai. Rather, it accounts for the facts of the growing trend of language contact in the dialects of the languages.

8.3 Further Studies

How could stress and the other prosodic features of an unknown language be documented and analyzed? Stress has been claimed to be difficult, complicated and unpredictable in many Formosan languages. Li (1977a) states that in Budai three- and four-syllable roots, stress falls on the second syllable. In disyllabic roots ending in a vowel, stress falls on the first syllable (the penult). In the Mantauran dialect, stress always falls on the initial syllable, in the Tona dialect on the second syllable. In the Maga dialect, it falls on the same vowel as in Tona. Stress is not reconstructed in Proto-Rukai (cf. Li 1977a), as it is not clear whether it fell on the penult (as in Budai) or the final (as in the other dialects). All of these have shown the diverse distribution and vague description of stress in the other dialects of Rukai.

Now that stress patterns in Paiwan and Budai Rukai are clearly described and analyzed in the current project, further studies should focus on the prosodic patterns of the other dialects of Paiwan (such as Eastern Paiwan) and Rukai. After the stress patterns in the other dialects of Paiwan and Rukai are defined and disclosed, stress in Proto-Paiwan and Proto-Rukai can be reconstructed.

The current project has offered a preliminary description of phonetic and prosodic patterns in the two languages. Yet, a few tasks remain undone in the current project. Reduplication has been an issue in Formosan Languages. There are still a lot of interesting and distinct reduplication patterns I was not able to address and offer a formal account in this study. Besides, I was not able to show the prosody in narrative and conversation of Budai Rukai, due to the restriction of the corpus. The fieldwork reported here assesses the nature of the sounds of the Paiwan and Budai Rukai language, though it may be the last to record systematic data from a reasonable sample of speakers. Some of the recorded data were excluded from the measurements or analysis simply due to sudden background noise. Due to the limit number of the recorded tokens, formal statistical tests were not conducted after the measurements of stressed and unstressed syllables to verify the preliminary observations on the prosodic differences. Further field data are still needed for the documentation of prosodic patterns in the verbal arts of Paiwan and Budai Rukai. In fact, the study of prosody in Formosan languages is still in its infancy. The ancestral accent of these indigenous languages cannot be completely preserved without the work on prosody. The documentation of prosodic patterns has become a prerequisite for the preservation of ancestral accent of Formosan languages. It is hoped that the number of study on Formosan prosody will increase drastically in the future. It is also hoped that further work on prosody will implement instrumental studies to enhance the understanding of tones and intonation variation of Formosan languages.

As Inkelas and Zec (1995) have addressed at the end of their article, work on the phonology-syntax interface has emphasized certain languages or families. Nevertheless, much insight will be gained from improving the typological coverage of the database. Language diversity will provide particular illumination to which many standard phrasing algorithms or parameters are not presently applicable. The study on phonology-syntax interface and phonology-morphology connection in Formosan languages is urgently needed, as specific affix morphemes and construction markers play a role in different types of syntactic phrases and sometimes do affect the prosodic patterns in utterances.

Another significant area of research that should inform work on the Formosan phonology is the micro-study of language shift in the tribal communities. I have shown a few cases of language contact in Paiwan and Budai Rukai. Younger speakers of the tribal society are importing and creating new forms to their indigenous languages. It has been observed in the current project that there is a lot of free variation in Paiwan and Budai Rukai even for an individual speaker, more for younger speakers than older speakers. Younger speakers would sometimes use an alternative allophone, and sometimes not. A comparison of sound patterns in different age groups may capture the loss and shift of the linguistic features in the indigenous languages. A more thorough study of the linguistic variation among different Formosan languages might illuminate the status of a particular language relative to the larger language group in the language family tree.

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