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COMPARATIVE, DIACHRONIC AND EXPERIMENTAL PERSPECTIVES ON THE INTERACTION BETWEEN TONE AND VOWEL IN STANDARD CANTONESE

DISSERTATION

Presented in Partial Fulfillment of the Requirements

for the Degree Doctor of Philosophy

in the Graduate School of the Ohio State University

By

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* * * * *

The Ohio State University

1993

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A study of Toishan F0. (ed. Mary Beckman and Gina Lee) *Ohio State University Working Papers in Linguistics* #36: *Papers from the Linguistics Laboratory* 1985-1987: 16-30. Sept. 1987.

Diglossia in ancient India. (ed. Brian D. Joseph) *Ohio State University Working Papers in Linguistics* #34: *Studies on Language Change*: 151-164. Dec. 1986.

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EXPLANATION OF PHONETIC SYMBOLS

Different sources use slightly varying phonetic transcriptions, with as many different transcriptions as there are authors. For the sake of consistency, only one system is used here, which is listed below. Notations from other sources are converted to the present system. In some cases, the symbols chosen do not reflect any particular theoretical claims, but rather reflect an effort to avoid diacritics and unusual symbols.

Vowels

[i]	high front unrounded
[I]	lower high front unrounded
[e]	mid front unrounded
[E]	lower mid front unrounded ("epsilon")
[u]	high back rounded
[U]	lower high back rounded
[o]	mid back rounded
[O]	lower mid back rounded ("open 'o'")
[A]	low back unrounded
[a]	low central unrounded ("inverted 'a'")
[oe]	lower mid front rounded
[Ø]	mid front rounded
[y]	high front rounded
[ɨ]	high central unrounded
[ê]	mid central lax (schwa)
[:]	long

Consonants

[ng]	velar nasal
[sh]	palatal fricative
[lh]	voiceless lateral fricative
[j]	palatal glide
[ʔ]	glottal stop
[^{h}]	aspirated

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INTRODUCTION

Tone languages

All languages use pitch in various ways. In a tone language, pitch is used to distinguish different lexical items, in that words have "lexically significant, contrastive, but relative pitch on each syllable" (Pike 1948: 3). That is to say, words that are segmentally identical are phonologically distinguished only by different specifications for their pitch contours, as seen in Mandarin Chinese [mā] "mother", produced with a high level pitch, contrasting with [mà] "scold", produced with a high falling pitch. Other diverse languages such as Vietnamese, the Bantu languages, and American Indian languages such as Navajo also employ tone (Pike 1948).

Pitch is also used contrastively in pitch accent languages, which differ from tone languages in that the pitch specification occurs in a particular syllable within the word. Standard Japanese, Swedish, and Serbo-Croatian have been described as having pitch accent (Beckman 1986, Elert 1964, Lehiste and Ivic 1973). There is no consistent agreement among linguists as to the nature of the distinction between tone and pitch accent; McCawley (1978) has shown that it is not always easy to determine whether a language uses one or the other. Further complicating the picture is the lack of consistency in the use of terms. Some authors use "tone" to describe pitch accent, and in some areas, it is common practice to use the term "intonation", usually used for pitch

contours of a phrase or sentence, to mean the same thing as "tone" and "pitch accent" (e.g., Carlton 1990). Here, I will restrict my focus to tone languages with respect to Pike's definition, while recognizing that the points discussed may be relevant to pitch accent languages as well.

Of particular interest here is how such languages acquire their tones and how their tones change over time. The current assumption is that, in much the same way that segments can change over time, a tone language's inventory of tones can change. Tones can be lost, added, or modified in their phonetic realization. Like segments, tones can be lost via merger, and tones can be added via split. The addition of new tones over time has been termed *tonogenesis* by Matisoff (1973).

Some modern tone languages were originally non-tonal. Haudricourt (1954) presented evidence that the tones of Vietnamese tones are a complete innovation. The basic vocabulary of Vietnamese suggests that Vietnamese is an Austroasiatic language. Under current assumptions, early Austroasiatic lacked tone; if so, then Vietnamese tones could not have been inherited. Eastern Punjabi, a member of the Indic branch of Indo-European, has a three-way tonal system which developed independently of the other Indic languages (Bhatia 1975). Vedic Sanskrit, the earliest well-documented Indic language, had pitch accent, but there is no relationship between Vedic pitch accent and the tones found in Punjabi. Classical Sanskrit did not have tone; nor did the Prakrits. Thus, Punjabi also reflects a case of total tonogenesis because its tones are not remnants of an earlier ancestor tone language.

Interactions between tones and segments

One clue as to how tone languages have acquired contrasting lexical pitch is seen in the ways in which tones and segments interact, synchronically as well as diachronically. It is well-attested across many unrelated, geographically separated tone languages that high tones tend to occur in syllables which at an earlier stage had prevocalic voiceless consonants, while low tones tend to occur in syllables with earlier prevocalic voiced consonants. The voicing contrast has been lost, but the pitch contrast remains as a way of distinguishing meaning, resulting in lexical tone. In addition, there is an abundant amount of instrumental studies on tonal and non-tonal languages, as summarized in Hombert, Ohala and Ewan (1979), which demonstrate that the voicing of initial consonants generally lowers or raises the fundamental frequency of the following vowel in precisely the same way seen in cases of tonogenesis, e.g. fundamental frequency is higher after voiceless stops than after voiced stops. Cross-linguistically, tones interact with consonants, at least in terms of voicing.

A considerably less common interaction between tones and segments involve vowels. One of the more clear-cut interactions is found in Cantonese, and is the focus of the work presented here. A tonal split that is synchronically conditioned by vowel duration has occurred in Standard Cantonese, a variety of Chinese spoken primarily in Guangdong province and Hong Kong. Historically, it is a member of the Yue dialect group, one of seven major dialect groups of Chinese. Cantonese is the best-known Yue dialect, and serves as a lingua franca for many parts of southern China and southeast Asia. As a result, the Yue dialects are known collectively as the Cantonese dialects,

especially in older sources; following current practice, I will use "Yue" for the dialect group and "Cantonese" only for the specific variety.

Modern Chinese dialects have inherited their tones from an ancestor language closely related to Middle Chinese, an earlier stage of Chinese known to modern scholars primarily through the *Qieyun* rhyme dictionary of the seventh century A.D. Middle Chinese had four lexical tones; after the Middle Chinese period, each of the four tones underwent a register split based on the voicing of the prevocalic consonant, resulting in a total of eight tones.

In most Chinese dialects, some of these tones have been lost. However, many Yue dialects have not only retained reflexes of the four Middle Chinese tones and the later bifurcation into eight tones, but have also added one (and in at least one case, two) new tone(s). The "extra" tone occurs in one particular historical tonal category, in which morphemes generally end in [p, t, k]. This tone category is known in traditional Chinese philology as the *Ru* or "Entering" tone, so-called because the morpheme "enter", Cantonese [jap], is an example of a form which bears this type of tone. For Standard Cantonese, the Upper register Entering tone, which generally occurs on those Entering tone forms beginning with a voiceless consonant, has undergone a further split into two tones, a higher and lower tone, which are synchronically described as the high and mid Entering tone respectively. Those dialects outside of Yue which retain the Upper Entering tone category have one Upper Entering tone.

Synchronically, the split in Cantonese is based on the vowel: the high tone is associated with morphemes containing short vowels, the mid with morphemes containing

long vowels. The following forms are representative of the tone split, where [5] represents a high tone, [3] represents a mid tone:

[pak 5]	"north"	[pA:k 3]	"100"
[sØt 5]	"cricket"	[kO:k 3]	"corner"
[sIk 5]	"color"	[ki:t 3]	"clean"
[tsUk 5]	"bamboo"	[fu:t 3]	"wide"
		[t^hE:k 3]	"to kick"
		[hy:t 3]	"blood"
		[tsoe:k 3]	"nobility"

Diachronically, the two tones did not evolve from two earlier tones but appear to be reflexes of a segmental difference. Oi-kan Yue (1976:49), analyzing short and long vowels as "lax" and "tense", respectively, considers the Cantonese Upper Entering split as a case of tonogenesis where ". . . one can easily perceive that the birth of these two tones is due to the tenseness of the vowels". However, as O. Yue (1976) points out, there is no phonetic explanation for such an interaction; in fact, it seems to run counter to known phonetic effects. As stated by Hombert, Ohala and Ewan (1979), any explanation for the development of tones should meet certain well-defined requirements: the presence of acoustic and/or articulatory evidence to support the proposed developments; evidence that the pitch differences that are a part of the lexical tones under examination must on some level be perceptible to listeners; and well-attested examples across many unrelated languages, and even in languages that do not use tone. There are few clear-cut examples of tonogenesis involving vowels; in looking at tonal development across languages, ". .

. it is difficult to find convincing cases or a consistent pattern of the historical development of tones from vowel quality" (Hombert et al. 1979: 51)—though Hombert et al. indirectly suggest a way in which vowel duration could play a role, as will be explained in a later chapter.

Also under investigation is the role of substratum influence in language change. The tone/vowel correlation is not restricted to Yue Chinese. Similar patterns occur in languages spoken by various ethnic minorities in southern China, from the Tai, Tibeto-Burman, and Mon-Khmer language families. O. Yue (1976) suggests that the Cantonese case may be due to substratum influence from Tai. She also mentions the possibility of an areal feature involving south China and southeast Asia. Southeast Asia is already a well-established linguistic area, and the interaction between tone and vowel duration may be an additional feature of this general region.

Goals of the present study

This dissertation examines the interaction between tone and vowel in Cantonese and attempts to explain the unusual register split that has taken place. Chapter I provides a summary of the phonetics and phonology of Standard Cantonese, particularly with respect to tone, and serves as the background for the discussion in later chapters. In Chapter II, the regularity of the tone-vowel interaction in Cantonese is examined in detail, as well as the question of whether a tone split in the manner of sound change has taken place. Chapter III examines the interaction between vowel and tone in other Yue dialects, developments which are not as straightforward as in Cantonese, but which are important

in understanding the Cantonese case. It also provides an historical overview of the tone split. Chapter IV summarizes the known phonetic motivations for pitch (fundamental frequency) differences and relates them to our current knowledge of tonogenesis; it will be shown that no such phonetic motivation can be convincingly demonstrated for the tonal split examined here. Chapter V describes the vowel-tone interaction as seen in non-Chinese minority languages. The significance of these findings is discussed in chapter VI.

The transcription used here is a modified version of the IPA system and is summarized under "Phonetic Symbols". Some terms used in the traditional approach to historical Chinese phonology are introduced in their Mandarin form, along with an English translation; the English translation is used for the remainder of the discussion. For typographical ease, tone marks have been omitted in Mandarin forms. The names of languages and cities are given in an unhyphenated Pinyin romanization, with the exception of certain names well-known to western readers, such as Canton (Guangzhou) and Hong Kong.

CHAPTER I

SYNCHRONIC PHONETICS AND PHONOLOGY OF STANDARD CANTONESE

In order to understand the sound changes that have occurred in Cantonese, we must first examine the end result of these changes, i.e. its synchronic phonology. This chapter contains a brief description of the segmental and suprasegmental phonology of Standard Cantonese. The main purpose of this section is to acquaint the reader with the phonological structure of Cantonese, without endorsing any particular framework. In addition, this section provides background material for the issues discussed in later chapters. Also presented here are the results of an acoustic study of Upper Entering tone syllables, which was carried out to determine the phonetic reality of the Upper Entering tone split according to vowel length.

Past work on Cantonese phonology

Next to Mandarin, Standard Cantonese is the best studied Chinese dialect. Among the earliest works available to Western scholars are dictionaries dating back to the mid to late nineteenth century, which were compiled primarily by missionaries; some of these sources are described in Hashimoto (1972). Syllabaries, such as S. L. Wong's *A Chinese Syllabary Pronounced According to the Dialect of Canton* (1940, 1954), have also been

used as sources of information, as well as textbooks. One of the first well-known sources, Chao (1947), is actually a textbook, but it also contains one of the earliest descriptions of the overall structure of Cantonese.

Later sources handle Cantonese phonology in more detail. Hashimoto (1972) is the most complete individual source on Cantonese phonology to date, and has been used as the basic source of information in every study—including the present one—since its publication. Working within a generative framework, Hashimoto (1972) examined the synchronic as well as the historical phonology of Cantonese. A less widely cited but useful source is Kao (1971), a largely synchronic study told from a structuralist viewpoint, which was overshadowed by the later appearance of Hashimoto (1972). More recent work on Cantonese phonetics and phonology have focused on tone and intonation, examples of which are Vance (1976), Gandour (1981), Johnson (1987), and others which are discussed in more detail below.

The traditional approach

The Chinese languages are considered to be monosyllabic in the sense that each morpheme generally consists of one syllable. Words, on the other hand, are often formed by compounding and are thus often polysyllabic, e.g. Cantonese /ji 55 sA:ng 55/ "doctor", composed of morphemes meaning "cure" and "give birth", respectively. Although there are examples of polysyllabic morphemes, such cases are infrequent.

Because of the monosyllabic nature of Chinese, the sounds of Chinese are traditionally categorized with reference to syllable structure, the two major portions being

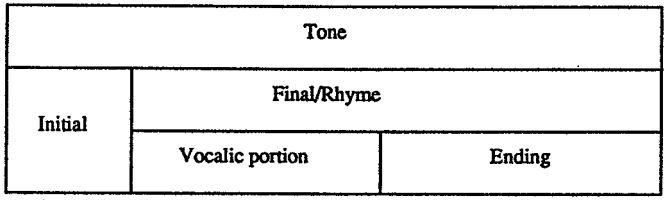

Figure 1: The traditional analysis of the syllable in Cantonese.

the initial and final. The initial is the beginning consonant; if there is no beginning consonant, the syllable is said to have a "zero initial". Everything after the initial is known as the final. The final includes three parts: a medial, usually a glide; a vocalic element, either a vowel or syllabic nasal; and an ending, which is the postvocalic consonant. The portion of the final excluding the medial is known as the rhyme. Tone is considered part of the syllable, and is generally considered to be overlaid over the entire syllable, although some view tone as part of only the final.

For Cantonese, the structure of the syllable is summarized in Figure 1. In Cantonese, the ending is optional, and many, such as Hashimoto (1972), analyze Cantonese as having no medials. As a result, in Cantonese the final is the same as the rhyme.

Consonants

Figure 2, based on Hashimoto (1972: 88), lists the consonantal inventory of Cantonese. Cantonese has voiceless obstruents but lacks voiced obstruents, a situation

common to many Chinese languages. Within the stops and affricates, a distinction is made between aspirated and non-aspirated. A glottal stop, which is usually not included in a listing of standard Cantonese consonants, sometimes appears initially in syllables with an underlying zero initial. Two of the nasals, [m] and [ng], also occur as syllabic [m̩] and [ng̩]; syllabic [m̩] occurs only in the form for the negative marker. Because Cantonese lacks initial consonant clusters, the labialized velar consonants are considered by most sources as single consonants. Phonotactically, all consonants occur as initials, but only glides, nasals and unaspirated stops occur as endings. Moreover, final [p, t, k] are unreleased.

There are common dialectal variations as well. In some regions of Guangdong, the sibilants [ts, ts^h, s] have palatal variants, which generally occur before high front

	Labial	Labio-velar	Dental	Alveolar	Velar
Stop	p p^h	kw kw^h	t t^h		k k^h
Fricative	f		s		h
Affricate				ts ts^h	
Nasal	m		n		ng
Liquid			l		
Glide		w		j	ʏ

Figure 2: Consonants in Standard Cantonese.

vowels. Some speakers substitute [l] for [n] initially, and in some dialects [ng] alternates with the zero initial. These variations may be due to influence from other Yue dialects (Hashimoto 1972: 120-121).

Vowels

Duration

Cantonese has thirteen vowel phones which are included in the set of finals listed in Figure 3, adapted from Hashimoto (1972: 90). There are in all fifty-three possible finals. The seven vowels, [i, y, u, oe, E, O, A] are phonetically long, and are hereforth transcribed with [:], while the remaining six, [I, e, Ø, o, U, a], are short. (In this study, I am using a narrow transcription for vowels that is based on the system used in Hashimoto 1972). Long and short vowels differ not only in terms of duration, but also

A:	A:i	A:u	A:m	A:n	A:ng	A:p	A:t	A:k
ai		au	am	an	ang	ap	at	ak
E:					E:ng			E:k
	ei							
					Ing			Ik
i:		i:u	i:m	i:n		i:p	i:t	
oe:					oe:ng			oe:k
Øi				Øn			Øt	
O:	O:i			O:n	O:ng		O:t	O:k
		ou						
					Ung			Uk
u:	u:i			u:n			u:t	
y:				y:n			y:t	
			m		ng			

Figure 3: Finals in Cantonese, based on Hashimoto (1972: 90).

in terms of distribution. Long vowels occur in closed and open syllables, while short vowels occur only in closed syllables. Because long vowels have a wider distribution than short vowels, long vowels are considered to be basic and unmarked, while short vowels are marked (Kao 1971).

There is no consistent agreement as to the number of vowel phonemes, or to the ways in which the phones are grouped into phonemes. The number ranges from as many as eleven (Kao) to as few as six (Chao). A large part of the reason for the lack of consensus is that it is unclear how duration should be treated phonologically. Chao and others have regarded length as phonemic. The clearest case is seen in the low vowels [A:] and [a], which are found in minimal pairs such as [sA:m 55] "three" and [sam 55] "heart". In some sources these vowels are transcribed with the same quality, e.g. as /a:/ and /a/. However, there is also reason not to consider duration phonemic. In high and mid vowels, a long vowel and its short counterpart are generally in complementary distribution; for example, [oe:] appears only with the endings [k], [ng], and syllable-finally, while [Ø], which is often considered to be the short counterpart, appears only with the endings [t], [n], [j]. It should be noted, though, that no generalization can be made about the contexts in which each variant appears.

A compromise view, which is generally accepted, is that length is phonemic only in the low vowels, but not in other vowels. Some sources reflect this analysis by indicating duration only for [a] and [a:] (narrow transcription [A:]), and omitting length for the other vowels. The vowel [a] is phonetically close to schwa and is sometimes transcribed that way, particularly by those who regard duration as non-distinctive.

Regardless of how duration should be treated phonologically, it is evident that the difference between "long" and "short" vowels has a strong phonetic correlation. Kao (1971) and Lee (1983) have demonstrated that "long" vowels in Cantonese have a duration approximately twice as long as that of "short" vowels. For the two speakers in Kao's study, the mean duration ratios of long vowels/short vowels were 2.00 and 1.81 in Entering tone syllables, while the speakers in Lee's study had a mean ratio across speakers of 1.9, based on figures supplied by Lee.

Quality versus quantity

Duration is not the only phonetic distinction in Cantonese vowels; there are also differences in quality. Figure 4 contains an acoustic diagram of the thirteen Standard Cantonese vowels, based on Lee's (1983) results from three Canton speakers. It is worth

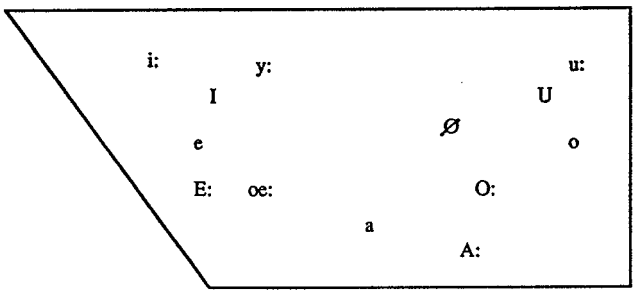

Figure 4: Vowel phones in standard Cantonese, based on Lee (1983).

noting that Lee had somewhat different results for Hong Kong speakers. The front long vowels [i:, y:, E:] were more peripheral in Hong Kong speakers; [Ø] was not significantly higher than [oe:]; and the low vowels [a] and [A:] did not differ in advancement.

Because Cantonese vowels differ in both quantity and quality, some scholars such as Hashimoto (1972) have described the distinction between vowel pairs such as [i:] and [I], [A:] and [a], and so on as one between "tense" and "lax" respectively, terms which are in traditional use among Sinologists. According to O. Yue (1976), "tense" and "lax" are to be understood not so much in terms of muscular tension, but, rather, in terms of degree of deviation from the neutral position in the acoustic vowel space (Jakobson and Halle 1961; Hashimoto 1978-1979). Cantonese long vowels are tense, while short vowels are lax. In general, as illustrated in the schematic diagram in Figure 5, tense vowels are produced with greater deviation from the neutral point than lax counterparts. This is the case for Cantonese; its front tense vowels are more advanced than front lax vowels, and its back tense vowels are more retracted than their lax counterparts. In addition, its tense

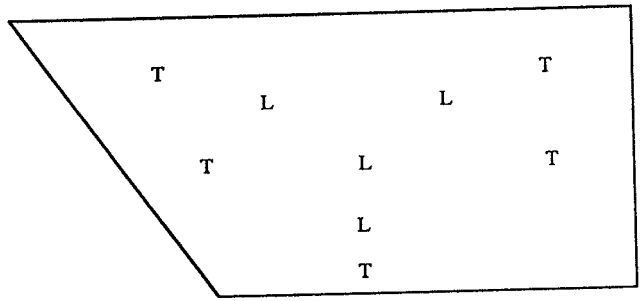

Figure 5: Schematic representation of acoustic differences between "tense" and "lax" vowels. T = tense vowel; L = lax vowel.

vowels are higher than their lax counterparts, with the exception of the low vowels [a] and [A:], where the lax [a] is higher. This is not surprising; in order for [a] to be closer to the center of the vowel space than [A:], [a] must be higher. Thus, as Figure 5 illustrates, tense vowels are peripheral, forming the outer layer of the vowel space, while lax vowels are centralized, forming the inner core.

There is some cross-linguistic evidence in support for this explanation of the tense-lax distinction, although the generalization is not true for all languages. Within other Sino-Tibetan languages, long vowels are more peripheral than short vowels, and long low vowels are lower than short low vowels (Ma and Luo 1962, cited in Liu 1983). For long and short vowels in Czech, Lehiste (1970) reported findings identical to the Cantonese case. Long front vowels had higher F2, i.e. were more "fronted", than their short counterparts, and long back vowels had lower F2, i.e. were more "backed", than their short variants. Long vowels also had a lower F1, i.e. greater height, than their short variants. In Czech, as well as in Cantonese, the low vowels were an exception in that the short vowel was higher than the long vowel.

The main question is whether one of the two features, duration or quality, is phonologically distinct in the Cantonese vowel system, and in addition, most salient to speakers. Duration is predictable from vowel quality, e.g. [i] is phonetically long, while [I] is phonetically short. However, vowel quality can also be predicted from duration. If a source uses the broad transcriptions [i:] and [i], the second vowel must be phonetically [I].

Yet there is some evidence that duration is the major cue. Lee (1983) found overlaps in acoustic space for Cantonese vowels that are considered to be in contrast, e.g. in the low vowels [a] and [A:] which, according to most sources, contrast phonologically. Because there is overlap, quality is not likely to be the major cue; rather, it must be duration. In the case of Czech, Lehiste concluded that duration must have been the salient cue, and affected the quality. In the case of Cantonese, phonetically the terms "long" and "short" are preferable to the terms "tense" and "lax". This reasoning is important because, as explained later, vowel duration and tone interact in other languages spoken in the same general area as Standard Cantonese.

Tones

Tonal inventory

Cantonese is generally considered to have nine phonetic tones, which are listed according to their traditional tone categories in Figure 6. The notation used here is based on Chao's system, with the numbers 5 and 1 representing the highest and lowest part of the speaker's pitch range, respectively. The tones are listed according to their traditional categories of *Ping*, *Shang*, *Qu* and *Ru*, for which I will use the English terms "Even", "Ascending", "Departing" and "Entering", respectively. *Ping* and *Shang* are also translated as "Level" and "Rising", respectively, but in order to avoid confusion with the phonetic terms "level" and "rising", I will use the first set given.

Also included in Figure 6 is the split into *Yin* and *Yang* registers, or "Upper" and "Lower". Certainly "Upper" and "Lower" could be confused with "upper" and "lower"

	(Ping) Even	(Shang) Ascending	(Qu) Departing	(Ru) Entering
Upper (Yin)	53/55	35	33	5
				3
Lower (Yang)	21/22	24	22	2

Figure 6: Cantonese tones as reflexes of Middle Chinese tonal categories and the subsequent split into Upper and Lower registers.

in the phonetic sense. However, these terms are part of standard usage, and are not really problematic because "Upper" register tones are usually higher in pitch than "Lower" register tones across dialects. The split in the Upper Entering tone is also noted here as well. The higher of the two Upper Entering tones is sometimes known as the *Shang* ("Upper") *Yin Ru* tone, and the lower tone as the *Zhong* ("Middle") *Yin Ru* tone, termed "Middle" because it is the middle tone within the Entering category as a whole. Here, I will simply use "high" and "mid" respectively. The High Upper Entering occurs in syllables containing a short vowel; the Mid Upper Entering occurs in syllables containing a long vowel.

The Even and Ascending tones are, in general, contour tones. Each Even tone has two realizations, a falling tone and a level tone. There is some question as to the status of these variants; they are in free variation in some situations, while in other cases, the

level tone is a predictable variant of the falling tone. The Departing and Entering tones are all level tones; the Entering tones occurring only in forms ending in [p, t, k], while the Departing tones do not occur with these endings. Entering tone forms are also termed "checked" syllables because the airstream is abruptly blocked or "checked" by the unreleased voiceless stop ending. Phonetically, the main difference between the Departing and Entering tones is in the duration. The Entering tones are shorter than the Departing tones, which otherwise have the same pitch as the Entering tones. The vowels in the Entering tones are also shorter than those in the non-Entering tones.

The high and mid Upper Entering tones are in complementary distribution in terms of vocalic segment. The high Entering tone [5] occurs only with the four short, lax vowels [I, Ø, a, U]. The mid Entering tone [3] occurs only with the seven long, tense vowels [i:, E:, oe:, y:, u:, O:, A:]. As discussed in Chapter II, there are a small number of morphemes with a mid Entering tone and short vowel, and many others with a high Entering tone and long vowel; aside from these exceptional forms, the interplay between tone and vowel is in total complementation.

There has been no general agreement as to the phonological treatment of the tones. The major issue is whether some or all of the Entering tones have an independent phonological status, or whether they are predictable variants of non-Entering tones, occurring before [p, t, k] endings. The number of phonological tones thus ranges from six (Chao and others) to nine. There is also the question of how to treat the Upper Entering tone category. Since the Upper Entering tones are in complementary distribution, the high and mid Upper Entering tones can be interpreted as predictable

variants, and therefore non-distinctive. The status of the Entering tones does not actually, affect the major issue at hand; regardless of the number of phonological tones, it is an indisputable fact that there are three phonetic Entering tones. Certainly it would not be to the advantage of the present study to consider the Entering tones merely as variants of the non-Entering tones; rather, they are separate tones worthy of consideration.

The phonetics of the Upper Entering tone syllables

Past instrumental studies on Standard Cantonese have virtually ignored the Entering tones. In all likelihood this is due to the traditional phonological analysis of the Entering tones; any examination of the overall tonal system would not need to include the Entering tones, if the Entering tone syllables are short versions of the non-Entering tones. Relatively recent sources such as Kao (1971) and Lee (1983) include experimental data on Entering tone syllables; however, these were part of a larger study of the vowel system of Cantonese, and were not the focus of their investigations. To fill in the gap, and also to allow the author to actually hear the tonal differences, an acoustic study was carried out. The purpose was to examine in more detail the differences in vowel duration between long and short vowels in the Upper Entering tones, the differences in fundamental frequency, and the relationship between duration and F0.

Method

A speaker from Hong Kong was recorded. YBY was a twenty-year-old undergraduate at Ohio State. He was born and raised in Hong Kong, and had been in the

United States for a year. His parents spoke Mandarin, but he considered himself to be a native Cantonese speaker and a relatively poor Mandarin speaker. He also spoke some Fukienese.

A corpus consisting of high and mid Entering tone morpheme-syllables was composed. Because vowels before bilabials such as [p] tend to be shorter than vowels before other consonant types (Lehiste 1970), syllables with a [k] and [t] ending were chosen to minimize the effects of postvocalic consonants on vowel duration. As a set, syllables with [k] and [t] endings contained all possible eleven vowels occurring in the Entering tone—five high vowels [i, y, u, I, U], four mid vowels [E, oe, O, Ø], and two low vowels [A, a]. Of these, seven are "long" [i:, y:, u:, O:, oe:, E:, A:] and four are "short" [Ø, I, U, a]. The entire corpus is listed below.

	Long			Short	
High Vowels					
[i:]	phi:t	"to branch"	[I]	pIk	"to force"
	hi:t	"stop"		phIk	"depraved"
	hi:t	"scorpion"		pIk	"greenish jade"
	pi:t	"turtle"		phIk	"to burt forth"
	pi:t	"must, certainly"		pIk	"to crowd"
	pi:t	"hold breath"			
[y:]	thy:t	"take off (clothes)"			
	ly:t	"bad, inferior"			
	hy:t	"blood"			
	tsy:t	"arrange"			
	khy:t	"pickaxe"			
[u:]	mu:t	"to mop, rub"	[U]	fUk	"happiness"
	pu:t	"container (mug)"		pUk	"foretell"
	fu:t	"wide"		sUk	"spend the night"
				hUk	"weep"
				fUk	"a roll of map or pictures"

Mid Vowels

[E:]	hE:k	"eat"			
	tsE:k	"to roast"			
	tshE:k	"red; naked"			
	tshE:k	"(Chinese) foot, ruler"			
	tsE:k	"one (classifier)"			
[oe:]	tshoe:k	"blanch"	[Ø]	tsØt	"soldier"
	tshoe:k	"nobility"		tshØt	"go out"
	toe:k	"to cut (gems)"		sØt	"the 11th of the 12 branches"
	khoe:k	"yet, but"			
	koe:k	"foot"		sØt	"sympathize"
[O:]	hO:t	"thirsty"			
	hO:t	"to drink, cheer"			
	kO:t	"cut; injure"			
	kO:t	"creeping plant"			
	hO:k	"husk, shell"			
	pO:k	"argue"			
	fO:k	"sudden"			
	mO:k	"to strip of"			
	phO:k	"plain, simple"			

Low Vowels

[A:]	pA:t	"eight"	[a]	pat	"pen, brush"
	mA:t	"mop"		pat	"no, not"
	fA:t	"way"		fat	"opening; hut"
	phA:k	"to hit"		hat	"beg"
	hA:k	"bright"		phat	"measure for horses"
	pA:k	"one hundred"		tsak	"a rule, law"
	hA:k	"guest"		tak	"get, gain"
	phA:k	"cedar"		pak	"north"
				sak	"obstruct"
				tak	"virtue"

Each morpheme was placed in this frame sentence, borrowed from Lee (1983)'s study:

[ngO: 13	jiu 33	tUk 22	_____	pei 35	nei 13	t^{h}E:ng 55]
'I	want (to)	read	_____	for	you (to)	hear.'

The sentences were arranged into four sets, consisting of eighteen or nineteen sentences each. The last sentence in each set was a "dummy" sentence, intended to carry possible effects of final lowering, and was not included in the analysis.

The sentences were presented in Chinese characters, written on 8½ by 11 inch sheets of paper, with each set on one sheet. The speaker was asked to read the sentences at a normal rate, and, importantly, to maintain the same rate for all of the sentences. To ensure that he was able to recognize each character, he read through the corpus before the recording began. The recording took place in an anechoic chamber at the Linguistics Laboratory at Ohio State. The utterances were digitized on an IBM-compatible 80386 computer at a sampling rate of 10 kHz and 12 bit resolution, using the DT2801-A analog to digital converter.

Duration and F0 differences

A waveform editor, SPED, was used to measure vowel duration. There were forty-two tokens with long vowels, twenty-three with short vowels. YBY read the morpheme [pUk] "foretell" with a long vowel, [pO:k]. For all tokens, there was a clear duration difference between long and short vowels. As Table 1 shows, the long vowels as a group were longer than the short vowels. High vowels have intrinsically shorter duration than non-high vowels; to account for the inherent difference, the high vowels are

Table 1: Mean duration in msec. of long and short vowels in Upper Entering tone syllables for a Cantonese speaker.

	Long	Short
High	65.99	42.16
Non-high	89.1	56.15

compared as a set separately from the other vowels. Results of independent t-tests showed that the differences were significant ($p < .001$) for both sets of vowels.

Next, the fundamental frequency of the two Upper Entering tones was measured. The structure of the Upper Entering tone syllables makes them difficult to analyze instrumentally. The autocorrelation algorithms used in the "pitch-tracking" programs available to me at the time of this portion of the study could not calculate F0 for short syllables; syllables with high vowels are especially problematic. In addition to short duration, the surrounding stop consonants also pose a problem; the surrounding consonants should be sonorants.

Table 2: Range of vowel duration in Upper Entering tone syllables (msec.).

	Long	Short
High vowels	50.2—89.2	28.5—53.6
Non-high vowels	59.7—121.4	41.1—73.0

For the purposes of the current study, F0 was calculated based on the duration of the period of the sound wave. Using SPED, the waveform editor used in making the earlier vowel duration measurements, I measured the duration of one period. The medial period was selected to offset the effects of the initial and ending consonants. I identified the medial period by counting the total number of periods within the vowel and determining which period was in the middle. F0 tracking programs also calculate by measuring pitch period, but they are not capable of determining which period is relevant; thus, this part had to be done manually.

Figure 7 describes the measurement of the medial period of the utterance [fUk 5] "happiness". This particular utterance had five periods, and so a measurement was made

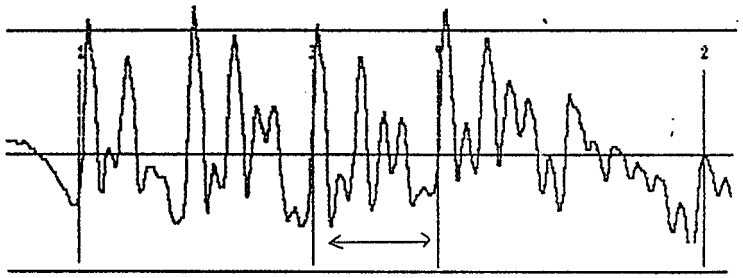

Figure 7: Measurement points for the medial pitch period in the token [fUk] 55 "happiness".

of the third period. The beginning and ending points were marked at the spots where the period crossed the zero line. The fundamental frequency was calcuated by evaluating the reciprocal of the length of the medial period.

Table 3 contains the results of calculating the F0 differences. F0 measurements for [mO:k] "strip" and [pO:k] "foretell" were not included because they had the high [5] tone and are exceptions to the usual pattern. As a group, the high tone-short vowel forms had an average F0 approximately 20.8 Hz higher than the long vowel-mid tone forms. The F0 differences between high and mid tones were statistically significant ($p < .0001$).

The differences in F0 and duration were not as large as expected, and, in retrospect, there could have been problems with the F0 and duration measurements with respect to the design of the corpus. In selecting the token types, I attempted to include examples of each possible syllable type, and did not control for vowel height, which made comparison of minimal pairs difficult. Also, I did not control for the aspiration of the initial. In Zee's 1980 study, the onset of F0 was higher after aspirated consonants than

Table 3: F0 in short and long vowels in Upper Entering tone syllables for a Cantonese speaker.

Long Vowel, Mid Upper Entering		Short Vowel, High Upper Entering	
[i:]	126.3	[I]	145.9
[u:]	125.4	[U]	145.5
[y:]	132.1		
[E:]	119.3	[Ø]	143.4
[oe:]	121.8	[a]	141.7
[O:]	120.6		
[A:]	117.6		

unaspirated, as is the case in many languages. The lack of control could have affected the results, though any effect would have been minimized because I began measuring at the onset of voicing for the vowel.

A second *caveat* which always exists in studies involving one subject is that the results may be due to idiosyncratic qualities of the speaker and do not necessarily reflect all speakers. In fact, I had recorded a second speaker with a background similar to speaker YBY, but the second speaker's data could not be used because I recorded him using only syllables ending in [k]. My original plan had been to use only syllables with the same ending. Because of time constraints, I decided to use only the results of speaker YBY. Thirdly, since the speaker was not monolingual, there is always the possibility of language interference, although there is no clear evidence for such influence here.

It is difficult to compare these results with past findings, as few instrumental studies of F0 in Entering tone syllables have been done. Hashimoto (1972) includes a brief description in a footnote, but the instrumental study was small in scope. Fok Chan (1974) measured F0 in all nine tones for several speakers. For one speaker, the high Entering started at 205 Hz, mid Entering at 164 Hz, and the low Entering at 138 Hz, for a difference of 41 Hz between high and mid, and 26 Hz between mid and low. The mid Entering tone had the longest duration of the three; the high Entering, the shortest. Statistics for the other speakers in Fok Chan's study are not directly available, but it is known that the results for the other speakers were similar to the first.

The acoustic study discussed in this chapter demonstrates the phonetic reality of the split of the Upper Entering tone in Cantonese. Instrumentally, the difference between

the high and mid Upper Entering syllables is evident both in vowel duration and in fundamental frequency. The correlation of tone height with the duration of the vowel is acoustically present in the speaker examined here. Also, the relatively young age of the speaker also shows that the tone split, which has been described in the literature for several decades, is still maintained by younger generation speakers.

Modifications of tones

Each morpheme has a particular tone when produced in isolation, known as its citation form. On occasion, the tone for a certain form varies from that in its citation form. There are two main types of such tonal variation in the Chinese languages: tone sandhi and what many authors refer to as the "changed tone" phenomenon.

Tone sandhi

Compared with other Chinese dialects, Cantonese displays relatively little tone sandhi, a modification in tone that is based on tonal or prosodic environment. There is a low level rule involving the Upper Even tone, which in its citation form is [53]. It becomes a high level [55] tone when preceding another high tone, that is, before another Upper Even tone or an Upper Entering tone. Chao (1947) gives the following example:

[kou 53] "high" ===> [kou 55] "high" [sha:n 53] "mountain"

Hashimoto (1972) reports a parallel though less frequently discussed change occurring with the Lower Even tone [21]. Aside from these cases, there are no other tone sandhi rules. The tone sandhi facts are not directly relevant here, but are included for the sake of completeness.

Changed tones

Cantonese has numerous examples of "changed tones", known in Mandarin as bianyin, literally bian "change" + yin "sound". This is a modification of tones that is morphologically or syntactically conditioned, in which different surface tones are considered to be derived from underlying citation form tones. The changed tone has a variety of semantic functions, the most common of which denotes "that familiar thing (or person, less frequently action) that one often speaks of" (Chao 1947: 34). Many of the functions of the changed tone are affective as well. Phonetically, the changed tone has two shapes: a high rising 35 tone and a less commonly occurring high level 55 tone. Sometimes the changed tone signals unimportance, as in

[mu:n 21] "door" ==> [hau 33] [mu:n 35] "back door"

as compared with [tsIng 33] [mu:n 21] "central door"

Changed tones also occur in reduplicated forms such as:

[ngA:u 23] "to bite" ==> [ngA:u 35] [ngA:u 23]

"to take a bite, tentatively"

and also in isolation, such as the following, where a more specialized meaning is the result:

[kai 33] "a plan" ==> [kai 35] "a trick".

Changed tones generally involve nouns, although there are examples involving other lexical classes. Only particular nouns can take on a changed tone; these nouns are thus marked in the lexicon.

Besides Standard Cantonese, changed tones are found in other Yue dialects: Taishan and other Siyi dialects, Bobai, Shunde, Yangjiang, and to a limited extent in Zhongshan and Dongguan. The function of the changed tone is similar to that of the Mandarin -er suffix, a so-called "diminutive" form which has many of the same functions. Wong (1982) demonstrated that the two phenomena are related, and analyzed the high rising changed tone in Cantonese as, in part, the historical result of tone sandhi with the diminutive suffixes [ji 55] and [tsi 35]. The changed tone is an example of diachronic morphologization (Joseph and Janda, 1988), in which a morphologically conditioned phenomenon is originally the result of a phonologically conditioned process.

Tone split compared with changed tones

The Upper Entering tone in Cantonese has been assumed to have undergone a register split. The existence of a second Upper Entering tone is unlikely to be the result of tone sandhi, as tone sandhi in Cantonese is limited to the rule given earlier involving the Even tone(s). There is, however, a general, more likely possibility that what is believed to be a tonal or register split in a Yue dialect might actually be examples of changed tones (see discussion of the Lower Entering tone in Taishan in Chapter III). Since changed tones are not part of the underlying tonal system, no tonal split would have occurred. The important differences between a tonal split and variation due to the changed tone are summarized below.

As noted above, the changed tone has a semantic function, e.g. as a marker of familiarity, casualness, etc., while tones arising from a register split have no particular

function whatsoever. On the surface the high Upper Entering forms could be examples of the high level changed tone, but they do not fit into any specific semantic class, nor do they occur in any expression indicating familiarity.

Another difference between tone split and the changed tone is the presence of a phonological conditioning factor. In the case of tone split in the languages of the world, there are clear phonological conditions for the split. As explained in a later chapter, a common condition for tone split (or the development of new tones) is the voicing of the prevocalic consonant: typically a low tone with voiced consonants, high tone with voiceless consonants. Often, too, the conditioning factor is lost, leading to the development of distinctive tones. Disregarding the exceptional morpheme-syllables discussed in another chapter, the split of the Upper Entering in Standard Cantonese was strictly along the lines of short versus long vowel (or lax versus tense vowel). On the other hand, the synchronic conditions for the changed tone are purely morphological and/or syntactic. In some cases, the condition for the tone split is not clear from a synchronic viewpoint; for it to be a split, it should be clear from a diachronic viewpoint as well.

A third difference is the participation of forms from other tonal categories. Tone split typically involves only members of one tone category, while the changed tone affects members of several tone categories. The split in Standard Cantonese affects only the Upper Entering tone; forms from other tone categories do not take on one of the Upper Entering tones.

The fourth factor is the lexical category of the affected forms. Because tone split is phonologically conditioned, lexical class is irrelevant, and it would be expected that all major lexical categories would be affected. The split of the Cantonese Upper Entering tone in fact affected five different lexical classes: nouns such as [A:p 3] "duck", verbs such as [si:t 3] "pour", adjectives such as [fu:t 3] "broad, wide", adverbs such as [k^hO:k 3] "really", and classifiers such as [tsE:k 3] "one, single". Because dictionaries generally do not give the lexical class of a form, with the exception of classifiers, I am assuming that the lexical class of the morpheme is the same as its English translation, though it is not necessarily the case. In contrast, each type of changed tone typically affects only one major lexical category, or one category plus classifiers. It is clear that all the forms that are affected by the tonal split do not belong to a single lexical category.

In Standard Cantonese, the occurrence of the second Upper Entering tone is clearly the result of a tone split, the conditions for which are complementary. The conditions for the split are based on vowel duration as the major cue, and not vowel quality; there is no consistent pattern with respect to vowel height, and duration has influenced the quality, specifically the peripheral position of the vowel. Such an analysis is important because, as discussed later, other tone languages show a similar interaction between tone and vowel duration as well.

CHAPTER II

THE REGULARITY OF THE VOWEL/TONE INTERACTION

The previous chapter dealt with the phonetic reality of the interaction between tone and vowel in the Cantonese Upper Entering tone forms. The interaction itself has been noted in many earlier sources. Some nineteenth century Cantonese-English dictionaries such as those compiled by Eitel (1877) and Parker (1878) describe the split. Williams (1856), an early source, does not mention the split, but this may be because the split, being phonetic and not phonemic, was not considered salient enough to mention. Chao (1947) was perhaps the first to formally state the correlation between duration and tone height.

Chao, Kao (1971), Hashimoto (1972) and many others have noted the interaction between tone and vowel as one that is, presumably, regular throughout Cantonese. Kao and Hashimoto also point out exceptions to the pattern. In fact, Hashimoto (1972) gives no direct examples of forms which fit the pattern, but emphasizes the forms which are exceptions—feeling, perhaps, that there was nothing interesting to say about the regular forms. Until now, no one has examined the regularity of the interaction in detail, nor explained why certain types of morphemes were irregular in their tone or vowel.

This section examines the interaction from the perspective of sound change. The assumption here is that tonal change has the same characteristics that (segmental) sound

change has. In the long-standing Neogrammarian view, sound change is regular, with no exceptions, and is based on purely phonetic factors. Any irregularities that are found result from non-phonetic factors, such as language contact, avoidance of taboo forms, analogy, and the like. These properties are examined in terms of the tone-vowel interaction under consideration here, showing the extent to which the interaction is regular and accounting as much as possible for the irregularities. It is vital to show that this is a case of tone split because such an interaction between tone and vowel is relatively unusual, and in theory could turn out to be something other than a true tonal split. It may, for example, turn out that one class of tones is the result of a morphophonemic "changed tone", as seen later in the chapter on comparative Yue.

The expected interaction

As noted earlier, the high and mid Entering tones occur in syllables containing short and long vowels respectively. The high Entering tone, designated here by [5], occurs with the four short vowels [I, Ø, a, U]. The mid Entering tone, designated here by 3, occurs with the seven long, tense vowels [i:, E:, oe:, y:, u:, O:, A:]. The two remaining vowels, [e] and [o], do not occur in syllables with a [p, t, k] ending.

To determine the regularity of the interaction between vowel and tone, I examined two sources. The main source was the comparative morpheme-syllabary of languages spoken near the Pearl River Delta, compiled by Zhan and Cheung (1987). The morphemes listed in the syllabary are those given in the *Table of Chinese Characters for Dialect Survey*, originally compiled by the Linguistic Institute of the Chinese Academy

of Sciences. Zhan and Cheung used an expanded version of the *Table*, containing a total of 3,810 morphemes.

Several pieces of information are given for each morpheme: the gloss, given in terms of its written character, sometimes along with the compound or phrase in which it is used, and its historical categories, which including rhyme group, tone group and initial group. The order of the morphemes is based on rhyme group. For each morpheme-syllable in Zhan and Cheung, a broad phonetic transcription is given for each of twenty-six dialects spoken near the Pearl Delta region. The data for each dialect came from the speech of one or two informants between the ages of 35 and 80 who had grown up in that region and who had little or no contact with speakers of other dialects.

Two varieties of Standard Cantonese are represented in Zhan and Cheung, that of Canton City and the urban portion of Hong Kong. Past authors have focused, for good reason, on one or the other variety, usually the one they spoke natively. Kao examined the Canton City variety, while Hashimoto examined Hong Kong Cantonese. As noted earlier, there are noticeable differences between Guangdong and Hong Kong Cantonese. As a way of resolving the issue, as well as to get a more comprehensive view of Cantonese, I looked at both Canton and urban Hong Kong pronunciations, noting, where appropriate, differences between these regions.

Number of forms

The corpus gathered from Zhan and Cheung was defined in the following way. Only those morphemes that had an Entering tone in Middle Chinese and that

synchronically had an Upper Entering tone were considered. By the latter, I am referring to only those morphemes that have either a mid level or high level tone, and which maintain a [p, t, k] ending[1]. The entire set of morphemes examined, along with all pronunciations given, is listed in the Appendix.

The number of forms that had high or mid Entering tone, as well as the number that had a short or long vowel, was calculated. If the same character was listed twice with different meanings, each form was considered separately. Some morphemes had two pronunciations listed, often a literary and a colloquial pronunciation; in addition, a small number of morphemes had differences in the Guangdong and Hong Kong pronunciations. Nearly all variant pronunciations given in the morpheme-syllabary were considered; the only ones not examined in the present study are those which were produced with a Lower Entering tone. As a result of counting variant pronunciations separately, the number of forms examined was larger than the number of morphemes. The corpus contained 336 Upper Entering tone morphemes; a total of 357 forms was analyzed.

The number of morpheme-syllables that had a particular combination of tone and vowel was then considered: the total number of pronunciations that had a long vowel and high tone was calculated, and so on for the other three combinations of tone and vowel. Zhan and Cheung's data contained more cases of long vowels than short vowels, at least for the Upper Entering tones. As observed earlier, this finding is consistent with the findings of authors such as Kao (1971), where long vowels were found to be statistically

[1]The following morphemes listed as having an Entering tone in Middle Chinese were not included in the corpus: [lai 55] "to pull", [tsA: 33] "fry", [mO: 35] "pattern, model", [k^{h}O:ng 33] "expand", [kau 35] "meat dumplings", [kØy 33] "?".

more common than short vowels.

One point of consideration is to verify whether the interaction between tone and vowel is correct. One hypothesis, known statistically as the null hypothesis, is that there is no relationship between the variables of tone height and vowel duration. If the null hypothesis is true, we would expect a random distribution. As Table 3 shows, the distribution is not likely to be random. To determine the correlation of vowel duration and tone height and to reinforce the relationship, a two-variable chi-square test was done. The result was statistically significant, with $\chi^2 = 298.47$, $p < .001$, $df = 1$. This means that there is a 0.1% probability that the distribution is random, and thus the null hypothesis is rejected. The relationship between tone height and vowel is indeed a strong one.

Percentage-wise, the vast majority of morphemes, nearly 96%, fits the vowel-tone pattern. There are altogether fifteen forms which do not fit the expected vowel-tone interaction, constituting the remaining 4% of the total set. Based on the corpus, one might also conclude that the irregularities occur to the same extent for both long and short vowels, since the percentages are the same for both (96% regular versus 4% irregular). As discussed in the immediately following sections, it turns out that most irregularities to the Upper Entering tone pattern involve long vowels, though this is in part due to the earlier mentioned fact that long vowels are more common than short vowels, and therefore we would expect to find more examples of words containing long vowels.

Zhan and Cheung's syllabary does not include certain classes of lexical items. Because the informant(s) for each dialect had to be able to read each character, the

Table 4: Number of Upper Entering tone forms from Zhan and Cheung (1987) listed according to vowel duration and tone height.

	High tone	Mid tone	Total
Long vowels	9	196	205
Short vowels	146	6	152
Total	155	202	357

syllabary does not include colloquial forms which have no character, or those forms which lack a standard Chinese character but have a character particular to Cantonese. Because the syllabary did not provide a complete range of forms, another source was consulted, namely, the syllabary in Hashimoto 1972. Like Zhan and Cheung, Hashimoto's set is also intended to be a representative set of forms, but it is representative in terms of presenting different syllable types, and not so much in terms of examples of different rhyme groups. Hashimoto's syllabary was based on data from various dictionaries, syllabaries, and Hashimoto's own intuitions as a native speaker. The list of morphemes from Hashimoto's corpus are given at the end of the Appendix. Other sources such as Kao (1971) were also examined to supplement Hashimoto's data.

Hashimoto (1972) identifies four major classes of Upper Entering tone morphemes that are exceptions to the expected interaction between vowel and tone. Three of these types can be explained; the fourth, the "real" irregularities, does not have any apparent

explanation. The exceptions are discussed in detail below.

Exceptions to the pattern

Loanwords

As a result of contact with English speakers beginning in the mid 19th century, Standard Cantonese contains numerous loanwords from English, particularly in the variety spoken in Hong Kong. When examining borrowings, one generally expects them to fit the phonological patterns of the borrowing language, and in this case, English loanwords generally conform to the rules of Cantonese phonology. However, in one sense, they do not.

In native Cantonese words, each syllable bears tone. Thus, English loanwords are transliterated with a tone on each syllable. Monosyllabic loanwords from English that end in /p, t, k/ are borrowed into Cantonese with the voiceless stop intact. Thus, their tones by definition belong to the Entering category. Those borrowings which bear one of the Upper Entering tones do not follow the expected pattern of tone and vowel, in that all but one example in the corpus have a long vowel and a high Entering tone; Hashimoto's data lists one loanword with a mid tone, [p^ha:k 3] "park". Hashimoto (1972) provides the following examples.

[mA:k 5]	"mark"
[t^hA:t 5]	"tart"
[t^hi:p 5]	"tip"
[ts^hE:k 5]	"check"
[ts^hO:k 5]	"chalk"
[k^hA:t 5]	"card"
[kO:t 5]	"court"
[ki:p 5]	"suitcase"

In the case of "suitcase", Hashimoto cites John McCoy's analysis of this as a loanword from "grip".

There are no cases of a loanword with the other possible exceptional pattern of short vowel and mid Entering tone. As Hashimoto (1972) and Kiu (1977) observe, and as a closer examination of Hashimoto's corpus shows, nearly all monosyllabic transliterated loanwords have a high level tone. Examples of monosyllabic loanwords other than those ending in /p, t, k/ are the following:

[p^{h}ai 55]	"pie"
[pO: 55]	"ball"
[tØn 55]	"ton"

For loanwords containing more than one syllable, the tone for a particular syllable depends on the stress pattern in the English pronunciation, as Kiu (1977), Kao, and Hashimoto point out. When the syllable is stressed in English, the syllable in the Cantonese borrowing always has the Upper Even [55] or [53] tone. A monosyllabic word contains one stressed syllable and generally has the [55] or [53] tone.

If the syllable is unstressed, it has one of two possible tones in the Cantonese transliteration. The high rising [35] tone, the "changed tone", occurs when the syllable is word-final, as in [sO: 55 fa 35] "sofa". In other positions, the unstressed syllable has a mid level 33 tone, as in [a 33 khA:ng 55] "account".

Compound forms with a syllable ending in /p, t, k/ also follow the same pattern. Kiu (1977) gives many examples, of which the following are representative.

[k^{h}E:p 5 t^{h}an 35]	"captain"
[fo:k 5 si 35]	"Volkswagen"
[hi:t 5 t^{h}a 35]	"heater"

Kao, Hashimoto and Kiu conclude that the use of the high tone is an interpretation of English stress. English has contrastive stress; Cantonese, on the other hand, has stress, but does not use it contrastively. Kiu (p. 20) summarizes the rules for tonal assignment to each vowel in an English loanword in the following, modified slightly to fit the system used here:

$$
V \longrightarrow \begin{cases} 55 \text{ or } 53 \;/\; \underline{\quad\quad} \; [+ \text{stress }] \\ 35 \;/\; [+ \text{stress }] \; X \; \underline{\quad} \; \#, \text{ where X does not contain ##} \\ 33 \text{ elsewhere} \end{cases}
$$

Accounts for the occurrence of the high tones in such loanwords noted a long-believed relationship between stress and high pitch. Earlier it had been assumed that because of the increase in pulmonary airflow associated with stressed syllables, stressed syllables are generally higher in pitch than an unstressed syllable. In the Cantonese examples, the citation form is transliterated with the high tone [55] or [5]. As Kiu notes, the tone used is not just any tone with relatively high pitch, but the tone with the highest pitch. However, the connection between high pitch and stress is not as strong as

previously thought, and thus there is no sound phonetic principle underlying the use of the high tone. Nonetheless, it is clear that Cantonese has a rule mapping stress into high tone in loanwords, which accounts for the irregular forms.

There is also internal evidence for this rule. Within native Cantonese words, there is a perceptual connection between stress and high tone (Hashimoto 1972: 101-102). According to Hashimoto, syllables that have the Upper Ascending [35] tone, the Upper Even [53] or [55] tone, and the high Upper Entering [5] tone are stressed more heavily than syllables bearing other tones. For example, in "egg yolk" [tA:n 33 wO:ng 35], [wO:ng] is stressed more strongly than [tA:n], while in one possible pronunciation of "egg white" [tA:n 35 pA:k 2], [tA:n], which has taken on the changed tone, has greater stress.

There are two possible ways of analyzing this situation. The phonetic shape of the loanwords provides evidence that the tone and vowel interaction is no longer synchronically active. Loanwords, which are an easily obtainable source of new words in a language, would not necessarily follow the pattern if they entered the language after the completion of the tonal split. The other possibility is some sort of rule ordering, in which the change leading to the tonal split still applies synchronically, but the loanword rule was applied first.

In any event, the exceptional case of the loanwords is not really an exception after all, but rather can be explained in light of what is known about Cantonese loan phonology. The irregularity is the result of an interpretation of stress in terms of phonemic pitch. Put another way, the reason why monosyllabic loanwords ending in [p, t, k] are exceptions to the expected tone-vowel correspondence is that all stressed

loanwords have high tone, regardless of their segmental composition. Since many of these forms have a long vowel, we end up with irregular forms. Along different lines, there are as well other examples of loanwords resulting in anomalies within the Cantonese phonological system. For example, the syllable [pi] does not occur in Cantonese except for loanwords such as [pi pi] "baby", presumably an English borrowing, and onomatopoeic forms such as [pi], "whistling sound".

Onomatopoeia

Many onomatopoeic forms with an Upper Entering tone do not follow the pattern. These exceptions contain a long, tense vowel yet have a high Entering tone, similar to the loanwords discussed earlier. Hashimoto (1972) gives the following examples of onomatopoeia with a high Upper Entering tone. According to Hashimoto, some morphemes, such as the form for "slippery", are onomatopoeic in a metaphorical sense. Most do not occur in isolation but rather are reduplicated along with the morpheme [sE:ng 55] "sound", e.g. the full expression for "car sound" is [pu:t 5 pu:t 5 sE:ng 55].

[pu:t 5]	"car sound"
[tA:p 5]	"to taste"
[ty:t 5]	"gloss?"
[ly:t 5]	"slippery, smooth"
[lA:k 5]	"cracking noise"
[ngi:t 5]	"creaking sound"

Kao (1971: 142) supplies the following additional examples, which also have a long vowel and high Upper Entering tone.

[wA:k 5]	"jabbering"
[hA:k 5]	"interjection of anger"
[tO:k 5]	"cackling of hens"
[fi:t 5]	"sound of striking with a rattan"
[tA:k 5]	"giliap"
[(s)O:k 5]	"sound of crispy food"
[pO:k 5], [mO:k 5]	"sound of shelling nuts"
[k^hi:t 5]	"laughing sound"

Hashimoto and Kao do not list any examples of onomatopoeic Upper Entering forms with a short vowel and mid [3] tone.

In addition, Hashimoto's syllabary gives several examples of onomatopoeic forms with no translation: [pA:k 5], [tA:k 5], [tO:k 5]. Two forms have a short vowel: [plk 5] and [tlk 5]. These forms are representative in some way of the sounds [pA:k 5], [tA:k 5], etc.

The reason these forms are exceptional is likely to be due to the directness of their representation, in that the sounds indicated are, or can be interpreted as, long, high-pitched sounds. For example, [lA:k] and [ngi:t] sound like their referents, and the sounds of cracking and creaking are typically long sounds.

Other onomatopoeic, non-Upper Entering morphemes also contain long vowels for relatively long sounds. The morpheme [ku: 21] in [ku: 21 ku: 21 sE:ng 55] "noise of a

rumbling stomach or anger" also refers to a long sound. Admittedly this pattern does not hold for all onomatopoeic forms in Cantonese. For example, [ngang 21] in the reduplication [ngang 21 ngang 21 sE:ng 55] "moaning sound" has a short vowel, yet moaning is long by nature.

Nonetheless, it is a well-established fact that onomatopoeic words often are apparent exceptions to what is otherwise regular sound change. For example, the English word cuckoo is descended from Proto-Germanic */kuku/, a form which historically should have been */huhu/ by way of the development of Proto-Indo-European *k > h under Grimm's Law. A possible explanation for the retention or reintroduction of /k/ is the connection between form and meaning that is found in onomatopoeia. Words that are arbitrary in nature have a conventionalized connection between meaning and form, and are more free to change their phonetic form with no effect on this connection. Words that are iconic, on the other hand, have a natural connection between meaning and form, are less free to change in form, and, if they do change, are more readily re-created. Thus the stop consonants in cuckoo did not become fricatives—or else [kuk] was re-created—because such a change would have resulted in the word becoming less representative of the bird sound (Joseph 1987: 4). The same reasoning applies to these Cantonese forms. [k^hi:t 5 k^hi:t 5] would be less representative of the sound of laughter if it were to change in form. Thus, for similar though not identical reasons as the English loanwords, the onomatopoeic forms are explainable exceptions.

Colloquial and literary forms

A third group of exceptions consists of morphemes which have colloquial and literary pronunciations, or which belong to the colloquial or literary layers. Most Chinese dialects have at least two strata: a colloquial stratum, consisting of forms that are native to the dialect, and a literary stratum, which consists of forms introduced into the dialect at various stages in its development. In many cases, the literary pronunciations arise as a result of the practice of reading texts.

Because the colloquial and literary forms are reflexes of the same morpheme in earlier stages of Chinese, both forms are written with the same character. The end result is that many Chinese characters have two pronunciations, colloquial and literary. There are some morphemes, however, which have only a colloquial form; these morphemes usually do not have a written character, or if they do, the character is used only in a particular dialect. Cantonese in particular has many examples of such colloquial characters.

In Cantonese, the difference between colloquial and literary pronunciations can be signaled by a change in vowel quality, often by means of an alternation between [I] and [E:]. This alternation is reflected in the Upper Entering tone data; for example, the morpheme "to chop, split open" has the literary form [p^hIk 5] and the colloquial form [p^hE:k 3]. For this pair, the tone "changed" in accordance with the general tone-vowel relationship.

For some lexical items, the Upper Entering tone does not "change". The following is a complete set of morphemes, based on Zhan & Cheung and Hashimoto, in which the

long vowels occur with the high Entering tone in the colloquial pronunciations. The literary pronunciations follow the expected Upper Entering pattern.

	Colloquial	Literary
"black"	[hA:k 5]	[hak 5]
"hold"	[A:k 5]	[ak 5]
"time"	[hA:k 5]	[hak 5]
"carve, engrave"	[hA:k 5]	[hak 5]
"to overcome; a gram"	[hA:k 5]	[hak 5]

McCoy 1966 suggests that the long vowel in the colloquial form [hA:k] "black" could be the result of analogy with the form "white" [pA:k 22]. This would mean that the long vowel in the other colloquial forms, which have the same segmental shape [(h)ak], is due to analogy with the form for "black". That is, "black" changed first, followed by the other forms, based on a principle of "phonic attraction" to the form for "black". Although McCoy's account sounds plausible, the occurrence of the long vowel in "black" could be accounted for by analogy with all of the forms with an [A:k]/[ak] alternation, which constitute a large class—and not necessarily to one particular form. In any event, since these morphemes maintain their high tone, an irregularity to the vowel-tone interaction results.

Moreover, there are a small number of exceptions in the other direction, where the short vowel occurs with the mid tone. Zhan and Cheung as well as Hashimoto list the following morphemes which are examples of this exception. Here, the literary

pronunciation is the exception.

	Colloquial	Literary
"arrest, catch"	[tsUk 5]	[tsUk 3]
"backbone"	[tsE:k 3]	[tsIk 3]
"ruler, measure"	[ts^{h}E:k 3]	[ts^{h}Ik 3]
"tin, pewter"	[sE:k 3]	[sIk 3]
"red"	[tsE:k 3]	[tsIk 3]
"lizard, frog"	[kA:p 3]	[kap 3]
"dove, pigeon"	[kA:p 3]	[kap 3]

According to Hashimoto (1972: 170), the literary pronunciations of "ruler, measure" and "backbone" are uncommon but are attested in various sources. Hashimoto (1972: 199) believes that the literary pronunciations of "lizard" and "dove" may be due to analogy with other morphemes containing an [A:p] rhyme in their colloquial forms. The literary readings for these morphemes is [ap]; in "lizard" and "dove" the rhyme changed, but the tone remained mid level. For "tin" and "red", Hashimoto suggests that the literary forms at one point disappeared but were re-introduced through so-called "folk etymology", presumably with morphemes like [sIk 5] "divide, explain" and [tshIk 5] "to blame, expel", respectively.

Colloquial words

In addition, there are colloquial words, those forms which generally lack a standard Chinese character. Some do not follow the expected pattern of vowel-tone

interaction with the Upper Entering tones. Hashimoto and Kao supply the following examples of colloquial Upper Entering tone morphemes which contain a long vowel and the high tone.

[p^{h}O:k 5]	"blister, air ball"
[mi:t 5]	"to peel, pinch"
[tsi:t 5]	"to tickle"
[lA:k 5]	"armpit"
[pO:k 5]	"to hit on the head with something hard"
[tsE:k 5]	final particle implying limitation or delay
[lE:k 5]	"to be smart"
[mO:k 5]	"to strip"
[mu:t 5]	"pout"
[ts^{h}oe:t 5]	"in a split second"
[ngA:k 5]	"to deceive"
[sA:p 5]	"coarse"
[k^{h}wA:k 5]	"loop"
[lO:k 5]	"corner"
[lO:k 5]	"to remove teeth"

For the morpheme "to deceive", McCoy (1980) gives [ngak 5] as another pronunciation.

One could make the claim that these forms have the high level changed tone, which is certainly possible for morphemes such as those for "tickle" and "pout"; it is harder to make this claim, though, for morphemes such as "loop" and "to remove teeth".

Hashimoto (1972: 199) believes [mO:k 5] could be due to "an association of a colloquial word with the character having the same meaning", but does not elaborate on this. I believe Hashimoto may be thinking of [mO:k 3] "peel the skin off", but this form has mid tone, not high.

Many of the forms listed above have nasal and lateral initials. The Yin-Yang or Upper/Lower register split discussed earlier was along the lines of voicing. Morphemes in Upper register tones have voiceless obstruent initials, while morphemes in Lower register tones have voiced obstruent and sonorant initials. But in many Chinese dialects, certain morphemes with sonorant initials are part of the Upper register, while other morphemes with sonorants are part of the Lower register of the same tonal category.

For the Upper register sonorant forms, McCoy (1980) proposes an "irregular tone" that has a function similar to the Yue "changed tone". The "irregular tone" is a high tone, and occurs mainly in forms that have a lateral or nasal initial. Thus, a Cantonese Upper register form with an [l, m, n, ng] initial is in all likelihood a colloquial form. Because this phenomenon is found in many Yue dialects, McCoy reconstructs this "irregular tone" for Proto-Yue (his Proto-Cantonese). Thus, Upper register colloquial forms are exceptional in one way, and some can be exceptional in a second way: in terms of the Upper/Lower register split, and in terms of the split within the Upper register.

Not all Upper register colloquial forms are exceptional to the interaction between vowel and tone in the Entering tone; there are morphemes which do fit the expected pattern. The following is a representative set of those colloquial forms which have a long vowel and mid tone.

[ly:t 3]	"inferior"
[mu:t 3]	"mop"
[lA:k 3]	"naked"
[li:t 3]	"a knot"
[ngA:t 3]	"stench"
[ni:p 3]	"thin, flat"
[lO:k 3]	"sentence particle"

There are also forms with a short vowel and high tone, also conforming to the interaction pattern, such as the representative set below.

[nIk 5]	"secret, anonymous"
[mat 5]	"what"
[lUk 5]	"to roll"
[ngap 5]	"to tattle"

One explanation as to why the irregular colloquial forms have high tone is based on one assumption. Originally there were two Entering tones, high and low, one in the Upper register and one in the Lower register respectively. Presumably the synchronic third tone is the mid tone, the result of a lower-than-high tone developing on morphemes with a long vowel. It is also possible that the synchronic high tone is the new third tone, the result of a higher-than-high tone developing on morphemes with a short vowel; the earlier high tone is now mid. For now, we will assume that the first scenario took place; it seems more intuitive to consider the mid tone as an innovation.

It is impossible to predict which long vowel colloquial morphemes have high tone and which have mid tone. Under the above assumption, those with high tone were not affected by the tonal split, while those with mid tone were affected—again, describing only the Upper register colloquial forms. One possible explanation is some type of "lexical diffusion". The implementation of the tonal split must have begun after the assignment of the "irregular tone" was complete, but stopped before all of the colloquial forms were affected. On this basis, the reason why certain Upper register colloquial forms have a long vowel and high tone, and not mid tone, is that these forms have retained the original tone before the split, which corresponds to the synchronic high tone.

The colloquial-literary distinction suggests something more. The tone split is more regular for the literary level than for the colloquial level. The near-complete regularity of the interaction in literary forms could mean that the tonal split originated as a result of external influence. If the split were an innovation within Cantonese, one would expect the interaction to be more regular with the colloquial forms.

In summary, there is a pattern as far as the colloquial and literary levels are concerned. The exceptional forms containing a long vowel and high tone are all colloquial forms of some type. For those morphemes with colloquial and literary readings, exceptions to the vowel-tone interplay in the Upper Entering arise that are in all likelihood due to some type of analogy with a homophonous or semantically related morpheme, or some type of reanalysis such as folk etymology. The exceptional forms containing a short vowel and mid tone, of which there are much fewer examples, are all literary pronunciations. The colloquial exceptions, however, cannot be as readily

explained, except in terms of "lexical diffusion".

Other exceptions

On a somewhat related note, there are some morphemes which have alternate pronunciations not connected to the colloquial and literary levels. The morpheme [A:k 5] "yoke" is an exception to the pattern according to Zhan and Cheung, but it is listed as [ak 5] in Hashimoto. [pA:k 5] "to force" is also an exception, but it has another pronunciation that is given in Hashimoto and Zhan and Cheung, [plk 5]. These morphemes are not clear-cut counterexamples because they have other pronunciations which do fit the expected pattern. Also, these exceptional pronunciations are not used by all speakers and might not reflect Standard Cantonese forms.

There is as well a small number—two, to be exact—of exceptional morphemes whose irregularity cannot be explained. They do not fall into any of the categories mentioned above, and do not have variant, regular pronunciations. There is no explanation as to why they have their particular combination of tone and vowel, except that one of the two, the vowel or tone, is not the expected reflex. The morphemes, one of each exception type, are[2]:

[kap 3] "join, agree"

[pi:t 5] "must, certainly"

[2]Hashimoto (1972) also lists [kap] "conspire" as an exception, but transcribes it with the Upper Departing tone, using [44] in her notation.

[kap 3] is commonly used in expressions referring to a unit of measurement translated as "peck", a morpheme which evidently existed in Middle Chinese times. [pi:t] is reconstructed for Middle Chinese; thus, these two forms are not recent borrowings. [pi:t 5] is a member of the Zhen rhyme group, a group which typically has finals containing short vowels. What is irregular here is the vowel; however, the motivations for the vocalic change are unclear.

Thus, the number of "real" irregularities, with no clear explanation as to why they are irregular, totals two. In Kao's corpus, the number of exceptions, which includes loanwords and onomatopoeia, total about 10% of the entire set. Kao includes some of the colloquial forms under the heading of "expressive" terms, and includes exceptional literary forms under "learned" pronunciations. The number of unexplainable exceptions, so-called "normal common words", constitute about 2%, seven out of 311 morphemes in Kao's corpus (1971:126).

The occurrence of a small number of unexplainable counterexamples does not provide evidence against the regularity of a particular sound change. A situation parallel to the present one is seen in Latin rhotacism, as discussed in Anttila (1972), citing Sturtevant. By the sixth century B.C. Latin *s > r intervocalically, yet there are some words in which s is retained between vowels, e.g. di:vi:sus "divided", genesis, and miser "miserable". Similarly to the Cantonese case, there are three major classes of Latin words which were ineligible for the rhotacism: in di:vi:sus, the -s-is derived from a geminate -ss- which in turn arises from an earlier cluster -dt-; genesis is a Greek loanword, presumably borrowed after the completion of the sound change; and miser is a word that

did not fit the phonetic context for the change; when the following consonant was r and the initial consonant was one other than s, the rhotacism did not take place. There is only one word whose irregularity cannot be readily explained: na:sus "nose"[3]. But as Anttila points out, the existence of one word in which the sound change did not apply—versus hundreds of words in which it did apply—does not negate the regularity of the sound change. If tonal splits are a special type of sound change, then the existence of two exceptions does not negate the regularity of the tonal split either.

Conclusion

In this section we have seen that the interaction between tone and vowel in Cantonese is regular, though not perfectly so. The sources consulted list a total of over fifty morphemes that violate the expected pattern, and the majority of them have high tone with a long vowel. However, there are at least three easily identifiable classes of morphemes that are exceptional: loanwords, onomatopoeia, certain colloquial forms, and forms affected by analogical change in their colloquial or literary forms. Therefore, in considering the regularity, we must consider morphemes that are not borrowings, are not iconic and which have not been influenced by other forms. It has been shown that these classes of forms can be disregarded to some extent, and that the number of exceptions can be reduced to two examples. The vowel-tone interaction in the Upper Entering tones is

[3]Hock (1976) noted that na:sus occurs in a form with "expressive gemination", na:ssus, in Plautus. Thus the irregularity of na:sus could be explained after all as the result of a degemination of -ss- after the rhotacism had completed its course.

a case of regular tone split, albeit, as will be explained in following chapters, an unusual one in the languages of the world.

CHAPTER III

COMPARATIVE-HISTORICAL STUDY OF YUE

The Yue dialect group

Our understanding of the split in the Upper Entering tone in Standard Cantonese becomes clearer when it is viewed in the context of the Yue dialect group. A split in one of the Entering tones is not unique to Standard Cantonese; similar splits have occurred in several well-studied Yue dialects. In some cases the conditions are not synchronically obvious because of further sound changes that have taken place in those dialects. In addition, there are at least two Yue dialects in which the Lower Entering tone has split. This section deals with the post-Middle-Chinese development of the Entering tones in those Yue dialects for which information is available.

Within mainland China, the Yue dialects are spoken mainly in Guangdong and southeastern Guangxi, two southern provinces bordering the South China Sea and the Gulf of Tonkin, respectively. It is the main dialect group spoken in the areas around the Pearl River delta. In addition to Yue, dialects of Hakka, Min and Mandarin are also spoken in these areas; in Guangxi, dialects of minority language groups such as Miao-Yao (a.k.a. Hmong-Mien) and Zhuang are spoken as well.

This section has two parts. The first part examines the cross-dialectal evidence from a comparative viewpoint. The major characteristics of Proto-Yue, hereafter PY, are

summarized. Because no single tone or tonal group exists in total isolation from other tones in that language, the entire tonal inventory for each dialect is listed. The discussion is limited to the amount of information available on these dialects. There are considerably fewer sources on Yue dialects other than Standard Cantonese, and the length of the descriptions of these dialects reflects this. This is particularly true for the Guangxi dialects, where the information comes for the most part from Tsuji (1980).

Reconstruction of Proto-Yue

Reconstructions of PY come from two sources. McCoy (1966) presented the first systematic effort to reconstruct PY, a "first approximation" of PY (termed "Proto-Cantonese") with the understanding that such reconstructions would be revised as more details about the Yue dialects became known. McCoy's data came from twenty-four dialects, including Standard Cantonese, various other dialects spoken in Guangdong, and Bobai[1]. All but one of the Yue dialects examined by McCoy are spoken in Guangdong, and so his reconstruction in a sense represents Eastern Yue.

Tsuji (1980) took McCoy's reconstruction work further by combining part of McCoy's Guangdong data with his own fieldwork on Yue dialects from the Guangxi province. Thus Tsuji's account is to a degree closer to actual PY than McCoy's, though slightly skewed toward Guangxi. Tsuji examined a total of eleven dialects; in addition

[1]In addition to Standard Cantonese, McCoy examined Kungyik, Tikhoi, Tailing, Chunglau, Natai, Kwongtoi, Hoian, Namchuen, and Pakshek; the Hoiping dialects Hoisum, Wuchung, Chekham, Hinkong, Paksha, and Cheksui; the Yenping dialect Shuenkok; Sunwui; Bobai; Zhongshan; Kausai; Tanshui Hau, Yeungkong, and Tungkun.

to Standard Cantonese and two other Guangdong dialects, he used data from seven Guangxi dialects and one Guangdong dialect, Cenxi. Tsuji's reconstruction method is based on the traditional Chinese phonological analysis, in that he reconstructs the sound system based on initials, finals and tones. The next section describes Tsuji's reconstruction. A discussion of initials is not relevant here and has been omitted.

Finals

PY endings do not differ from those of Standard Cantonese. Aside from the diphthongs, only the nasals *m, *n, and *ng can occur finally, as well as the oral stops *p, *t, *k. The following list contains the Entering tone finals that have been reconstructed for PY. Dashes indicate gaps in the inventory. ê represents schwa.

*ap	*at	*ak
---	*wat	*wak
---	---	*yak
*êp	*êt	*êk
*yêp	*yêt	---
---	*et	*ep
*yep	*yet	*yek
---	---	*ik
---	*ot	*ok
---	*wot	*wok
---	*ut	*uk

The PY vowel inventory can be determined from the reconstructed finals. Tsuji does not reconstruct long and short vowels in PY, although Norman (1988: 217) believes that PY had a contrast between long and short vowels. A six vowel system is reconstructed as follows:

*i *u

*e *o

*ê *a

Tones

Tsuji reconstructs the PY tonal system with the Upper-Lower register split, as listed in Figure 8. Thus, the eight tones of the post Middle Chinese period are preserved

	Even	Ascending	Departing	Entering
Upper	"1"	"3"	"5"	"7"
Lower	"2"	"4"	"6"	"8"

Figure 8: The tones of Proto-Yue (Tsuji 1980).

in PY. Because the phonetic values of the PY tones cannot be determined, the tones are termed "1", "2", and so forth in Tsuji. It is likely, though, that the tones of the Upper register were higher in pitch than those of the Lower register, given that most Upper register tones in modern Yue dialects have higher pitch. This is not terribly surprising, given the phonetic plausibility of voiceless prevocalic consonants raising the vowel's F0, as well as the cross-dialectal presence of higher pitch in other Chinese groups.

In addition, Tsuji groups tones "1" through "6" together as "long" and considers "7" and "8", the Entering tones, to be "short" versions of the long tones—identical to many analyses of synchronic Standard Cantonese. The "changed tone" that is present in Cantonese and other Yue dialects is not reconstructed in PY.

Dialect description

Figure 9 lists the best documented Yue dialects which have undergone a split in the Upper and/or the Lower Entering tone, along with the phonetic values of the tones. The numbers listed follow the notation conventions used by the references consulted, with one normalization: all level tones are indicated by double digits. The complete tonal inventories for each dialect are listed in later sections. Sources consulted are Hashimoto (1972), Standard Cantonese; Chao (1951), Taishan; M. Chan (1980), Zhongshan; Norman (1988) and Beijing Daxue (1964), Yangjiang; A. Yue (1979), Tengxian; Tsuji (1980), Binyang, Cenxi, and Nanning; Wang (1932), cited in Wong (1982), Bobai. The first five dialects are spoken in Guangdong; the last four, in Guangxi. With the exception of Bobai, evidence from the Guangxi province dialects were, until recently, not included in

	Upper Entering		Lower Entering	
Dialect	A	B	A	B
Cantonese	55	44	33	
Taishan	55	33	32	
Zhongshan	55	22		
Yangjiang	24	21	454	
Tengxian	55	33	22	
Binyang	55	33	22	
Cenxi	55	34	22	
Bobai	54	11	44	32
Nanning	55		24	22

Figure 9: Modern tonal reflexes of the Middle Chinese Entering tone in nine Yue dialects which have undergone a split in the Upper and/or Lower Entering tone.

comparative examinations of Yue. Most of the dialects listed in Figure 9 have undergone a split in the Upper Entering tone. Nanning Pinghua and Bobai have undergone a split in the Lower Entering tone.

In addition to the dialects listed, some sources have briefly mentioned other Yue dialects in which the Upper Entering tone has split. McCoy (1966) tentatively listed Kausai, Tan Shui Han, and Yeung Kong, southeast of the Szeyap region. Some of these dialects are dialects of Taishan. Based on her own fieldwork, and possibly also field notes from Chao, Hashimoto (1972) cites Shunde, Sanshui, Guiping, and Guixan. The

exact number of dialects in which a split has taken place is unclear, but it is not crucial here. It would be impossible to determine such a number anyway, due to the lack of information on the lesser-known Yue dialects and, hence, to the absence of a way of determining the degree of mutual intelligibility.

The location of the principal city or district in which each dialect is spoken is located on the map in Figure 10. It should be noted that the geographical distribution is much more complex than illustrated, in that speakers of a given Yue dialect are, of course, not restricted to the major city in which it is spoken. In addition, speakers of varieties of other Chinese dialect groups, as well as of non-Chinese languages, live in the Yue dialect area. The tones of each dialect are given with respect to traditional tonal categories, i.e. the four tonal categories of Middle Chinese and the further split into "upper" and "lower" registers.

Taishan

Upper Entering tone

Next to Cantonese, the second best documented Yue dialect is Taishan, also known as Toishan. Approximately 86% of Chinese-Americans trace their origins to Guangdong, and most are from the Taishan area (Ramsey 1987). The Taishan district is located southwest of Canton, near the coastline of the South China sea. It is one of the Siyi (Cantonese Szeyap) or "four-district" dialects of Yue, spoken in a four county area along with the three dialects Sunwui, Kaiping, and Enping. The Siyi dialects form a distinct subgroup within Yue, with phonological systems different from other varieties.

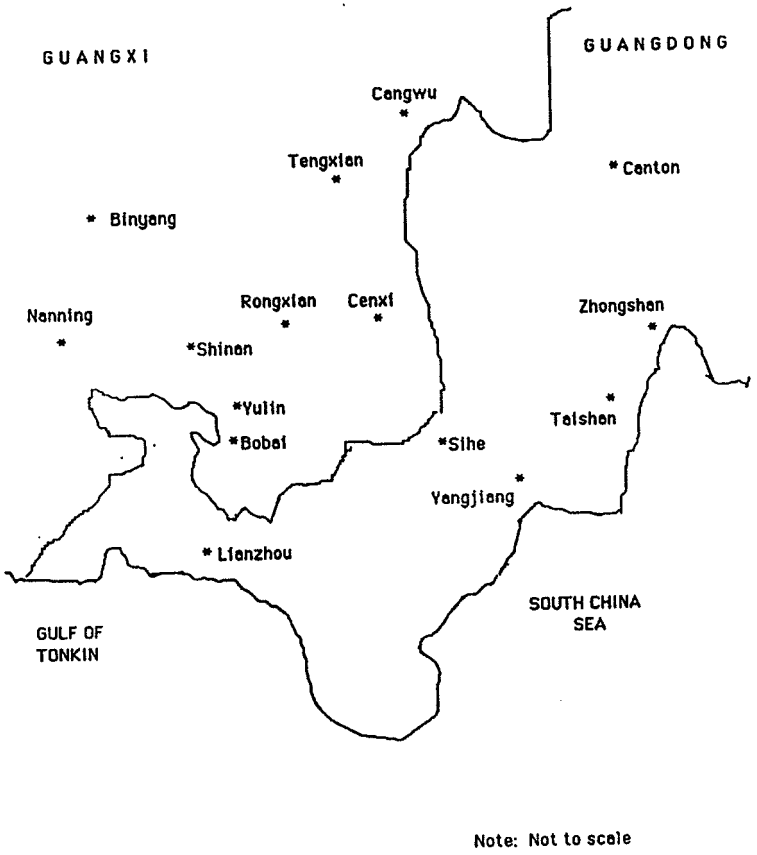

Figure 10: A geographical map of the Yue-speaking area in southern China.

Because it is a non-standard variety, there is much less literature on Taishan than on Cantonese. No extensive phonological study in the manner of Hashimoto (1972) exists, but information is available from Chao (1951), McCoy (1969), Cheng (1973), and in passim in Hashimoto (1972).

	Even	Ascending	Departing	Entering
Upper	33	55	31	55
				33
Lower	22	21		21

Figure 11: Taishan tones (Chao 1951).

The phonetic tones of Taishan are listed in Figure 11. Most authors describe Taishan as having undergone a split in the Upper Entering tone, resulting in the two Upper register tones [55] and [33], and the Lower Entering [21]. Tsuji (1980), apparently noting the lack of conditioning factors, did not think there was a split. The conditions for the split are synchronically opaque because of sound changes that have taken place. These changes will be discussed in more detail below.

Like Standard Cantonese, Taishan vowels have a tense/lax distinction, though not identical to Cantonese. Taishan does not have a length distinction in the way that

Cantonese does. Phonemically there are five vowels; phonetically, there are eleven or twelve vowels. McCoy excludes [a], which Cheng says occurs before velars. In either analysis, there is no length distinction in low vowels.

Synchronically, the distribution of the Upper Entering tones based on the vowel is not complementary. This distribution is illustrated below, from Oi-Kan Yue (1976), where the final is listed with the Upper Entering tone with which it occurs. Although three finals occur only with the high Upper Entering, and three other finals occur exclusively with the mid Upper Entering, there are six finals which have both tones.

High only	Mid only	Either tone
[it]	[Ot]	[ap]
[ip]	[Ok]	[at]
[ouk]	[iak]	[ak]
		[iap]
		[eik]
		[ut]

The nature of the Taishan split will be returned to later.

The Lower Entering tone

Some have argued for a tone split in the Lower Entering tone as well. Cheng (1973), as well as Wang and Qian (1950), has said that the Lower Entering category in Taishan has two tones, phonetically high rising and low falling, as in [pak 52] "white" and [siak 31] "stone", respectively. McCoy (1969), however, strongly disagrees and,

along with others, analyzes the so-called second tone as a case of the changed tone. To settle this point, I examined the Zhan and Cheung syllabary and found fourteen morphemes which had the low Lower Entering tone, transcribed as [11] in their notation; the higher tone is transcribed as [21]. Cognate forms in Standard Cantonese are given for comparison.

Taishan	Cantonese	Gloss
[hap 11]	[hAp 22]	"covered box"
[kut 11]	[kO:t 33]	"a creeping plant"
[set 11]	[si:t 22]	"tongue"
[mbet 11]	[mi:t 22]	"splints"
[puOt 11]	[pu:t 33]	"container (mug)"
[mbit 11]	[mAt 22]	"honey"
[ziak 11]	[(j)ioe:k 22]	"medicine"
[vOk 11]	[(w)uO:k 22]	"wok"
[pak 11]	[pa:k 33]	"father's older brother"
[kak 11]	[ka:k 33]	"a pattern; to reach"
[vut 11]	[(w)uAt 22]	"fruit pit"
[khiak 11]	[khE:k 22]	"wooden clog"
[tshiak 11]	[ts^{h}E:k 33]	"Chinese foot, ruler"
[siak 11]	[sE:k 22]	"stone"

An examination of these morphemes shows that some of them belong diachronically to the Upper Entering category, as seen in the correspondences in Cantonese. The forms for

"creeping plant", "container", "father's older brother", "pattern", and "Chinese foot" are derived from Middle Chinese voiceless initials, and correspond to Cantonese Mid Upper Entering tone. Excluding the six morphemes that are reflexes of Upper Entering forms, the occurrence of the low tone is limited to only eight morphemes, out of a total of 238 Lower Entering morphemes given in Zhan and Cheung. A ninth morpheme, "small bird" is listed in Cheng as [tiak] with the low tone, but Zhan and Cheung list it with the high 55 tone.

Based on the data seen here, the so-called "second" Lower-Entering tone is likely to be due to the changed tone. In these forms, the low tone apparently denotes familiarity, which is one of the major functions of the changed tone. A "wok" is an integral part of a Chinese household, and "stone", "tongue", etc. are certainly familiar objects. Wong (1982) also notes that in Taishan, changed tones occur on monosyllabic forms to a much greater extent than in Cantonese, where the changed tone tends to appear in compounds or reduplicated forms; thus, in a study of a morpheme-syllabary, cases of the changed tone are likely to turn up.

Zhongshan

The third best documented Yue dialect is Zhongshan, which is spoken in its namesake county immediately south of Canton and just north of Macao. Zhongshan Yue is spoken in Shiqi, the capital city. Brief descriptions of Zhongshan phonology are found in sources on Cantonese such McCoy (1966); a detailed description is provided in Chan (1980). The tones of modern Zhongshan are listed in Figure 12. Compared with other Yue dialects, which typically have eight tones or more, Zhongshan has only six—the

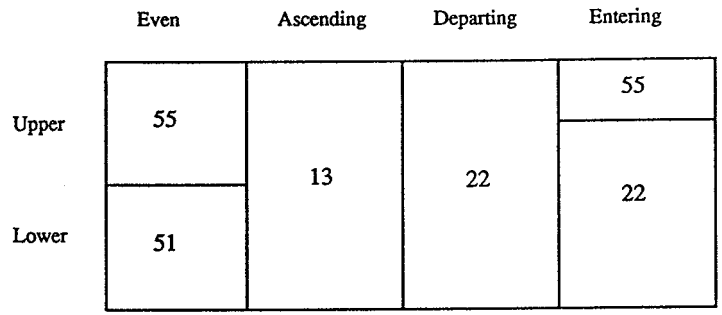

Figure 12: Zhongshan tones (Chan 1980).

fewest number of tones among the Yue dialects. Zhongshan is the only one of the twenty-two Yue dialects surveyed by Hashimoto (1972) in which there is no synchronic split within the Ascending and Departing tone categories. A likely reason for the small number of tones is influence from a Hakka Chinese dialect spoken just south of Shiqi, which has four tones—the number as Zhongshan, excluding the Entering tones.

The existence of only one tone in the Ascending and Departing categories makes it appear as if the Upper-Lower register split did not occur in Zhongshan. This point will be returned to below. Likewise, at first it seems that the Upper Entering tone did not split in Zhongshan, with only one tone, 55, and the Lower Entering tone, 33. But a closer look reveals that both splits must have occurred. Chan (1980) proposes that the Upper-Lower split did occur in all four tone categories, with subsequent merger in Ascending, Departing and Entering. The split into Upper and Lower Entering is, synchronically speaking, not entirely along the lines of voiceless and voiced. Although voiced initials occur only in the Lower, voiceless initials occur with both Upper and Lower. The split

in the Upper Entering apparently did take place, with the tone of the voiceless initial, long vowel syllables merging with the tone of the voiced initial syllables. The following are examples of the Entering tone morphemes in Zhongshan, with Standard Cantonese forms given for comparison.

Cantonese	Zhongshan	
[sIk 55]	[sIk 55]	"color"
[ki:t 55]	[kit 33]	"clean"
[ngO:k 22]	[ngOk 33]	"lofty mountain"
[ti:t 22]	[tit 33]	"decorum"

The form meaning "clean" has an Upper Entering tone and a long vowel in Cantonese, but has a Lowering tone in Zhongshan. The Lower Entering tone forms in Cantonese, in general, correspond to Lower Entering tones in Zhongshan.
Such a development could not be neatly explained without positing this intermediate development. Chan (1980: 324) connects the loss of register split in the Departing tone with a similar loss in the Entering tone.

Yangjiang

Yangjiang is located in Guangdong, southwest of the Siyi area near the coastline of the South China sea. The tones of Yangjiang are listed in Figure 13. The Ascending tones have merged; in the other three categories, the Lower register tones are all higher in pitch than the Upper register tones. Like Cantonese, Yangjiang also underwent a split in the Upper Entering tone; the conditions are unclear. Norman (1988) believes that

Yangjiang at one point had a distinction in vowel duration, but no longer has it.

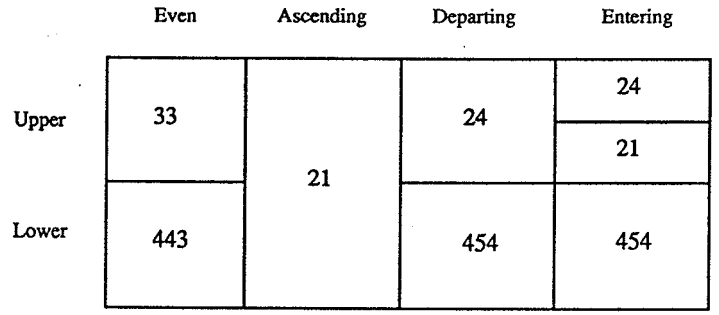

Figure 13: Yangjiang tones (Beijing Daxue 1962).

Tengxian

Tengxian is spoken due east of Canton in southeastern Guangxi, close to the border of Guangdong. Discussions of the phonology of Tengxian are found in A. Yue (1979) and in passim in Hashimoto (1972). The tones are listed in Figure 14. In Tengxian, there is a split in the Upper Entering. An investigation of the morphemes in A. Yue's syllabary shows that forms with a high Upper Entering tone in Tengxian correspond to forms with a high Upper Entering in Cantonese; the same pattern is true

for the mid Upper Entering tone forms in both varieties[2]. The high Upper Entering occurs with the vowels [ê, a, e], the mid Upper Entering with the other vowels [E, i, u, y, O, a]. The distribution of vowel and tone is not quite complementary; this is due to the partial merger of the low vowels [ê] and [a] in Tengxian.

	Even	Ascending	Departing	Entering
Upper	42/44	55/35	33	55
				33
Lower	231/11	24/35	22	22

Figure 14: Tengxian tones (A. Yue 1979).

Binyang

Binyang is located in central Guangxi, northeast of the capital city of Nanning. It is a highly prosperous commercial city in Guangxi and the area considered, Luxu Zhen, is next to Binyang City. The tones are listed in Figure 15. The Upper and Lower

[2]There is a remote possibility that this could be due to dialectal interference on the part of the informant, who spoke Cantonese, Mandarin, and English, as well as several other Chinese dialects. According to A. Yue, the subject spoke these varieties with a Tengxian accent; presumably if there is any interference, the main direction of influence was that of Tengxian on Cantonese, not vice versa.

Departing tones have merged into a single Departing tone. The Upper Entering tone in Binyang has split in the same way as Cantonese. The high tone occurs with lax vowels, the mid with tense vowels, as in the following word pair.

[c'êp 5] "suck" [t^ha:p 3] "pagoda"

In addition, judging from the transcription Tsuji uses, tense vowels are longer than lax vowels as well.

	Even	Ascending	Departing	Entering
Upper	25	44	52	5
				3
Lower	13	22		1

Figure 15: Binyang tones (Tsuji 1980).

Cenxi

Cenxi is located south of Tengxian in southeastern Guangxi along the boundary between Guangxi and Guangdong. It is one of the older Chinese settlements in the Beilu River valley. Its tones are listed in Figure 16. In Cenxi, there is a tone split in the Upper Entering, but the pattern is unknown or not stated in Tsuji.

	Even	Ascending	Departing	Entering
Upper	52	35	44	5 34
Lower	21	12	22	2

Figure 16: Cenxi tones (Tsuji 1980).

Bobai

Bobai is situated in southeast Guangxi, near the coast of the Gulf of Tonkin. The best known source on Bobai is Li Wang (1932), whose description has been said by some to be of a variety heavily influenced by Hakka, and a brief description in McCoy (1966). As the full tonal inventory in Figure 17 shows, Bobai underwent a split in both the Upper Entering and Lower Entering. Within the Upper Entering tone, the low [1] tone occurs with long vowels. Within the Lower Entering tone, the high [4] tone occurs with long vowels. Presumably, the other Entering tones occur elsewhere, that is, with diphthongs, long vowels and short vowels, which would mean that the distribution is not complementary.

	Even	Ascending	Departing	Entering
Upper	44	33	32	54 1
Lower	23	45	21	4 32

Figure 17: Bobai tones (Wang 1932, cited in Wong 1982).

Nanning (Pinghua)

The variety of Nanning under consideration is Nanning Pinghua, the local vernacular. Nanning is the capital city of Guangxi, located in the central part of the province. The tones of Nanning are listed in Figure 18. No split occurred in the Upper Entering category, but there is a split in the Lower Entering, based on the initial consonant. A low rising tone [24] occurs with sonorant (glide, nasal, liquid) initials; a low level tone [22], with the other initials. Tsuji does not give a historical reason for the distribution, but the situation is parallel in some respects to the occurrence of sonorant initials in Upper register forms in Cantonese. More information is necessary before the actual reason can be determined.

	Even	Ascending	Departing	Entering
Upper	52	44	55	4
Lower	21	24	22	24
				2

Figure 18: Nanning Pinghua tones (Tsuji 1980).

Dialects with no split

Several Yue dialects show no split in either Entering tone. All but one are spoken in Guangxi. Examples are Rongxian, located in the Beilu River valley, southeast of Cangwu; Yulin, spoken by the upper stream of the Nanliu River; Shinan, formerly known as Xingye, northwest of Yulin; Cangwu, in the Lung Xu area, considered the "gateway" of Guangxi province, located by the border; and Sihe, a small village south of Cangwu. The cities or districts where these dialects are primarily spoken are those which are clustered around southeast Guangxi near the Guangxi/Guangdong border, with the exception of Cenxi. The map in Figure 19 shows the locations of the major cities and districts where these Yue dialects are spoken. The dialects in which one of the Entering tones split are indicated as well.

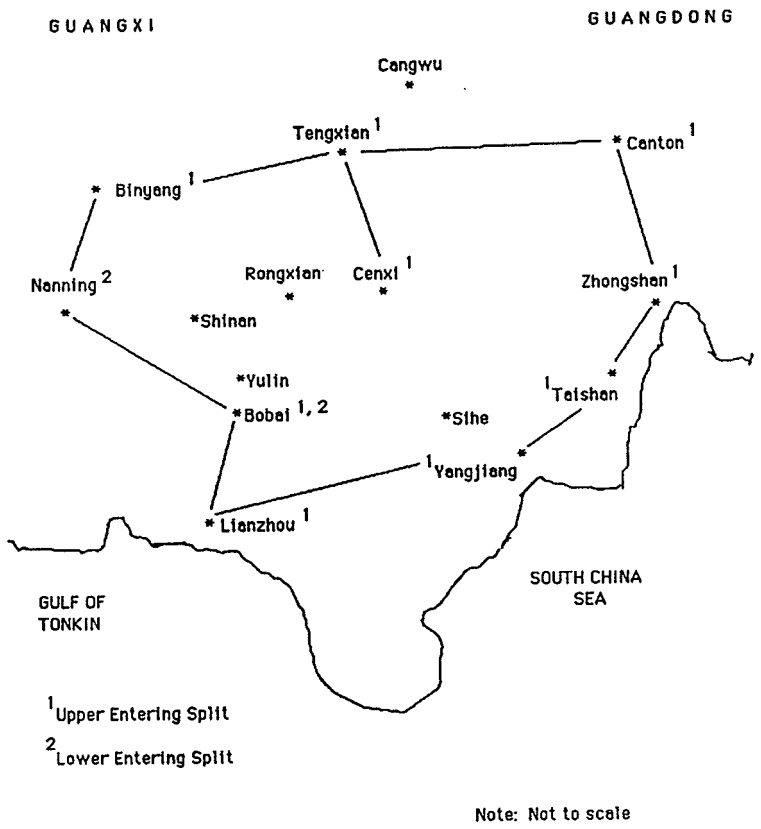

Figure 19: Locations of the Yue dialects with respect to the Upper Entering and Lower Entering tone splits.

The Upper Entering tone split as an innovation

The split of the Upper Entering tone must have been a shared innovation in Yue. Given the lack of phonetic plausibility for tonal splits based on vowels and the fact that this interaction does not occur in other Chinese dialect groups, it is highly unlikely to be the result of independent innovations on the part of each dialect. The question is how they came to be shared. One possibility is dialect borrowing; under this scheme, the tonal split originated in one dialect, then spread to other Yue dialects. Another, simpler scenario is inheritance from the ancestor language.

In an examination of twenty-seven Yue dialects, Oi-kan Yue (1976) found that the Upper Entering tone had split in all of them. She does not reconstruct the tonal split for PY, noting only that the split must have occurred in PY, before the dialectal differentiation, with the result that all Yue dialects known at the time inherited the feature (1976: 48). Apparently, there was not enough evidence to date the Upper Entering split to Pre-PY. Oi-kan Yue also commented at the time that the split in the Lower Entering tone in Bobai must have been an innovation within the Yue dialects, having taken place in one dialect alone. However, we now know that the Upper Entering split did not occur in all Yue dialects, and that there is at least a second dialect which underwent a split in the Lower Entering.

However, these findings do not refute the timing of the tonal split to PY. As Figure 19 shows, the dialects which presently do not have the tonal split are currently spoken in areas that are interior to the Yue speaking area. They form a line, going north to south, near the Guangxi-Guangdong border. The dialects which have the tonal split

are spoken outside of the non-splitting dialects, in locations that are along the periphery of the Yue dialect area. This geographical distribution suggests that the Upper Entering tonal split was indeed an old PY development. The dialects in which the Upper Entering tone has split are conservative, in the sense that they preserve a PY feature. The dialects in which there is no split might have been innovative in that they underwent a merger of the high and mid tones, thus "undoing" the split. What we should consider next is whether there is any independent evidence that there were two Upper Entering tones. Admittedly, there is no evidence for any merger of the earlier split based on their current tonal inventories; the tonal inventories of these dialects is similar to those in the dialects in which there is a split. And to my knowledge, no non-Yue varieties could have influenced these dialects. Also, it is not clear why Cangwu, which is located along the periphery, does not have a split.

The less common Lower Entering tone split is most likely a later development, present in at least two dialects that we know of. It is difficult, though, to see how they could be shared features; both Bobai and Nanning Pinghua are spoken in Guangxi, but not particularly close to one another, at least in the current locations. In addition, the conditions for the split are very different. Dialect borrowing could be at work here, but there are several dialects spoken in closer proximity to Nanning where there are no splits in the Lower Entering tone.

Based on the comparative data from various Yue dialects, the split of the Upper Entering tone is clearly a shared innovation within Chinese. The nature of the innovation will become clearer in the second part of this discussion, which provides a historical

account for the split. The first part provides a brief account of the phonological development of Chinese, from its earliest known stages to PY. The second portion reviews the development of the Cantonese Upper Entering tone finals from Middle Chinese rhymes as the clearest surviving relic of a Middle Chinese distinction of what is translated as an "inner" versus "outer" distinction in the rhyme groups.

Historical development of the Upper Entering tones

Pre-Modern Chinese

The period preceding Modern Chinese is traditionally divided into three stages. Very little is known about the earliest stage, Proto-Chinese, dated pre-1000 B.C. The next period, Old Chinese, or "Archaic" Chinese in Karlgren (1926), was spoken circa 1000 B.C. The main source of the phonology of Old Chinese is the *Shijing* (Classic book of poetry), a collection compiled in the sixth century B.C.

Middle Chinese, called "Ancient" Chinese in Karlgren (1926), was spoken between the third and twelfth centuries A.D. It is known to modern day scholars largely through the *Qieyun* rhyme dictionary, compiled by Lu Fayan in 601 A.D., only fragments of which survive. Some authors, such as Pulleyblank, distinguish between an Early Middle Chinese period, the late sixth century form represented in the *Qieyun*, and a Late Middle Chinese period, spoken during the late Tang to early Song dynasties, 9th-13th centuries A.D. Like other dictionaries of that time, it consisted of Chinese characters arranged by tone and rhyme. The pronunciation described was a reading pronunciation of each character. The current consensus view is that the variety described in the *Qieyun* was not

that of any particular region, but was a hybrid variety of a northern and southern dialect (Norman 1988, citing Zhou 1966). A later revision of the *Qieyun*, the *Guangyun*, was compiled in A.D. 1011; together with the *Qieyun*, it is a major source for the reconstruction of Middle Chinese.

Current accepted reconstructions of Middle Chinese are found in Pulleyblank (1962) and Li (1971). The reconstruction of Middle Chinese is not so much a comparative reconstruction based on modern Chinese languages, as it is a summary of the rhyme groups and a determination of the phonetic value of each Middle Chinese final. The reconstructions are based on the rhyme tables of the Song dynasty, A.D. 960-1279, which were an interpretation of the *Qieyun*; the earliest and best known set is the *Yunjing*.

Modern Chinese dialect groups

Li (1937) was the first to classify Chinese in terms of major "dialect" groups. "Dialects" is the traditional term used for these varieties. Most varietics are not mutually intelligible with one other; in this sense, they do not fit the traditional linguistic definition of dialects. Despite the spoken differences, all varieties use the same writing system, and the various speech communities share the same ethnic identity.

The current classification divides the dialects into seven groups, which are, in north to south order, Mandarin, Wu, Xiang, Gan, Min, Hakka (or Kejia, in Mandarin) and Yue (Norman 1988). The original criterion for the classification into dialect groups is the development of the Middle Chinese voiced obstruent initials. In Yue, these initials became voiceless aspirates in the Even tone and voiceless non-aspirates in the other tones.

There is an exception in the Ascending tone, which has both aspirated and non-aspirated initials. The differences among the dialect groups are not limited to phonological differences; there are also morphological and lexical differences as well, e.g. the development of the third person pronoun.

The Yue dialects are distinguished from the other dialect groups in other ways. Phonologically, the Yue dialects are, in some respects, conservative. Along with Hakka and Min, Yue retains Middle Chinese morpheme-final voiceless stops /p/, /t/, and /k/ and also final /m/. Most Yue dialects preserve the four Middle Chinese tones and have undergone the *Yin-Yang* register split, while in most other branches of Chinese, some of the tones have been lost. But Yue is innovative as well; for example, like most other dialect groups, Yue has lost the Middle Chinese voicing distinction in initial consonants. The existance of three and sometimes four Entering tones is a characteristic which Norman (1988) feels uniquely distinguishes Yue from the other dialect groups.

Historically speaking, the Yue dialects branched off from "mainstream" Chinese no later than the Tang dynasty, circa A.D. 618-907 (Cheng 1973). The movement of the Han people into the current Yue speaking areas began at a very early time; the earliest known migration took place in 218 B.C.

Sinologists describe the phonological development of Yue, Mandarin, Hakka, Gan, Xiang, and Wu using Middle Chinese as their ancestor language. The Min dialects preserve certain Old Chinese contrasts that were lost in Middle Chinese, and therefore must have branched off before the Middle Chinese period. In actuality, Middle Chinese is not the direct ancestor of any of these dialect groups. However, scholars use Middle

Chinese as a point of reference because it is highly convenient. From a theoretical standpoint, such a method is sound because early ancestral forms of each dialect group were likely to have been quite similar to Middle Chinese.

Tones in the history of Chinese

The history of Chinese provides evidence for both common and uncommon types of tonogenesis. Whether Chinese has always been a tone language is an open question. Norman (1988) cites evidence that Modern Chinese tone may have developed in a way that was similar to Vietnamese, where the tones are a complete innovation. There is some debate on whether Old Chinese had tone; some believe that Old Chinese had tones of the same type as Middle Chinese.

The exact timing of the first development of tones in Chinese is unclear. The earliest description of what is believed to be tone is dated from the fifth century A. D., and descriptions given in the *Qieyun* also indicate that tone was present by early Middle Chinese times (*sheng* "sound", which on the basis of modern reflexes is understood to mean "tone"). Four tone categories (*Sheng*) are cited in the *Qieyun*, each known traditionally by the Mandarin pronunciation of their names: *Ping* "Even", *Shang* "Ascending", *Qu* "Departing", and *Ru* "Entering". The names given to the tones are examples of morphemes which had those tones, and are not synchronically phonetically descriptive. No information is available on the exact phonetic values of the Middle Chinese tones.

Sometime after the Middle Chinese period a register split began to take place. Each of the four tones were split into two registers, Yin "Upper" and Yang "Lower". The Upper is generally matched with voiceless obstruent initials, the Lower with voiced obstruent initials. The development based on the initial sonorants is not as straightforward. For some tones, the sonorants behave like the voiced obstruents; for other tones, the sonorants behave like the voiceless obstruents.

Each tone category has developed in various ways within each dialect group. Some dialects, such as Mandarin, have lost the Entering tone category entirely. All of the Yue dialects studied so far have retained the Entering category, and in most cases have increased the number of Entering tones.

Middle Chinese

Historical categories

From a historical perspective, the sound changes that have occurred from one stage of Chinese to the next cannot be described in terms of isolated segments, but instead require reference to their phonetic context. Because the present study is concerned with finals to a much greater extent than initials, I will discuss only the development of the finals.

Historically, each final belongs to a particular rhyme group, or *she*, in Middle Chinese; there are a total of eighteen rhyme groups. The rhyme groups are further subdivided into rhymes. Some rhymes belong to the *Hekou*, or "closed mouth" set, while others belong to the *Kaikou*, or "open mouth" set. *Hekou* rhymes have a rounded medial,

while *Kaikou* rhymes do not. In addition to rhyme group, each final belongs to one of four divisions (*deng*), which in the modern tradition are designed by Roman numerals. The general consensus is that syllables in the third division had some kind of palatal medial, and syllables in the first did not have a palatal medial. There is wide speculation, however, on the exact nature of the other divisions.

A third category concerns what is termed an "inner" (*Neizhuan*) and "outer" (*Waizhuan*) series type, which is discussed in detail in a later section.

This section describes the development of the Upper Entering tone syllables in Cantonese in terms of the Middle Chinese rhyme groups. The discussion is based mainly on the analyses provided in Tsuji (1980). It is far beyond the goals of the present study to provide details of the various developments; rather, I will concentrate on the modern Cantonese reflexes within the Upper Entering tone forms.

A few points about the development of MC rhymes in Yue are in order. First, the Dang and Jiang groups have merged in the Yue dialects, as well as in most modern Chinese dialects. Therefore, scholars usually refer to these groups collectively as Dang/Jiang. In Cantonese, the Dang/Jiang syllables with an Entering tone have [k] endings.

A second type of merger was the fusion of Zeng with the literary layer of Geng in most Chinese dialects. It is in Geng, and only this group, that we see a split in some Yue dialects based on the literary-colloquial strata, as far as syllables with an ending stop consonant are concerned. This is seen in the reflexes of Zeng K-I (MC *êk) and Geng K-III (MC *Ak) classes, which became [ak] in Standard Cantonese; colloquial Geng is

maintained as [A:k]. In addition, Zeng K-III (MC *iêk) merged with Geng K-III, literary (MC *iAk) as [Ik]; literary Geng has [E:k]. Examples of Upper Entering syllables are the forms for "backbone" and "tin, pewter". Interestingly, the literary forms of these morphemes are exceptions to the vowel-tone interaction. Note though that not all literary forms are exceptions; "chop, split open" has the expected [55] tone in the literary pronunciation.

The inner-outer distinction

Over the centuries scholars have debated the phonetic nature of the "inner" and "outer" rhyme series. Not only was the basis not stated in the *Yunjing* and other sources, but there were some slight differences within the rhyme tables as far as the classification of the inner and outer series, differences which are likely to be due to dialectal differences. Hashimoto (1979) described how some scholars characterized the difference in terms of duration: that the inner rhymes had a "shorter, 'weaker' main vowel with a longer, 'stronger' ending", while "outer" rhymes had a "longer, 'stronger' main vowel and a shorter, 'weaker' ending" , where, "stronger" and "weaker" are probably meant in a phonological sense. Hashimoto characterizes the modern phonological characterization as that of tenseness ("outer") versus laxness ("inner").

It is currently thought that the inner-outer distinction was based on the height of the nuclear vowel. The MC outer rhymes had the low vowels *a, *ɑ—sometimes called open vowels—while the outer rhymes had the non-low vowels *ê, *i, *u, *y.

Some reflexes of the MC inner-outer distinction are seen in modern dialects. One example of how the MC inner-outer distinction is seen in modern Chinese is seen in Mandarin, where vowels in syllables from each series differs in phonological behavior. The outer series generally contain the "compact" vowel a, while the inner series contain "noncompact" vowels (M. Hashimoto 1979: 229-230). Finals containing noncompact vowels often undergo some type of reduction, while those with the compact vowel a are not reduced and are less readily affected by neighboring segments than finals with noncompact vowels.

The most clearcut example supporting the linguistic reality of such categories is the split of the Upper Entering tone in Cantonese. The Entering tone syllables occur in eight rhyme groups, which are listed below according to whether they are inner or outer.

Inner	Outer
Shen	Xian
Zhen[3]	Shan
Zeng	Dang/Jiang
Geng (literary)	Geng (colloquial)
Tong	

It is clear from Chapter II that the interaction between tone and vowel in Cantonese is connected with a tone split. In terms of historical development, the finals in Cantonese are in complementary distribution with respect to the high and mid Upper Entering tones.

[3]Zhen is categorized as "outer" in the *Yunjing*, but as "inner" in Pulleyblank (1984: 105-106). Dang is categorized as "inner" in the *Yunjing*, but as "outer" by Pulleyblank.

The distribution of each final in Standard Cantonese, along with its rhyme group, is summarized in the following.

High Entering		Mid Entering	
[ap]	Shen	[A:p]	Xian
[Øt]	Zhen	[i:p]	Xian
[at]	Zhen	[A:t]	Shan
[ak]	Zeng, literary Geng	[i:t]	Shan
[Ik]	Zeng, literary Geng	[u:t]	Shan
[Uk]	Tong	[y:t]	Shan
		[O:t]	Shan
		[A:k]	Zeng, Geng
		[E:k]	Geng
		[oe:k]	Dang/Jiang
		[O:k]	Dang/Jiang

Historically speaking, the development was as follows for Standard Cantonese. In the As a result of the partial merger of Zeng and Geng, the Cantonese finals [ak], [A:k] and [Ik] are synchronically ambiguous as far as rhyme group. For example, [sIk 55] "color" belongs to Zeng, while [sIk 55] "former, ancient" belongs to Geng. Since Zeng is "inner" and Geng is "outer", this seems on the surface to contradict the split according to type of rhyme group. However, literary Geng is "inner", suggested by the high tone, because it is known to have merged with the inner Zeng group by PY times. Thus, with the exception of [Ik, ak, A:k], the three finals which are at first glance ambiguous, it is easy

Table 5: Cantonese short vowel syllables and their rhyme groups.

Cantonese		PY		MC	Rhyme group
[ap]	<	*iêp	<	*iêp	Shen
[ap]	<	*êp	<	*ap	Xian
[Øt]	<	*iêt	<	*yêt	Zhen
	<	*wêt	<	*iuét	Zhen
[at]	<	*êt	<	*êt	Zhen
[at]	<	*iêt	<	*iêt	Zhen
[ak]	<	*ak	<	*êk	Zeng
[ak]	<	*ak	<	*Ak	Geng
		(literary layer; [A:k] in colloquial)			
[Ik]	<	*ik	<	*iAk	Geng
		(literary layer; [E:k] in colloquial, from PY *iêk)			
[Ik]	<	*ik	<	*îêk	Zeng

to determine the rhyme group of the final by considering its vowel duration. The short finals historically come from the inner rhyme groups. The long finals historically are derived from the outer rhyme groups. In terms of tone, the high Upper Entering tone occurs with finals from the inner groups; the mid Upper Entering tone occurs with finals from the outer groups.

Historical development of Upper Entering tones in Taishan

The development of the Upper Entering in Taishan can be explained in terms of the same diachronic development as Cantonese, i.e. in terms of the Middle Chinese rhyme groups. The discussion and examples that follows are taken from Oi-kan Yue (1976). As stated earlier, the distribution is not complementary, as seen below. The finals that can occur with the high Upper Entering only are all from the inner groups Zhen, Shen, and Tong. For the outer groups, the situation is somewhat complex. The finals that can

Table 6: Cantonese long vowel syllables and their rhyme groups.

Cantonese	PY	MC	Rhyme group
[A:p] <	*ap <	*ap	Xian
[A:t] <	*op <	*iwAp	Xian
[A:t] <	*at <	*at	Shan
[A:t] <	*at <	*at	Shan
[A:t] <	*at <	*iwEt	Shan
[i:p] <	*iap <	*iep	Xian
[i:t] <	*iat <	*iet	Shan
[u:t] <	*wot <	*uat	Shan
[y:t] <	*ut <	*uat	Shan
[y:t] <	*iut <	*iwEt	Shan
[O:t] <	*ot <	*at	Shan
[(u)A:k]<	*wak <	wêk	Zeng
[A:k] <	*ak <	*Ak	Geng
	colloquial layer; literary is [ak]		
[E:k] <	*iêk <	*iAk	Geng
	colloquial; [Ik] is literary, from PY *ik		
[oe:k] <	*ok <	O:k	Dang/Jiang
[O:k] <	*ok <	*ak	Dang/Jiang

occur with the mid Upper Entering tone only are all from the outer groups Dang/Jiang and Shan. The remaining finals occur with both Upper Entering tones, and they come from the outer rhyme groups Xian, Shan, Zhen, Zeng and Geng.

High only	Mid only	High or Mid
[it] (Zhen)	[Ot] (Shan)	[ap] (Xian)
[ip] (Shen)	[Ok] (Dang/Jiang)	[at] (Shan)
[ouk] (Tong)	[iak] (Dang/Jiang)	[ak] (Zeng, Geng)
		[iap] (Xian)
		[eik] (Zeng, Geng, Shan)
		[ut] (Zhen, Shan)

In addition, three of the finals have synchronically ambiguous origins which involve an inner and outer group: [ut], which can be from Zhen or Shan; [ak], which can be from Zeng or Geng; and [eik], which can be from Zeng, Geng or Shan. The rhyme group is synchronically reflected in the tone. The [ut] final that belongs to Chen has the high Entering tone only; the [ut] final that belongs to Shan has either high or mid Entering. Examples are as follows:

[lhut 55] (Zhen) "11th earthly branch"

[lhut 33] or [55] (Shan) "snow"

The [ak] final that comes from Zeng has high tone; the [ak] that comes from Geng has either high or mid tone. At first glance, it appears that the Zeng and Geng merger had not yet occurred at the time of the tone split. Example:

[pak 55] (Zeng) "north"

[pak 33] or [55] (Geng) "hundred"

The [eik] final that comes from Zeng or Geng has only the high tone, suggesting that the two groups did merge, at least for the division that [eik] belongs to. The [eik]

that comes from Shan has both high and mid. Examples are as follows:

[teik] 55 (Zeng)	"immediately"
[teik] 55 (Geng)	"accumulate"
[keik] 33 (Shan)	"bear fruit"
[keik] 55 (Shan)	"to tie"

The generalization is that the finals that belonged to the "outer" category have both tones; those from the "inner" category have only the high tone. However, for the "ambiguous" outer finals, it is usually not the case that high and mid tone are used in free variation for a particular morpheme. Certain finals occur with only mid tone; some morphemes bear either high or mid, but with a difference in meaning that is sometimes associated with the colloquial-literary distinction.

Therefore, as Oi-kan Yue (1976) argues, in earlier stages of Taishan the outer finals had the mid Upper Entering tone only. Then, after some rhyme groups merged, there came to be a mixture of tones as well. The split of the Upper Entering tone in Taishan ultimately developed from the same pattern as that of Standard Cantonese.

Oi-kan Yue provides a parallel argument for Lianzhou, spoken in southwestern Guangdong near the coast of southern Guangxi. This dialect has also undergone a split in the Upper Entering tone[4]. Oi-kan Yue (1976) argues that Cantonese, Taishan and

[4]For another perspective, see Wang (1990)'s description of Lianzhou, in which there are four Entering tones in symmetry with four non-Entering tones (Wang, Zongmeng. 1990. Lianzhou-hua cihui dicengde yuynin fenxi (Deep structure of phonetic analysis of the vocabulary of Lianzhou speech. In *A Collection of Thesis* [sic] *from the Second International Conference on Yue Dialects*, Bohui Zhan, ed., pp. 124-130. Guangzhou: Jinan University Press.)

Lianzhou represent different stages in the development of the split.

The historical nature of the change

The Upper Entering tonal split exhibited in most modern Yue dialects is clearly clearly not a characteristic inherited from Middle Chinese, but is an innovation within Yue. The innovation occurred in Proto-Yue, and the conditions for the split differ within the dialects; the tonal split for Standard Cantonese is the most clearly seen, and is the easiest to describe. The Upper Entering tone split for the major Yue dialects ultimately derive from the same MC source, the distinction between inner and outer rhyme groups. Thus, as many authors such as McCoy (1966) have surmised, it is descended from a MC vowel height distinction. In modern Cantonese, the inner and outer rhymes have shifted (as described in Chen and Newman 1984), with the result that vowel height is not a synchronic conditioning factor. We have a fairly clear historical account of the phenomenon; the next question is whether there is a plausible phonetic explanation for this development, one which is addressed in the next chapter.

CHAPTER IV

TONE-SEGMENT INTERACTIONS, TONAL DEVELOPMENTS, AND THEIR PHONETIC EFFECTS

Introduction

Ideally, proposed explanations for sound change should be based on phonetically natural conditions. That is to say, there must be, as much as possible, a relationship between historical and phonetic facts, particularly in the case of a sound change that occurs in many unrelated languages. The same can be said for tone changes as well. Explanations of the development of tone, including the tonal split under consideration here, should be consistent with our understanding of pitch, fundamental frequency and variations in fundamental frequency according to phonetic context.

This chapter discusses these explanations in some detail. The inspiration for this examination is Hombert, Ohala, and Ewan's (1979) investigation of the phonetic rationales underlying tonogenesis. Hombert et al. make it clear that explanations for particular types of tonogenesis that are common across languages must have a phonetic explanation based on the structure that is universal and invariant to all humans, namely the vocal tract. I will discuss the phenomena found in the tone languages, then describe the phonetic effects, or, where appropriate, the lack of phonetic effects.

Segmental effects on fundamental frequency

Tone involves both fundamental frequency (F0) and pitch. F0 is the rate at which the vocal folds vibrate; pitch is the way in which the ear perceives differences in fundamental frequency. F0 is an acoustic phenomenon, whereas pitch is a psychological phenomenon. Thus, the terms F0 and pitch are not truly interchangeable, and I will use the term that is appropriate to the context. However, what is true about F0 is usually also true about pitch, in that an increase (or decrease) in F0 generally corresponds to an increase (or decrease) in pitch, even though the relationship between the two is not linear, particularly at higher F0 frequencies.

Vowels have intrinsic fundamental frequency, which is the tendency for high vowels such as [i] to have higher F0 than low(er) vowels such as [a]. In the second part of this chapter I will provide a more detailed discussion of the various explanations for variation in intrinsic fundamental frequency. In examining F0, not only must intrinsic F0 be considered, but also possible effects of adjacent consonants, particularly prevocalic consonants. Not by coincidence, the most common explanations for the development of tones in many languages have involved properties of neighboring consonants and their effects. These effects, and the languages which have developed tones based on these effects, are discussed in more detail below.

Effects of prevocalic consonants

Voicing

One particular type of tonogenesis is evident from examinations of many unrelated tonal languages. Certain tones have been shown to originate as a means of compensation for the loss of a voicing contrast which had earlier distinguished different words. In Vietnamese, syllables beginning with voiced consonants were pronounced with low pitch; syllables beginning with voiceless consonants were pronounced with high pitch, as shown in stage 1. The distinction between voiced and voiceless consonants in prevocalic position was lost and the differences in pitch became crucial in distinguishing those words, as shown in stage 2. As a result, words with an earlier initial voiced consonant carry low tone; the words with an earlier initial voiceless consonant carry high tone. Haudricourt (1954) and others characterize this as a change in register.

		Stage 1		Stage 2
pa	>	pá	>	pá
ba	>	bà	>	pà

Experimental evidence

According to Hombert et al., proposed explanations for the development of tones should be supported by acoustic and/or articulatory evidence. The development according to the voicing of the prevocalic consonant meets this criterion, as it is well-motivated empirically. Numerous instrumental studies have shown that prevocalic consonants cause perturbations in F0 after the onset of the vowel, resulting in an overall change in the F0.

F0 is higher after a voiceless stop than after a voiced stop. In Lehiste and Peterson's (1961) study of English, vowels following [p] were on average 10 Hz higher than those following [b]. Similar results occurred with [t]/[d] and [k]/[g], with F0 after the prevocalic voiceless an average of 13 Hz higher.

Although the acoustic effect of prevocalic voiceless/voiced consonants on F0 is well-established, the articulatory mechanisms by which these effects arise are not completely understood. There have been three major hypotheses which attempt to explain these effects. While there are studies that support two of these hypotheses, there are also inconsistent, sometimes contradictory results from other investigations.

One explanation, known as the aerodynamic hypothesis, centers on the pressure drop across the vocal folds and the rate of airflow. After a voiceless stop, there is a relatively higher airflow after the release, which results in a higher than normal Bernoulli force. The Bernoulli force then draws the vocal folds together more quickly, which in turn increases F0. During the production of a voiced stop, the oral pressure builds up, resulting in a decrease in transglottal pressure and, thus, lowering F0.

The main problem with the aerodynamic hypothesis is the duration of the effects. Hombert et al. found that modifications of F0 due to consonantal voicing can last until at least 100 msec. into the acoustic period of the following vowel. But the aerodynamic effects of voicing last for a much shorter time; for voiced stops, the perturbation due to lowering of glottal pressure lasts for 10-15 msec. after the consonantal release. The aerodynamic hypothesis does not provide a complete account of the raising and lowering effects. Moreover, the Bernoulli effect is weak and is now known to have a minimal

effect on voicing.

A second hypothesis concerns vocal fold tension. Halle and Stevens (1971) proposed a model based on the assumption that the slackness or stiffness of the vocal folds plays an important role in making voicing distinctions. The vocal folds are slack during voiced stops, the idea being that slackness facilitates vibration. In slackening, the range of glottal openings is wider, and the transglottal pressure is lower than for voiceless. The effect of the slackness spreads to nearby vowels. Since vibration decreases with slackness, F0 is lowered. Stiffness, on the other hand, inhibits vibration, and so the vocal folds would be expected to be made stiff during voiceless stops. The range of glottal openings is narrower, and the transglottal pressure is higher. Since vocal fold vibration increases with stiffness, the F0 of neighboring vowels is raised.

However, there has been little experimental evidence supporting Halle and Stevens' model. Hombert et al. cite a lack of results from EMG studies for any corresponding increased activity in the cricothyroid muscle, which has a longitudinal effect on the vocal folds. In addition, the model predicts that preceding vowels would be affected as well, a type of tonogenesis that is rare, as will be discussed later.

The third hypothesis focuses on the vertical position of the larynx and vocal fold tension. There is a general tendency for larynx height and F0 to be directly related, i.e. the higher or lower the position of the larynx is, the higher or lower, respectively, the F0 is. In the production of voiced oral consonants, the larynx is lowered. The lowering increases supraglottal volume in the oral cavity and helps maintain the transglottal decrease in pressure that is necessary for voicing. The largest difference in laryngeal

height occurs near the end of the consonant closure. The effect of the height difference is carried over into the following vowel, thereby lowering the vowel's F0.

This explanation, if correct, would account for F0 variation of postconsonantal vowels, and would not account for the effects, if any, on preceding vowels. Therefore the vertical position view may indirectly explain why, compared with prevocalic consonants, cases of tonogenesis based on postvocalic consonants are less frequent.

Yet there are problems for the vertical position hypothesis as well. Some studies which supported this explanation did not account for effects of other consonant types on F0. In Peterson's study on Danish (1983), the F0 of a nasal and the following vowel is similar to that following a voiced consonant, i.e. is lower. Yet for nasals the larynx is raised, although there is no physiological reason to do so. Furthermore, Peterson found that F0 is higher after aspirated consonants, but there was no consistent difference in laryngeal height. As an additional point, in the same study there were height differences based on place of articulation, e.g. the larynx was higher for alveolars compared with labials—but no corresponding difference in F0.

In summary, no single hypothesis has best accounted for the effects of prevocalic voicing on F0. It may turn out to be a combination of some or all of the above mentioned factors. Part of the difficulty in finding the best explanation is that the general assumption is that all other things are equal, but in actuality they are not. At any rate, it is not crucial to the present study to know exactly how it happens; it is enough to know that this effect happens consistently across languages and that there is some degree of phonetic grounds for such an effect.

Further evidence

In addition to having articulatory and/or acoustic explanations, developments that could result in new tones must be universal in two ways, according to Hombert et al.'s criteria. First, they must be well-attested across many unrelated languages. The development described above was not limited to Vietnamese, but occurred in other Asian languages, such as Chinese, and in African languages such as Hottentot. As discussed earlier, the Yin-Yang register split of the Middle Chinese tonal categories, which is well preserved in Standard Cantonese, arises from a prevocalic voicing distinction. In addition, the same phenomenon must be observable even in languages that do not use tone. The effects of prevocalic voicing have been found to occur in languages such as English.

Hombert et al. also say that for tonal development that is articulatorily motivated, the pitch differences that are a part of the lexical tones under examination must on some level be perceptible to listeners. Several studies bear this out. In experiments reported in Haggard et al. (1970), subjects identified synthesized tokens as pea when the vowel began with a high falling pitch and as bee when the vowel began with a low rising pitch.

Hombert et al. describe a study of their own in which tokens consisting of varying F0 patterns of the vowel [i] were synthesized. Half of the tokens had a rising contour at the onset of the vowel, the other half had a falling contour. Native English speakers were able to perceive differences in the onset when the onset slope was at least 60 msec. long. On the basis of this, Hombert et al. conclude that consonant-induced changes in F0 are indeed perceptible.

Other prevocalic consonant types

The effect of other consonant types on F0 has been much less extensively studied than that for voicing. Generally, implosives raise the F0 of a following vowel; likewise with aspiration. Breathy voiced consonants tend to lower F0. They are characterized by a high airflow after release, with the vocal folds not closely adducted; thus, the Bernoulli force is weak. The subglottal pressure is lower, too, resulting in lower F0. Aside from these cases, no other consonant types have been known cross-linguistically to be a conditioning factor in F0 effects, although unusual examples do occur. Henderson (1982) cites a case involving prevocalic /r/ as the second member of consonant cluster (Noss 1966), where rising tone appears in the sequence #CrV-. There is a minimal pair in the form [cri:êng] > [cí:êng] "to sing", [ce:êng] > [ci:êng] "artisan".

Effects of postvocalic consonants

Glottals

In some languages new tones have developed due to the influence of postvocalic glottal consonants. There are numerous cases of a high or rising tone developing in syllables with a glottal stop coda. The phonetic reasoning for this is that the glottal closure is produced with a tensing of the vocal folds. Examples of tones arising from postvocalic [ʔ] are the high or rising tone in Burmese; the Rising tone in Middle Chinese; and the high rising tone in Lahu (Norman 1988). Chan 1989 cites a study by Tai (1968) in which a Min dialect, Yongcun, has undergone a split in the Lower Entering tone in which syllables ending in oral stops [p, t, k] have a rising [24] tone, while syllables

ending in glottal stop have a short [5] tone.

Yet the opposite development is also possible. Several examples have been cited in the literature; recently Thurgood (1992) describes Utset, a Chamic language spoken in Hainan, as having developed a falling tone before glottal stop. Some morphemes ending in a Proto-Chamic stop, including -*?, have a [?] ending in Utset. These morphemes have developed a high falling tone, as seen in forms such as *je? >se? 53 "near; about to" and *do:k > tho? 53 "live; stay; sit". Morphemes which lose the final stop altogether have a 35 tone. Hombert et al. also mention a similar development in Mohawk.

The development of low or falling tone also has a phonetic explanation. In a glottal stop, the closure shortens the vocal folds, making them thicker. This can lead to accompanying creaky voice, or laryngealization, which is associated with decreasing F0. In some respects, the development of low or falling tone in this context has an articulatory motivation equal to that for the development of high or rising tone. Nonetheless, the development of a low or falling tone is much less common.

The influence of [?] is generally postvocalic, but there are a few cases of apparent prevocalic influence. Burling (1959) describes a synchronic morphophonemic rule in Kachari (Bodo), a Tibeto-Burman language, in which [?] is deleted syllable-finally in the first syllable of a disyllabic word, with the second syllable taking on high pitch. If the first syllable ends with a non-glottal stop, the second syllable has low pitch.

In addition to the context of glottal stop, tones can also develop in syllables with a postvocalic glottal fricative, though this is less commonly attested. A following glottal fricative generally results in a low or falling tone, as seen in the falling Departing tone

in Middle Chinese and in Vietnamese (Norman 1988). The assumption is that the vocal folds are relaxed somewhat for the final [h]. Haudricourt and others characterize such development before glottal consonants as contour changes.

There is both acoustic and perceptual evidence from non-tonal languages to back up these tonal developments. In an investigation of Arabic speakers, Hombert found that F0 increased in a range from 9 to 48 Hz before [?] and decreased in a range from 25 to 50 Hz before [h]. Using synthesized tokens presented to English speakers, Hombert found that differences as small as +10 Hz before [?] and -10 Hz before [h] were perceptually salient.

Voicing and other consonant types

There is doubt as to whether the voicing of postvocalic consonants affects F0 and consequently plays a role in tonogenesis. Maran (1971) claims that in the southern dialects of Jingpho, which is closely related to Burmese, high tones appear in words which earlier had ended in a voiceless consonant, low tones in words which earlier had ended in a voiced consonant. Mid tones appeared in words which did not end in a consonant. Matisoff (1973), however, disagrees, saying that there is no evidence for the presence of underlying voiced consonants in contemporary Jingpho or in Tibeto-Burman. Hock (1986) also mentions that postvocalic voicing affected F0 in Polynesian Kate.

Unlike prevocalic consonants, the voicing of postvocalic consonants has not been shown to have a statistically significant effect on F0. Some studies such as Jeel (1975) found no difference at all based on postvocalic voicing. Hombert et al. suggest a possible

situation in which voicing could play a role, where the duration of the vowel is affected. Vowels are longer before voiced consonants than before voiceless. I will return to this point later.

Generally, tones have not developed based on postvocalic non-glottal consonants. There is, however, the unusual case of Panjabi, where "high" tones, which are phonetically rising-falling tones, have developed before breathy voiced consonants.

Contrary developments and their explanations

Given the universal effects of such tonal developments, we might expect tones to develop in an identical manner across languages. However, there are cases where the tones are contrary to the expected pattern, situations sometimes referred to as tonal "flip-flops", as discussed for Chinese by Yue-Hashimoto (1986). Some tone languages have synchronically high(er) tones in syllables having originally voiced initials, and low(er) tones in syllables having originally voiceless initials.

For example, the Yin-Yang register distinctions in certain Chinese languages run contrary to the expected pattern. In many Hakka and Min dialects, and in a few scattered varieties within other Chinese dialect groups, some Yang tones, which occurred with earlier voiced initials, have a higher pitch than the Yin tones, which occurred with voiceless initials.

In cases like this, especially for a firmly established pattern such as that for voicing, another explanation is possible. Perhaps the contrast was not actually voiced/voiceless, but of another type. What is thought to be a prevocalic voiced

consonant might have been some other type of consonant, or developed as another type of consonant, e.g. what was originally voiced could have become an implosive, as Hombert et al. suggest. Another possibility is that the tones or registers did develop according to the expected pattern, but that some change happened along the way which caused one of the tones to shift.

Tone sandhi phenomena sometimes provides a clue (Yue-Hashimoto 1986). Chan (1989) argues that for Chinese dialects which have abundant tone sandhi, which include Hakka and Min, the citation tones are not always the same as the underlying tones. The usual effect of tone sandhi is to neutralize distinctions found in non-sandhi contexts; however, for certain tones in Min the result of the sandhi is an increase in the number of distinctions. Hence, the sandhi form should be analyzed as underlying. M. Hashimoto (1986) analyzed the sandhi forms of the Entering tones in some Min dialects as the basic tones; this results in the normal pattern of Yin tone having higher pitch than Yang tone.

Likewise, the so-called "Great Tone Split" in Thai developed in the reverse order. In Central Thai dialects, where the development is clearest, earlier voiced initial consonants have given rise to higher tones, as in */bi:/ > /phi:/ "to be fat", with mid tone; earlier voiceless initial consonants have given rise to tones with a lower pitch, as in */phi:/ > /phi:/ "ghost", with low rising tone (Rischel 1986). Various proposals have been put forth for the causes of the reverse development, among them the effects of secondary articulation; a perceptual reinterpretation of the tones; and adjustments in phonological space. However, according to Rischel, none are adequate for lack of independent evidence.

Nonetheless, it is beyond the purpose of the present investigation to attempt to explain such tonal flip-flops, although they must be considered at some point for a complete understanding of tonogenesis. An additional unusual case of tonal development, involving vowels, will be discussed in detail later.

Vowels

Vowel quality

As stated earlier, vowels have intrinsic fundamental frequency which I will abbreviate as IF0. Steele (1985) describes two major explanations for intrinsic fundamental frequency, both of which are still under debate. One view is known as the acoustic coupling theory. There is an inverse relationship between the first formant (F1) and F0 in that as F1 decreases, F0 increases. The assumption is that there is an acoustic interaction between F1 and F0 which becomes stronger as the values of F1 and F0 become closer. Higher vowels have a higher F0 because F1 is sufficiently close enough to F0 that it attracts F0 and raises it.

The second explanation, an articulatorily based one, is known as the tongue pull theory. For high vowels, the tongue body is higher than for low vowels, and there is a resulting greater pull on the larynx. The pulling force results in an increase in vocal fold tension and, thus, higher F0. This view should also work for consonants as well (Ohala 1973). F0 would be raised after palatals and velars, which also involve raising the tongue body. But there are no consistent results for F0 increasing after "high" consonants.

Tone affecting vowel quality

Several studies have noted an apparent interaction between tone and vowel height in some tone languages, many of which involve synchronic phonological rules. In Mandarin, there is a low level rule in which the finals of some syllables are pronounced with lower vowel height in falling tones, i.e. lowering tones (Yue 1976: 47). The syllable /iêu/ (ê represents schwa) is pronounced [iou] in Mandarin Tones 3 and 4, which are falling-rising and high falling respectively. It is pronounced [iu] in Tones 1 and 2, which are high level and low rising respectively. Another Chinese language in which vowel height and tone interact is Fuzhou, a Min dialect. Fuzhou has a tone sandhi rule in which high tones have a raising effect on vowels (Chan 1985). In both situations the tones have apparently affected the vowels.

Vowel quality affecting tone

There have been few cases in which vowel quality has been shown to affect tone. Synchronically, Pilszczikowa-Chodak (1972) proposed a tone assignment rule in Hausa in which there is a direct relationship between vowel height and tone. In the final vowels of certain verbal endings and noun plurals, [+high] tones are assigned to [+high] vowels, [-high] tones to [-high] vowels. Pilszczikowa-Chodak does not offer any guess as to the direction of the change, whether the tones affected the vowels or the vowels affected the tones, but only notes that there is a pattern. Even so, Pilszczikowa-Chodak's analysis has not been widely accepted by Hausa scholars; see Newman 1975 for counterarguments, and Pilszczikowa-Chodak (1975)'s response to Newman.

Other aspects of vowel quality are believed to interact with tone. Lugbara, a Moru-Madi language spoken in Zaire and Sudan, is said to have a tone raising rule in the final vowel of verbal stems in which a high tone becomes "extra high" on a vowel that has the feature [+ Advanced Tongue Root] (Andersen 1986).

With the exception of the Hausa case, there appears to be no question that tone and vowel quality can interact. In these examples, it is clear (or assumed) that tone has affected vowel height. What is relevant for the present study is whether there are cases where vowel height has given rise to new tones, or, at the least, has affected the tones of a language in some way. If vowels have intrinsic differences in fundamental frequency and pitch, one would expect to encounter development of tones based on vowel height. High tones would develop from, or occur only with, high vowels, and the same would be true for low tones and low vowels. However, there is no established case of such development in the languages of the world.

If this type of tonogenesis exists at all, it is rare, especially when compared with consonantal tonogenesis. Hombert et al. suggest two reasons why this is the case. One reason may be due to the relative ease with which such differences in F0 can be perceived. Consonant-induced F0 modifications are abrupt and dynamic; after a voiceless obstruent, the F0 starts out very high and drops slightly. F0 differences due to vowel height, on the other hand, are uniform. Perhaps the ear perceives quick, steep differences more easily than level differences, and these differences are more likely to be reinterpreted as tonal contrasts.

The second possibility concerns the timing of the F0 perturbation and the conditioning factor. For prevocalic consonants, the F0 perturbation occurs after the acoustic offset of the consonant. For vowels, the F0 difference is simultaneous with the acoustic period of the vowel. It may be more difficult for listeners to perceive F0 differences when they are present at the same time as the triggers for those differences.

In addition to these two explanations, there may be other perceptual factors in pitch besides vowel height. Endo (1991) reported that in a perceptual investigation in which high and low vowels were synthesized with the same F0, the low vowels were heard as having higher pitch than the high vowels.

Duration

In addition to the above interactions between tone and vowel quality, there are also interactions between tone and vowel duration which have not received a great deal of attention. Gandour (1977: 60) in his discussion of tone and vowel duration in Thai observed that, cross-linguistically, "[o]ther factors being equal, . . . vowels (syllables) on low tones are longer than those on high tones" and that "vowel (syllable) duration is inversely related to the approximate average fundamental frequency." He provides several studies which support this observation; among them is Gill (1960), who noted that in Panjabi, the duration of the tones are in the order low > mid > high. It is not clear, though, whether Gill is describing vowel duration or syllable duration.

Duration affecting tone

Work done on Swedish by Erikson and Alstermark (1972) and later Bannert and Bredvad-Jensen (1975) examined the effects of vowel duration on the F0 contour in stressed syllables. There is a phonological difference between short and long vowels, as well as an allophonic difference before voiced consonants. They examined accent 2, which has a falling F0.

There are two possible ways in which duration could affect F0: truncation and compression, to adopt Bannert and Bredvad-Jensen's terms. For the sake of explanation, the short variant is assumed to be "derived" from the long variant. The shorter length results in a clipping of the pitch contour. The contour begins at the same point as for the long vowel, but because it ends at an earlier point, the contour ends with a higher F0. The pitch contour begins and ends at the same point as for the longer duration. Because the contour must reach the minimum point in a shorter period of time, the pitch contour falls more sharply.

The informant in Erikson and Alstermark's study had F0 contours which were truncated, and the minima decreased as vowel duration increased. Bannert and Bredvad-Jensen used more speakers, seven in all, and found that although three speakers showed a compression of the pitch contour, and one speaker used both truncation and compression, the vast majority of cases showed truncation.

If truncation is the main strategy, this has an important implication for the development of tones. In truncation, the endpoint of the contour is higher for a short vowel. If the value of the endpoint is the most salient part of the contour, then the pitch

differences would be likely to be reinterpreted as different tones. The opposite strategy, compression, would not allow for such an explanation. The minima is the same, or nearly the same, regardless of duration.

If Hombert et al. are correct about the reasons why vowel differences cannot develop into tones, the truncation effect, if it exists, could not be accounted for. The timing of the occurrence of the triggering factor and the change in F0 would be problematic for shortening by truncation because the endpoint is coincident with the end of the acoustic period for the vowel.

Conclusion

This section summarizes the known relationships between tone and segment, and explains their phonetic rationales. Past studies have concentrated on the more common type of interaction, involving consonants, and specifically on the development of tones based on properties of adjacent consonants. Here, we have a large amount of historical data, acoustic data, and some articulatory explanation(s), even though the latter are not completely satisfactory.

Tones also interact with vowels, as seen in studies such as Zee (1980). There are cases in which tones have apparently affected vowels, but there are no known cases of development of tones from vowels in terms of what might seem to some to be the most obvious trigger, vowel height. Here, we have a case of well-established phonetic effects, but no historical data. Hombert et al. suggest a way in which vowel duration can play a role in the development of tone, but such an explanation would not work in explaining

the main tonal development under consideration here, in Standard Cantonese. It is clear that tone is interacting with vowel duration and less so with vowel quality. Cantonese [i:] has a lower F1 than [I], i.e. is higher, yet has lower F0 than [I]. In order for Hombert et al.'s account to work, the tone(s) affected must be falling tones. In the Cantonese case, the tones are level and phonetically short. For tone and vowel duration, there are very few historical facts and very few phonetic facts in support.

For tonal developments as rare as the type found in the Cantonese case, it is just as important to find an explanation as it is for those developments which are more common. If the tonal split under examination here is not a natural development within Cantonese, one wonders, for instance, whether it was borrowed from a non-Chinese language. This issue will be examined in the next chapter.

CHAPTER V

THE INTERACTION BETWEEN VOWEL AND TONE IN THE MINORITY LANGUAGES OF SOUTHERN CHINA

Minority languages

In addition to the Chinese dialects under examination here, other tone languages spoken on mainland China show an interaction of some sort between vowel and tone. For several centuries, Chinese has coexisted with non-Chinese languages on the mainland, known as minority languages. Some ethnic groups in southern China, such as Tai, are indigenous to the region. Six percent of the population speak a non-Chinese variety (Norman 1988). As of 1987, the Chinese government has recognized a total of fifty-five minority languages, and there are many more which have not yet received official status.

The genetic affiliations of the minority languages in Northern and Southern China differ. The minority languages of Northern China are largely Altaic, with representatives of the Mongolian, Tungus and Turkish branches. In Southern China, most minority languages are of Tibeto-Burman and Tai[1] descent. Tibeto-Burman is part of the Sino-Tibetan family and is distantly related to Chinese, but not closely related. The minority language with the largest number of speakers is Zhuang, a Tai language, with over 13

[1]Here, I am following standard practice in using "Thai" as the name of the language that is also known as Siamese, and "Tai" as the name of the language family of which Thai is a member.

million speakers on the mainland (Ramsey 1987).

Substratum influence

As a group, the Northern Chinese dialects differ from the Southern Chinese dialects. For example, northern dialects typically have a relatively small number of tones, while the southern dialects have maintained most of the eight tones of post Middle Chinese. M. Hashimoto (1986) made the claim that there is a continuum from south to north that is parallel to the diachronic development of the dialect groups, in that there is a continuum of conservativism to innovation with respect to certain features.

There are varying explanations for the differences; in part, they are due to influence from or typological development with other languages. It is well-known that China has influenced its neighboring areas, both culturally and linguistically. Chinese characters are used in Japanese writing, and nearly all languages spoken nearby contain many Chinese loanwords. But it is also the case that Chinese has been affected by other languages as well, by languages spoken in neighboring countries, as well as by minority languages.

M. Hashimoto (1986) spoke of an "Altaicization" of Northern Chinese that began when Altaic-speaking groups invaded North China. The idea of substratum influence has been proposed as well. Ballard (1979) believed that there was a Miao-Yao substratum (or substrata) effect in the phonology of the Wu dialects, and M. Hashimoto (1986) found typological similarities in Wu and Miao-Yao in terms of syllable structure and demonstrative forms.

The vowel-tone interaction as an areal or substratum feature

The next question re the vowel and tone interaction in Cantonese concerns the origins of the split, as far as whether it was a contact-induced external influence. Oi-kan Yue (1976) suggests the possibility that the vowel-tone interaction in Cantonese is the result of substratum influence from Tai, or a more general, areal feature. The idea of tonal developments as an areal feature has been proposed for other languages, such as Weidert (1987: 163) who, among other explanations, attributes the relatively large number of tones in the Tibeto-Burman languages Lahu and Lisu to be an areal feature passed on by nearby Miao-Yao and Tai.

In considering the tonal split in upper register checked syllables in Standard Cantonese, I examined descriptions of various minority languages in southern China. The descriptions below are taken from various minority language serials written by Chinese scholars and published in mainland China. The purpose of these articles or books is to summarize the phonology of these languages, which are not very well known to mainland Chinese. As a result, they are not terribly detailed, and do not include any analysis (synchronic or diachronic). Hence, there is no way of knowing the historical tone categories of individual forms. Nonetheless, they are valuable sources of information.

Tibeto-Burman minority languages

Some members of the Yi branch of Tibeto-Burman have a tone raising rule which involves the tenseness of the vowel. The languages and the vowel-tone patterns are summarized below. Population statistics are from Ramsey (1987).

Lolo

This language, which is also known as Yi, is spoken by nearly 5.5 million people throughout Southern China (Ma and Dai, 1982). Lolo has three tones. The mid level tone is pronounced higher on tense vowels, as in the forms below:

[lu 33] "fry (cake-like)" [lu̲ 44] "move"

Lolo tense vowels are described as shorter in duration ("more hurried") than lax vowels (p. 52). Thus, the interaction can also be analyzed in terms of short versus long. Tense vowels in this language are produced with a lower tongue position than for lax, and so vowel height cannot be a factor.

The interaction is the same type as the Cantonese case; however, the pitch raising could be accounted for in another way. Tense vowel syllables are sometimes produced with an ending glottal stop, and, as described earlier, postvocalic glottal stops are known to raise pitch in many languages. Ramsey (1987) cites David Bradley, in a personal communication, as saying that in Jingpho, another Tibeto-Burman language, the label "tense" is given to vowels that are followed by a glottal stop; the same may be true for Lolo as well.

Lahu

Lahu (Ma and Dai, 1982) is spoken by approximately 300,000 people in southwest Yunnan. Lahu shows an interaction between tenseness, voicing of the prevocalic consonant, and tone, as seen in the chart below. The low falling tone has three

realizations: high falling when the initial is voiced and the vowel is lax; high rising when the initial is voiceless and the vowel is tense; and low falling elsewhere.

	Vowel tenseness	Prevocalic consonant	Tone
a.	Lax	Voiced	High falling
b.	Lax	Voiceless	Low falling
c.	Tense	Voiced	Low falling
d.	Tense	Voiceless	High rising

Given the interactions seen in other Tibeto-Burman languages, plus the known interactions between prevocalic voicing and tone, the following are expected:

a.	Lax -- lower	Voiced -- lower	===> lower
b.	Lax -- lower	Voiceless -- higher	===> no change
c.	Tense -- higher	Voiced -- lower	===> no change
d.	Tense -- higher	Voiceless -- higher	===> higher

The idea behind (b) and (c) is that the lowering and raising effects of the vowel and consonant cancel each other out, resulting in no difference. The assumption here is that the effects are equal in force, though that is not necessarily the case. Actual examples of each tone are given below, where the Hani forms are assumed to be representative of the proto-language.

	Hani	Lahu	
a.	ba 31	pa 53	"type of wheat"
b.	se 31	se 31	"to spread"
c.	za̲ 31	za̲ 31	"descend (mountain)"
d.	ce̲ 31	xi 35	"eight"

This correlates with the actual values given below. Forms (b) and (c) have retained the low falling tone; form (d) has become higher as well. (a) does not follow the above pattern, but, then again, there is no tone lower than a low falling tone, save an extra low falling tone. Perhaps some other change came along which raised the pitch of the tone.

Hani

Hani (Li and Wang, 1986) is spoken in southwestern Yunnan province by over a million people. There are two dialect groups, the Haya dialects and the Haobai dialects. Hani vowels are phonologically tense or lax. In both dialect groups, there is an interaction between tone and the laxness of the vowel. In Dazhai, a Haya dialect, tones are pronounced higher on tense vowels than on lax vowels. Examples are given below, where some type of mid falling tone becomes mid level. Following the format used in the books, the tense vowels have been underlined.

[dO	31]	"dress"	[dO	33]	"very"
[sa	31]	"meat"	[sa	33]	"to steam"

This pattern also occurs in Shuigui, a Haobai dialect. If the interaction is between tone and tenseness, then Hani has a pattern that is opposite to Cantonese. Nonetheless, it is the same general type of interaction. No description of duration is give, but it is possible that Hani tense vowels are shorter than lax vowels as well, parallel to the situation in Lolo and Lahi.

Other Tibeto-Burman

If the description of Lolo is representative of the entire branch, then the interaction is based on vowel duration, and the interaction is the same as the Standard Cantonese case. The interplay between tone and vowel duration is not limited to these languages. The same phenomenon occurs in Tibeto-Burman languages outside of China. In Sherpa, a Tibetan language spoken in parts of Nepal, there is a tone assignment rule based on

vowel quantity (Maddieson, Hargus and Nartey 1980). Sherpa maintains a phonemic distinction between short and long vowels. There are two phonological tones, high and low; phonetically there is a third tone, extra-high, which is dependent upon duration. Maddieson et al. found that within high falling tone forms, F0 is higher on short vowels than on long vowels. Short vowels had a mean duration approximately one-half of the mean duration of long vowels; their mean peak F0 was 26 Hz higher than that of long vowels. The differences in duration and peak F0 were statistically significant. These differences occurred only within high tone forms; there were no F0 differences within the low tone forms. Maddieson et al. describe this as a tone raising rule. Historically, they make no claim about the direction of the interaction.

The notion of "tense" and "lax"

What is problematic about the interactions found in some minority languages is the use of the "tense" and "lax" classifications, which are apparently terms assigned by Chinese scholars. According to Maddieson and Ladefoged (1985), there are no consistent phonetic correlations underlying these categorizations. They found that in four minority languages, Jingpho, Hani, Yi and Wa (Mon-Khmer), the distinction between tense and lax vowels was demonstrated to be based more on phonation type than on degree of muscular tension.

Even within the same language, F0 differences for tense and lax vowels are not always consistent. For Wa, a non-tone language, Qiu et al. (1980, cited in Ramsey 1987) describe tense vowels as having higher pitch than lax. However, Maddieson and

Ladefoged (1985) found that lax vowel syllables had a slightly higher F0. In a study using more speakers, Maddieson and Hess (1986) found no statistically significant difference in F0 between tense and lax syllables.

Duration differences for tense and lax vowels are not always the same across languages, either. According to Jakobson and Halle (1961: 97), "the heightened subglottal air pressure in the production of tense vowels is indissolubly paired with a longer duration". Yet in the Lolo case, tense vowels are apparently shorter than lax vowels.

Mon-Khmer minority languages

Several Austroasiatic languages are spoken on mainland China. Among them are several Mon-Khmer languages. Two languages which are not yet officially recognized as minority languages (probably because there are a small number of speakers) show a diachronic development of tones from vowel duration. The information presented here is taken from Svantesson (1988, 1989).

An important (for our purposes) branch of the Mon-Khmer family is Palaungic, which has developed in the following manner, adapted from Svantesson (1988, based on Diffloth 1982). The languages of interest here belong to the Angkuic branch of Palaungic.

Hu

Svantesson (1988, 1989) describes a correlation between vowel duration and tone in Hu, a Northern Mon-Khmer minority language which is not yet officially recognized.

Hu is spoken by approximately one thousand people in Jinghong county, Yunnan province. It belongs to the Angkuic group of the East Palaungic branch of Mon-Khmer. Svantesson (1988) quotes Diffloth (1982) as saying that Proto-Angkuic did not have tones, because there is one Palaungic language, Mok, that does not have tone. It is more likely that the other Palaungic languages were innovative in their development of tones than that Mok was innovative in losing all of an earlier set of tones.

Svantesson analyzes Hu as having two tones, high and low. Many Mon-Khmer languages which contain two tones developed such tones as a result of a loss of voicing in the initial consonants. Hu is unique in that high tones occur in words containing vowels that were short in Proto-Palaungic; low tones in words with vowels that were originally long in Proto-Palaungic. Although the length distinction goes back to Mon-Khmer, it has been lost by Proto-Angkuic times.

Examples of this correlation are given below, from Svantesson (1988). Lamet, another East Palaungic subgroup, preserves Proto-Palaungic vowel length; its cognates are given as comparison. The Hu case is clearly one in which tones interact with historical vowel duration. The transcription has been modified to fit the system used here. The acute accent indicates high tone, while the grave accent indicates low tone.

	Lamet	Hu	Gloss
*Short vowels:	yàm	yám	"to die"
	phán	pathán	"five"
	krmɲ̀	méɲ	"star"
	kcɛ̀n	ncɛ́n	"heavy"

	Lamet	Hu	Gloss
*Long vowels:	yà:m	yàm	"to cry"
	lì:k	lèk	"pig"
	ʔó:m	ʔòm	"water"
	yó:k	nasòk	"ear"

This pattern holds true only for non-high vowels in Hu. The high vowels [i, u] occur only with high tones, as seen in the following examples. [th] represents a voiceless interdental.

Lamet	Hu	
sí:m	ʔasím	"bird"
hú:m	thúm	"bathe"

The figures given below are taken from information supplied in Svantesson (1988), and are averaged over all tokens. * indicates reconstructed for Proto-Palaungic. All syllable types involved the low vowel [a].

	*Short vowel	*Long vowel
Duration (ms)	115.0	169.3
F0 (Hz)	254.0	207.3

The average duration of vowels from original short vowels is shorter than that of original long vowels; however, distributionally there is overlap between "short" and "long." The duration of the vowel in [yám] "to die" was longer than that of [khàp] "jaw" in one token. Also, the duration of [páp] "to speak" and [khàp] overlapped at 115 ms. each. For this reason, Svantesson does not consider duration to be synchronically

distinctive.

However, there is a consistent, non-overlapping difference in F0 between syllables having historically long and short vowels. Thus, tone must be the major factor. Svantesson proposes that the development of tone from duration is due to a generalization of differences in high versus non-high, where non-high vowels have intrinsically higher F0 and shorter duration than relatively lower vowels, all other things being equal. All of this is based on the assumption that Svantesson is correct in analyzing Hu as having lexical tone, with its tones apparently originating as a reflex of vowel duration.

U

Tonogenesis in U depends on four factors: vowel duration; vowel height; post-vocalic consonant; and prevocalic consonant. Some examples of the interaction are given below, with Lamet forms given as comparison (Svantesson 1989). Here, I am indicating low tone by [11]; high tone, [55]; falling tone, [31]; and rising tone, [35].

1. A Proto-Angkuic short vowel + voiced sonorant has low tone. (Final nasals > stops after original short vowels in U.)

Lamet	U	
[yam 11]	[yap 11]	"to die"
[ʔu:y 55]	[ʔuy 11]	"to smell"

2. A Proto-Angkuic short vowel + stop or s has high tone.

[kat 55]	[khat 55]	"cold"
[krɨs 11]	[ki 55]	"to count"

3. Sonorant + Proto-Angkuic long vowel + sonorant has falling tone.

Lamet	U	
[ya:m 11]	[yam 31]	"to cry"

4. Voiceless obstruent + long vowel + sonorant has high tone.

[po:n 55]	[phon 55]	"four"
[ʔE:r 55]	[yE 55]	"fowl"

5. Long vowel + stop or s has rising tone.

[la:t 55]	[lat 35]	"to fear"
[kɲa:s 11]	[ɲaʃ 35]	"to laugh"

These interactions are not crucial to the point being made here; what is important is that Hu is not the only Palaungic language which shows an interaction, and that other factors, such as properties of the pre- and postvocalic consonants, can also enter the picture.

Tai

Tai is divided into three branches, based on geographic location: the Southwestern dialects, of which Standard Thai is a primary example; Central, which includes Lungchow; and Northern, which includes Po-ai and Wuming. Many, varied authors have worked on Standard Thai. Work on other dialects, and on the Tai group as a whole, has been done largely by Li and summarized in his 1977 book.

The similarities between Tai and southern Chinese dialects are striking enough that earlier scholars believed them to be genetically related, though they are now generally

considered to be unrelated. Like the Yue dialects of Chinese, Tai dialects have nasals and voiceless stops in final position. Both language groups have a relatively large number of tones, eight or more. Also much like the Yue dialects is the occurrence in Standard Thai of "emphatic" tones, used when a non-high tone becomes high, usually in phrases involving reduplication and exclamation. These tones are parallel with the Yue "changed" tones, though the Thai tones appear to be more limited in their use.

Also, certain number terms in Tai have been borrowed from Yue, possibly Standard Cantonese: cf. Tai [ship], SCan [ship] "ten", Tai [shEt 55], SCan [tsoet] "seven", Tai [luk] SCan [lUk] "six". Phonologically, there are a few cases of diphthongization of high vowels in Tai which have been attributed to a Cantonese substratum (Gedney).

In some dialects of Tai there is a similar interaction, with higher tones used with short vowels, lower with long vowels. The following chart, based on information from Li (1977) lists examples of what Tai scholars refer to as the D1 and D2 tones in Proto-Tai. Proto-Tai had four tones which are designated as tones A, B, C, and D. Category D tones occurred with checked syllables. D1 tones historically occur in syllables containing original voiceless initials; D2 tones occur in syllables containing original voiced initials. Short vowels are indicated by S; long vowels are indicated by L. Po-ai is spoken in Yunnan province, near the Guangxi border.

In Po-ai there is an interaction between tone and vowel, which can be summarized in the chart below.

D1-S	55	tOk 55	"to fall"
D2-S	44	ka:t 22	"mustard plant"
D1-L	22	mOt 44	"ant"
D2-L	31	la:k 31	"root"

Within syllables ending in [p, t, k], the distribution of tones with respect to vowels is complementary. Po-ai has six tones in all, five of which occur in checked syllables. In syllables with short vowels, only the high level and mid-high level tones occur. There are a very few cases of forms with the mid level tone. Li does not give any examples of such forms. In syllables with long vowels, only the mid-low level and falling tones generally occur. There are forms with the high level tone, but these are all onomatopoeic forms. Hence, the higher tones occur with the short vowels; the lower tones, with long vowels.

In D2 and in Po-ai D1 and D2, tones occurring with synchronically short vowels are higher in pitch than tones occurring with synchronically long vowels. The interaction is purely synchronic, and in some dialects does not reflect a diachronic development. Within Tai minority languages, the following tone values are seen for Tone D1, as

described in Oi-kan Yue (1976:55).

	Wuming	T'ien-pao	Po-ai
Short V	High rising	High rising	High level
Long V	Mid rising	Mid falling/Midlevel	Mid-low level

It is evident, especially for Wuming, which is the standard variety of Zhuang, that higher tones occur with short vowel forms that have historically voiceless initials. The situation is exactly the same as the Cantonese case.

Lungchow and Standard Thai do not have the alternation. Lungchow has 55 for all historical D1 forms and 31 for all historical D2 forms, regardless of duration. For Standard Thai, the D1 tone category, regardless of vowel duration, has the 22 tone.

One could also draw the conclusion that the Lower Entering split found in at least two Yue dialects could be a result of Tai substratum influence. Oi-kan Yue (1976:57) notes that the split is an innovation within Yue, but that some Tai dialects, such as Standard Thai and Po-ai, have undergone a split in forms with an earlier voiced initial, equivalent to the Lower Entering register in the Yue dialects.

Tai as a substratum

Certain phenomena in the Yue dialects have been explained in terms of a Tai substratum effect, although some have been shown to be due to other factors. As discussed earlier, the Yue dialects have a number of Upper register forms that have nasal and lateral initials, which normally are expected to occur in Lower register tones. Yuan

Jiahua (1960: 181, cited in Pulleyblank 1986) argued that the occurrence of such forms is due to Tai influence, specifically from the Zhuang minority language. But, as Pulleyblank notes, although these forms are most abundant in Yue, Mandarin and other non-Yue dialects have examples of such forms. Also recall that McCoy (1980) reconstructs these forms for Proto-Chinese.

Another phonological development that Yuan analyzed in terms of Zhuang influence is the occurrence of the lateral fricative in Taishan. Lungchow, a Tai language spoken in southwestern Guangxi near the border of Vietnam, likewise has this sound. The lateral fricative is a typologically marked sound within the languages of the world. It has a limited occurrence within the Yue dialects; the only other dialects that have this sound are Hoiping, a Siyi dialect mutually intelligible with Taishan mentioned earlier, and Heshan. The corresponding Standard Cantonese sound is [s], as in Cantonese [sam], Taishan [lham] "three". Most other Yue dialects have a sibilant. As Pulleyblank (1986) argued, a substratum explanation is insufficient because the correspondence between Cantonese [s] / Taishan [lh] is a regular one. The development could be due to regular sound change within Taishan. Ultimately, Taishan [lh] goes back to Middle Chinese *s/*z.

Other claims about Tai substratum influence have been less controversial. There are a "handful", to use Pulleyblank's term, of colloquial forms in Standard Cantonese that are apparently of Zhuang origin. Thomason and Kaufman (1988) remark that cases of lexical borrowings from the substratum language are rare. Unfortunately, I do not have information at this point as to the exact number of words, or their meanings. It seems,

though, that the number of borrowings is not large enough to be a counterexample to Thomason and Kaufman's observation.

Another, more widely accepted assumption regarding a Tai substratum concerns the ordering of elements within compound nouns. In most modern Chinese dialects, the order is modified + modified. In certain Yue compounds, the order is modified + modifier. A. Hashimoto (1972:6) gives the following examples from Standard Cantonese.

"guest"	=	[ian] "human"	+	[hA:k] "guest"
"hen"	=	[kai] "chicken"	+	[na:] "female"
"rooster"	=	[kai] "chicken"	+	[kUng] "male"

Meyer and Wempe list the following example of a compound with a gender marker:

"sow" = [tsoe] "pig" + [na:] "female"

Hashimoto notes that the placement of the gender marker in second position in forms such as those for animal terms is not limited to the Yue dialects, but is a characteristic of Southern Chinese as a whole; Min and Hakka have this property as well.

In the Tai languages, the order is, likewise, modified + modifier. Zhuang has the following compounds (Ramsey 1987: 238)

"rooster"	=	[kai 5] "chicken"	+ [pou 4]	"male"
"cabbage"	=	[pyak 5] "vegetable"	+ [ha:u 1]	"white"
"May"	=	[di:n 5] "month"	+ [ngu 4]	"five"

However, Standard Cantonese and Taishan express the names of the month in the order of "(number)" + "month", so that "May" is "five" + "month". Also, the form for "cabbage" in northern varieties of Mandarin is likewise "vegetable" + "white". Thus the

form for "rooster" is the only one of the above that is most likely due to Tai influence on southern Chinese.

A second syntactic characteristic concerns the ordering of certain adverbs relative to verbs. The general order in Yue and other dialect groups is adverb + verb order; however, a small set of adverbs in Cantonese and Taishan come after verbs. Hashimoto (1972) provides examples, two of which follow:

Cantonese	sIk	tO:	(ti)	
Taishan	hiEk	u	(nai)	
	eat	more	(some)	= "eat more"
Cantonese	fUng	tIng	lai si:	
Taishan	foung	eing	li shi	
	pack	in advance	lucky money	

The ordering of verb-adverb in these forms is attributed to Tai influence.

Pulleyblank (1986) asserts that the southern Chinese dialects were not profoundly altered by any Tai substrata, implying that someone has made, or could make, such a claim. To my knowledge, no one has argued for this, except possibly for M. Hashimoto. It is certainly not the case that Cantonese or any of the other southern Chinese varieties are cases of *Mischsprache*. However, Pulleyblank indirectly makes an important point about substratum influence as an account for language change, in that one should be cautious in assuming substratum influence when there may be other explanations that are equally valid, if not superior. With this in mind, we will now consider the additional

evidence from the Upper Entering tone split in Cantonese.

The interplay between tone and vowel as an areal feature

With the exception of Tai, the minority languages described here are spoken in Yunnan province, in southwest China. While there is no direct evidence against positing the tone-vowel interaction as a Tai substratum, it is also clear that the interaction is a Southern China areal feature, occurring in all three of the southernmost provinces. It is unclear whether the vowel-tone interaction in Tibeto-Burman, however, is unlikely to be connected with the vowel-tone interaction in Yue and Tai. It may be of a different nature altogether, if the high tone is actually due to the effect of a postvocalic glottal stop, rather than tenseness or duration of the vowel. There is also the question of whether speakers in Yunnan province would have had prolonged contact with speakers in Guangxi and Guangdong province, particularly in earlier times when the mountainous nature of the area would have made traveling especially difficult.

Oi-kan Yue (1976) wondered, concerning the interaction between vowel and tone in Yue and Tai, why only the checked syllables were affected in both cases. If vowel duration is taken as the relevant cue, it is easy to see why. The long/short duration in vowels is manifested differently in this type of syllable than in other syllable types. In Standard Cantonese, the phonetic difference between long and short vowels is more obvious in Entering tone syllables, which are by definition checked syllables. According to A. Hashimoto (1972), the duration difference between long vowel syllables and short vowel syllables occurs in the vowel. In other syllable types with final consonants, i.e.

with final glides and nasals, the glide/nasal is phonetically shorter for the long vowel syllables than for the short vowel syllables; i.e. the final sonorant consonant bears the weight of the distinction.

Further evidence of the saliency of vowel duration in checked syllables is seen in Yanghuang, spoken in Guizhou. Here, tones on syllables ending in a voiceless stop are subdivided into a short/long distinction, while other syllable types do not show such a distinction. It is unclear whether the other syllable types lost earlier duration differences or whether this is an incipient distinction in the checked syllables. At any rate, if the tones under consideration here interact with vowel duration, it is logical to assume that the tonal splits are more apparent in checked syllables than in than other syllable types.

CHAPTER VI

THE INTERACTION BETWEEN VOWEL AND TONE AS AN AREAL FEATURE

Symmetry of tonal split

When looking at these tone-vowel interactions in Cantonese and other languages, one wonders why the interaction occurs mainly in checked (or in general, closed) syllables, and not other syllable types. Oi-kan Yue (1976) speculated, in essence, whether closing a syllable somehow encourages differences in pitch. At the end of the last chapter, it was suggested that there may be a functional reason: checked syllables differing in vowel duration manifest the vocalic difference in the vowel, while syllables ending in nasals or sonorants show an inverse relationship in the ending. The former is to be expected phonetically because a final unreleased stop cannot be varied in its duration.

A second, somewhat related issue is the overall symmetry of the tonal system. If tonal development operates in the same way as general sound change, then a possible result of the development of new tones in an already tonal language is to make the system more symmetrical. Standard Cantonese, with its synchronic distribution of 4 tones X 2 registers each = 8 tones, had a balanced system (or currently has, depending on one's analysis). With the additional Upper Entering tone thrown in, resulting in three tones for

that category, the system is not symmetrical phonetically. On the other hand, from the traditional view of tones held by Sinologists, in which there is a major distinction between Entering versus Non-Entering, there is now a greater balance (Endo 1991). Where there were previously six non-Entering and 2 Entering, the numbers are now 6 and 3, respectively. This view suggests that if there is an additional tonal split, it will also occur in the Entering tone, most likely the Lower Entering. Whether the current Cantonese tonal system is balanced, or aiming toward balance, depends on which tonal characteristics are judged to be more important.

Interplay between tone and vowel as an areal feature

Several points come to mind from the above discussion of the relationship between tone and vowel duration in Standard Cantonese. First, I should point out that the present discussion is by no means the first to deal with the issue of vowels and tones in the Chinese dialects. Endo (1991) provided a survey of vowel-tone interplay in various Chinese dialects, though focussing on the relationship between vowel height and tone, as well as the rare cases of vowel height affecting tone. The main goal of the current study is to understand the motivations for interactions between tone and vowel duration, particularly in a case where vowel duration is believed to have influenced tone.

It is apparent from the previous chapter that this particular interplay is a feature of an area encompassing south China and its immediately surrounding areas. This region is a fairly large one, but it seems unlikely that such tonal developments would be independent developments in each language family represented in those areas.

One reason for considering the interaction to be an areal feature is that this particular relationship between tone and vowel duration is not seen outside of the tone languages spoken outside of the linguistic area. This is not to say, though, that there are no cases of tones and vowels interacting outside of south China. Another pattern of interaction between tone and vowel duration that is attested crosslinguistically involves contour tones, in which rising tones occur with long vowels, falling tones with short vowels. In some Tai dialects, long vowels have developed from rising and non-high level tones, short vowels from falling and high level tones (Gandour 1977). In Czech, a pitch accent language, long vowels developed from syllables having earlier rising tone, short vowels from syllables having earlier falling tone (Jakobson 1931). In both cases, tones affected vowels. Since contour tones are not relevant to the vowel-tone interaction in Cantonese, it is beyond the scope of the present study to include a detailed discussion of rising and falling tones. Nevertheless, future discussions that intend to provide a comprehensive account of the relationship between vowels and tones should deal with contour tones.

The question is how the areal feature under examination here originated and spread. Oi-kan Yue's suggestion that it is the result of a Tai substratum is not inconsistent with the idea of an areal feature; the areal nature of the interaction could have started out as the result of Tai influence. It is possible that the interaction is due to Tai influence; however, the Tai variety that is most similar to Cantonese is Po-ai, which currently is spoken in an area somewhat far from the area(s) where Cantonese is spoken. Wuming, a Zhuang dialect, shows a similar interaction, but it involves high and

mid rising tones.

But one can not rule out the possibility that the tone-vowel relationships seen are due to a Chinese superstrate. Although there are many examples of apparent Tai influence on Chinese, one should not forget that Chinese has influenced its neighboring languages as well. Some tonal developments in Tibeto-Burman have been said to have developed due to the superstratum influence of Chinese. According to Weidert (1987: 92), a tonal split in Lisu based on manner of articulation of initial consonant was mainly the result of influence with Chinese dialects spoken in Yunnan. He also described some tonal developments within Tibeto-Burman as having "ultimately spread from the Chinese hinterland itself (p. 370)", though from the context it is not completely clear whether these are Chinese dialects.

Another point of consideration concerning possible Tai influence deals with the apparent regularity of the tonal split as sound change. If the tone split were due to Tai influence, the correspondence between tone and vowel would not be expected to be regular throughout the language. This may provide evidence that the tonal split was a strictly internal innovation within Proto-Yue. However, the regularity of the change is not necessarily incompatible with a substrate account for that change. Witness, for example, the many cases of foreign accents in which a target sound is systematically pronounced with a sound from the speaker's primary language. The sound correspondence is a regular one for most speakers who do not pronounce the target sound, but is the result of external influence. The same could be true for the Cantonese case; it is by all aspects a regular sound change, but could have had contact with Tai—or any

other minority tone language—as its impetus.

One last point is the question of why a split in the Upper Entering tone is more widespread among the Yue dialects than a split in the Lower Entering tone. We can answer this question: the Upper Entering tone split is an older change, having occurred in Proto-Yue, while the Lower Entering tone split, by all accounts, occurred after the emergence of the daughter dialects. There are several accounts of Yue dialects not mentioned here with a split in the Lower Entering tone (M. Chan, personal communication), but more information is needed before we reach a conclusion. As seen earlier, some described cases of "extra" Entering tones could be explained as examples of changed tones or some similar morphophonemic phenomenon.

Interactions between tones and vowels are not as limited or as sporadic as some may think, although ultimately the interactions known of now may turn out to have originated from the same situation. It is hoped that the present study will enhance our understanding of tone languages and their current tonal systems.

BIBLIOGRAPHY

Andersen, Torben. 1986. Tone splitting and vowel quality: evidence from Lugbara. *Studies in African Linguistics* 17: 55-68.

Bannert, R. and A. C. Bredvad-Jensen. 1975. Temporal organization of Swedish tonal accents: the effect of vowel duration. *Working Papers*, Phonetics Laboratory, Lund University 10: 1-36.

Baxter, William H. 1992. *A handbook of Old Chinese phonology*. Trends in Linguistics, Studies and Monographs 64. Mouton de Gruyter, New York.

Beckman, Mary E. 1986. *Stress and non-stress accent*. Foris Publications, Dordrecht. Netherlands Phonetic Archives VII.

Bhatia, Tej K. 1975. The evolution of tones in Punjabi. *Studies in the Linguistic Sciences* Vol. 5, No. 2 (Fall): 12-24. University of Illinois.

Carlton, Terence R. 1990. *Introduction to the Phonological History of the Slavic Languages*. Slavica Publishers, Inc., Columbus.

Chan, Marjorie Kit Man. 1980. *Zhong-shan phonology: a synchronic and diachronic analysis of a Yue (Cantonese) dialect*. M.A. thesis, University of British Columbia.

Chan, Marjorie K. M. 1983. Lexical diffusion and two cases studies in Chinese re-analyzed. *Acta Orientalia* 44: 117-152.

Chan, Marjorie K. M. 1989. On the status of "basic" tones. *Acta Linguistica Hafniensia* Vol. 21, No. 2, The Linguistic Circle of Copenhagen.

Chan, Steven Wai-Cheung. 1980. *Linguistic Experience in the Perception of Pitch*. Ph.D. dissertation, Stanford University. University Microfilms International, Ann Arbor, MI.

Chao, Yuen Ren. 1947. *Cantonese Primer*. Harvard University Press, Cambridge, MA.

Chao, Yuen Ren. 1951. Taishan yu liao. *Bulletin of the Institute of History and Philology*, Academia Sinica 23: 25-76.

Chen, Matthew and Newman, John. 1984-1985. From Middle Chinese to Modern Cantonese. *Journal of Chinese Linguistics* 12(1): 148-198, 12(2): 334-388, 13(1): .

Cheng, Teresa M. 1973. The phonology of Taishan. *Journal of Chinese Linguistics* Vol. 1, No. 2 (May): 256-322.

Elert, Claes-Christian. 1964. *Phonologic studies of quantity in Swedish*. Stockholm-Gotesborg-Uppsala: Almqvist and Wiksell.

Endo, Mitsuaki. 1991. Vowels and tones [in Chinese]. *Proceedings of the Second International Symposium on Chinese Languages and Linguistics*. Academia Sinica, Taipei, Taiwan.

Erikson, Y. and M. Alstermark. 1972. Fundamental frequency correlates of the grave word accent in Swedish: the effect of vowel duration. *Quarterly Progess and Status Reports*, Speech Transmission Laboratory, Stockholm, 2/3: 53-60.

Ewan, William G. 1979. Can intrinsic F0 be explained by source/tract coupling? *Journal of the Acoustical Society of America* 66(2): 358-362.

Fok Chan, Yuen-yuen. 1974. A perceptual study of tones in Cantonese. *Centre of Asian Studies Occasional Papers and Monographs*, No. 18. University of Hong Kong.

Fromkin, Victoria, ed. 1978. *Tone: a linguistic survey*. Academic Press, N. Y.

Gandour, Jack. 1977. On the interaction between tone and vowel length: evidence from Thai dialects. *Phonetica* 34: 54-65.

Gandour, Jack. 1981. Perceptual dimensions of tone: evidence from Cantonese. *Journal of Chinese Linguistics*, 9: 20-36.

Haggard, Mark, Stephen Ambler and Mo Callow. 1970. Pitch as a voicing cue. *Journal of the Acoustical Society of America* 47 (2, part 2): 613-617.

Halle, Morris and Kenneth N. Stevens. 1971. A note on laryngeal features. *Quarterly Progess Report, MIT Research Laboratory of Electronics* 101: 198-213.

Hashimoto, Mantaro. 1978-1979. *Phonology of Ancient Chinese* Vol. 1 (1978) and Vol. 2 (1979), Center for Study of Languages and Cultures of Asia and Africa, Monograph Series No. 10 and 11.

Hashimoto, Mantaro. 1974. Chuugokugo no tokushoku: on'in to hoogen [Characteristics of the Chinese language: phonology and dialects]. *Gengo [Language]* 3.8: 2-15.

Hashimoto, Mantaro J. 1986. The Altaicization of northern Chinese. In *Contributions to Sino-Tibetan Studies*, John McCoy and Timothy Light (eds.), Cornell Linguistic Contributions, Vol. V, 76-97.

Hashimoto, Oi-kan Yue. 1972. Phonology of Cantonese. *Studies in Yue Dialects 1*. Cambridge.

Haudricourt, Andre. 1954. De l'origine des tons en vietnamien. *Journal Asiatique* 242: 69-82.

Henderson, Eugenie J. A. 1982. Tonogenesis: some recent speculations on the development of tone. *Transactions of the Philological Society* 1-24. Basil Blackwell, Oxford.

Hock, Hans Henrich. 1976. Review of *An Introduction to Historical and Comparative Linguistics*, Raimo Anttila. *Language* 52(1): 202-220.

Hock, Hans Henrich. 1986. *Principles of historical linguistics.* Mouton de Gruyter (*Trends in Linguistics: studies and monographs 34*).

Hombert, Jean-Marie, John J. Ohala and William G. Ewan. 1979. Phonetic explanations for the development of tones. *Language* 55(1): 37-58.

Hyman, Larry (ed.). 1973. Consonant types and tone. *Southern California Occasional Papers in Linguistics* No. 1, July.

Hyman, Larry and Russell Schuh. 1974. Universals of tone rules: evidence from west Africa. *Linguistic Inquiry* 5: 81-115.

Jakobson, Roman. 1931. Prinzipien der historischen Phonologie. *Travaux du Cercle linguistique Prague* 4: 247-267.

Jakobson, Roman and Morris Halle. 1961. Tenseness and laxness. In D. Abercrombie et al. (ed.) *In Honour of Daniel Jones* 96-101.

Johnson, Keith. 1987. Intonation in Cantonese. *Ohio State University Working Papers in Linguistics* No. 36: *Papers from the Linguistics Laboratory*: 1-15. Edited by Mary Beckman and Gina Lee.

Joseph, Brian D. 1987. On the use of iconic elements in etymological investigation: some case studies from Greek. *Diachronica* IV, No. 1/2: 1-26.

Joseph, Brian D. and Janda, Richard D. 1988. The how and why of diachronic morphologization and demorphologization. In Michael Hammond and Michael Noonan, Editors, *Theoretical Morphology: Approaches in Modern Linguistics* Chapter 11: 193-210. Academic Press, Inc.

Kao, Diana L. 1971. Structure of the Syllable in Cantonese. *Janua Linguarum, Series Practica* 78, Mouton: The Hague.

Karlgren, Bernard. 1915-1926. Etudes sur la phonologie chinoise. *Archives d'etudes orientales*, vol. 15 (in 4 parts). Leiden: E.J. Brill; Uppsala: K.W. Appelberg.

Kiu, K. L. 1977. Tonal rules for English loan words in Cantonese. *Journal of the International Phonetic Association* 7.1: 17-22.

Lea, Wayne A. 1973. Segmental and suprasegmental influences on fundamental frequency contours. In Hyman (ed.): 15-70.

Lee, Thomas. 1983. The vowel system in two varieties of Cantonese. *UCLA Working Papers in Phonetics* 57 (April): 97-114.

Lehiste, Ilse. 1978. Polytonicity in the area surrounding the Baltic Sea. In Eva Gårding et al. (eds.) *Nordic Prosody*, Travaux de l'institut de linguistique de Lund 13: 237-247.

Lehiste, Ilse. 1970. *Suprasegmentals.* MIT Press.

Lehiste, Ilse and Pavle Ivic. 1973. Interaction between tone and quantity in Serbocroatian. *Phonetica* 28: 182-190.

Li, Fang-Kuei. 1971. Shangguyin yanjiu. *Tsing Hua Journal of Chinese Studies*, New Series 9: 1-61.

Li, Fang-Kuei. 1973. Languages and dialects of China. *Journal of Chinese Linguistics*: 1-13. Earlier version (1937), *The Chinese Yearbook*, Shanghai: Commercial Press.

Li, Fang-Kuei. 1977. *A Handbook of Comparative Tai.* University Press of Hawaii.

Li, Yongshui and Ersong Wang. 1986. A short introduction to the Hani language [in Chinese]. *Series of Introductions to Minority Languages*, Minority Nationality Publishers, China.

Lindau, Mona, Leon Jacobson and Peter Ladefoged. 1972. The feature advanced tongue root. *UCLA Working Papers in Phonetics* 22: 76-94.

Liu, Xunning. 1983. The split in the ancient Entering tone in Qingjian speech and the short and long Entering tone in Cantonese. *Yuyanxue Luncong* 10: 61-76. Beijing: Commercial Press.

Löfqvist, Anders, Thomas Baer, Nancy S. McGarr and Robin Seider Story. 1989. The cricothyroid muscle in voicing control. *Journal of the Acoustical Society of America* 85(3): 1314-1321.

Ma, Xueliang and Qingxia Dai. 1982. A comparative study of speech sounds in the Yi language branch [in Chinese]. Office of Minority Nationality Languages, Ed., *A Collection of Research Papers on Languages of Minority Nationalities*, 40-69. Qinghai Minority Nationality Publishers.

Maddieson, Ian. 1976. The intrinsic pitch of vowels and tones in Foochow. In Studies on Production and Perception of Tones: *UCLA Working Papers in Phonetics* 33: 191-202.

Maddieson, Ian and Susan A. Hess. 1986. "Tense" and "lax" revisited: more on phonation types and pitch in minority languages of China. *UCLA Working Papers in Phonetics* 63: 103-109. Also presented at the 19th International Conference on Sino-Tibetan Languages and Linguistics, Columbus, Ohio.

Maddieson, Ian, Sharon Hargus and Jonas N. A. Nartey. 1980. Pitch in Sherpa. *UCLA Working Papers on Phonetics* 51: 132-143.

Maddieson, Ian and Peter Ladefoged. 1985. "Tense" and "lax" in four minority languages of China. *Journal of Phonetics* 13: 433-454.

Matisoff, James A. 1973. Tonogenesis in southeast Asia. In Hyman (ed.): 71-95.

McCoy, John. 1980. The reconstruction of upper register nasals and laterals in Proto-Cantonese. In Frans van Coetsam and Linda R. Waugh (eds.) *Contributions to Historical Linguistics: Issues and Materials*, Cornell Linguistic Contributions, Vol. III, Leiden.

McCoy, William John Jr. 1966. *Szeyap Data for a First Approximation of Proto-Cantonese (with) Appendix.* Ph.D. dissertation, Cornell University. University Microfilms, Inc., Ann Arbor, Michigan.

McCoy, William John. 1969. The phonology of Toishan City: a Chinese dialect of Kwangtung province. *Orbis* 18:108-122.

Meyer, Bernard F. and Theodore F. Wempe. 1947. *The Student's Cantonese-English Dictionary*, third edition. Catholic Foreign Mission Society of America. Field Afar Press, New York.

Newman, Paul. 1975. The non-correlation of tone and vowel height in Hausa. *Studies in African Linguistics* 6: 207-213.

Norman, Jerry. 1988. *Chinese*. Cambridge Language Surveys, Cambridge University Press.

Ohala, John J. 1973. The physiology of tone. In Hyman (ed.): 1-14.

Pike, Kenneth L. 1948. *Tone Languages*. University of Michigan Press, Ann Arbor.

Pilszczikowa-Chodak, Nina. 1972. Tone-vowel height correlation and tone assignment in the patterns of verb and noun plurals in Hausa. *Studies in African Linguistics* 3: 399-421.

Pilszczikowa-Chodak, Nina. 1975. On the correlation of tone and vowel height in Hausa: a reply to Newman. *Studies in African Linguistics* 6: 315-321.

Pulleyblank, Edwin G. 1962. The consonantal system of Old Chinese. *Asia Major* 9:58-144. The consonantal system of Old Chinese, part 2. *Asia Major* 9: 206-265.

Pulleyblank, Edwin G. 1984. *Middle Chinese: a study in historical phonology.* Vancouver: University of British Columbia Press.

Pulleyblank, Edwin G. 1986. Tonogenesis as an index of areal relationships in east Asia. *Linguistics of the Tibeto-Burman Area* 9(1): 65-82.

Ramsey, S. Robert. 1987. *The languages of China.* Princeton University Press.

Reinholt Petersen, Niels. 1983. The effect of consonant type on fundamental frequency and larynx height in Danish. *Annual Report of the Institute of Phonetics, University of Copenhagen*, 17: 55-86.

Spears, R.A. 1968. Tonal dissimilation in Maninka. *Journal of African Languages* 7: 88-100.

Steele, Shirley. 1985. *Vowel Intrinsic Fundamental Frequency in Prosodic Context.* Ph.D. dissertation, Univ. of Texas at Dallas.

Svantesson, Jan-Olof. 1988. Hu—a language with unorthodox tonogenesis. *Contributions to Mon-Khmer Studies: Essays in honour of Professor H.L. Shorto,*

ed. Jeremy Davidson, SOAS, London.

Svantesson, Jan-Olof. 1989. Tonogenetic mechanisms in Northern Mon-Khmer. *Phonetica* 46: 60-79.

Rischel, Jorgen. 1986. Can "the great tone split" in Thai be phonetically explained? *Annual Report of the Institute of Phonetics, University of Copenhagen*, 20: 79-98.

Thurgood, Graham. (1992). From atonal to tonal in Utsat (a Chamic language of Hainan). *Proceedings of the Eighteenth Annual Meeting of the Berkeley Linguistic Society*, Special Session on the Typology of Tone Languages 145-156.

Thomason, Sarah Grey and Terrence Kaufman. 1988. *Language Contact, Creolization, and Genetic Linguistics*. University of California Press.

Tsuji, Nobuhisa. 1980. *Comparative Phonology of Guangxi Yue Dialects*. Kazama Shobo Publishing Co., Tokyo.

Vance, Timothy J. 1976. An experimental investigation of tone and intonation in Cantonese. *Phonetica* 33: 368-392.

Williams, S. Wells. 1856. *Tonic Dictionary of the Chinese Language in the Canton Dialect*. Canton: Office of the Chinese Repository.

Wang, Li. 1932. Une prononciation Chinoise de Po-pei (Province de Kouang-si) étudiée a l'aide de la phonétique expérimentale. Paris: Libraire Ernest Leroux.

Wang, Li and Songsheng Qian. 1950. Taishan fangyin. *Lingnan Xuebao* 10.2: 67-104.

Weidert, Alfons. 1987. *Tibeto-Burman Tonology: A Comparative Account*. Current Issues in Linguistic Theory 54, Amsterdam.

Wong, Maurice Kuen-shing. 1982. *Tone change in Cantonese*. Ph.D. dissertation, University of Illinois at Urbana-Champaign. University Microfilms International, Ann Arbor, MI.

Yue, Anne O. 1979. The Teng-xian dialect of Chinese—its phonology, lexicon and texts with grammatical notes. *Computational Analyses of Asian and African Languages* No. 12, CAAAL Monograph Series No. 3. Project on Lexicological Analysis, National Inter-University Research Institute of Asian & African Languages and Cultures, Japan.

Yue, Oi-kan. 1976. Interplay of vocalic segments and tones in the Yueh dialects. In Mantaro Hashimoto (ed.) *Genetic Relationship, Diffusion and Typological*

Similarities of East and Southeast Asian Languages. Tokyo: The Japan Society for the Promotion of Science.

Yue-Hashimoto, Anne O. 1986. Tonal flip-flop in Chinese dialects. *Journal of Chinese Linguistics* 14 (2): 161-183.

Zee, Eric. 1980. The effect of aspiration on the F0 of the following vowel in Cantonese. *UCLA Working Papers in Phonetics*, 49: 90-97. (Also in Zee, Yun-yang. 1980. *Phonetic Studies of Chinese Tones*, 30-37. Ph.D. dissertation, University of California at Los Angeles.)

Zee, Eric. 1980. Tone and vowel quality. *Journal of Phonetics* 8: 247-258.

Zhan, Bohui and Cheung Yat-shing (chief editors). 1987. *A Survey of Dialects in the Pearl River Delta*. Vol. 1, Comparative Morpheme-Syllabary. New Century Publishing House, Hong Kong.

APPENDIX: CANTONESE UPPER ENTERING TONE WORD LIST

The following list consists of the Upper Entering morpheme/syllables examined in the present study. The first part contains the morphemes listed in the syllabary of Zhan and Cheung (1987). The order of the morphemes is the same as that used in the Table of Chinese Characters for Dialect Survey. For ease of reference, the numbers given are the same numbers assigned to each morpheme in the syllabary.

Each morpheme is listed according to its historical rhyme group. Exceptions to the tone pattern are marked with an asterisk (*) next to the reference number; in cases where a morpheme has two pronunciations, an asterisk is placed next to the exceptional form. Zhan and Cheung indicate the Upper Entering tones by 55 and 33 for high and mid respectively, and Lower Entering with 22.

Glosses for the morphemes are taken from Choy 1981, Meyer and Wempe 1947, Tsuji 1980, and by consultation with native Chinese speakers. In cases where more than one distinct meaning is given, the first meaning is the primary one. It should be noted also that some morphemes do not occur in isolation, nor do they always have the same meaning when used in combination with other morphemes.

The second part consists of the morpheme-syllables listed in chapter 4 of Hashimoto (1972) that are colloquial, onomatopoeic, or loanwords. They are listed in the same order in which they are given in Hashimoto. Exceptions to the expected vowel-tone

interaction are indicated by (E) before the form.

Xian			
1697	tA:p	33	answer
1698	tA:p	33	ride, build
1702	t^hA:p	33	rub; bribe
1717*	kap	33	join, agree
1718*	kap	33	lizard, frog
1719*	kap	33	dove, pigeon
1725	hO:t	33	drink; shout
1740	t^hA:p	33	tower, pagoda
1741	t^hA:p	33	bed
1742	t^hA:p	33	collapse
1743	t^hA:p	33	wet
1773	tsA:t	33	to stab
1778	tsA:p sA:p tsam	33 (GD) 33 (HK) 35 (C in both)	blink
1779	ts^hA:p	33	insert
1788	kA:p	33	squeeze
1789	kA:p	33	clothes (between shirt & coat)
1791	hap	55	exactly, fortunately

1792	hA:p	33	clutch, pinch
1799	hap	22 (GD only)	be in harmony with
	hap	55 (C in GD; HK has only this)	
1806	kA:p	33	the first; fingernails
1807	kA:p	33	shoulderbone
1813	A:p	33	a duck
1814	A:t	33	arrest; seal, mortgage
1815	A:t	33	crush, repress
1830	tsi:p	33	join, receive
1833	$ts^{h}i:p$	33	concubine
1842	tsi:p	33	fold up
1843	tsi:p	33	wrinkle
1846	si:p	33	take pictures
1848	si:p	33	wade
1862	ji:p	33	to press
1873	ki:p	33	rob
1875	hi:p	33	timid, cowardly
1881	hi:p	33	coerce; the ribs
1883	ji:m	55	to pickle
	ji:p	33	
1887	ti:t	33	fall down
1891	$t^{h}i:p$	33	document, invitation
1892	$t^{h}i:p$	33	to tape, stick

1906	kA:p	33	pinch
	ki:p	22 (C, in HK)	
1910	hi:p	33	cooperate
1911	fA:t	33	way

Shen

1927	lap	55	cap
1928	nap	55	a grain of
	lap	55	
1933	ts^hap	55	arrest, catch (hotly wanted criminal)
1935	ts^hap	55	edit
1948	ki:p	33	sticky feeling
1953	tsap	55	execute; grasp, hold
1954	tsap	55	liquid, juice
1960	sap	55	wet
1976	kap	55	urgent
1977	k^hap	55	a grade, step
1978	k^hap	55	give
1981	(j)iap	55	weep
1989	k^hap	55	suck, inhale
1997	(j)iap	55	to bow

Shan

2008	$ts^hA:t$	33	otter
2026	lA:t	33	head skin illness
2031	$ts^hA:t$	33	rub
2037	sA:t	33	sow (seed); spread
2038	sA:t	33	wisdom
2048	kO:t	33	cut; injure
2049	kO:t	33	a surname? a creeping plant
2053	hO:t	33	thirsty
2058	hO:t	33	to drink, cheer
2070	pA:t	33	eight
2075	mA:t	33	mop; C in HK
	mu:t	33	(L, in HK)
2078	tsA:t	33	volume (of book or paper)
2079	tsA:t	33	to pierce
2081	$ts^hA:t$	33	examine, consider
2084	sA:t	33	kill
2097	tsA:t	33	groaning of wheels; crash
2127	pi:t	33	turtle
	pi:t	22	(also, in HK)
2169	si:t	33	a surname
2170	si:t	33	pour

2174	tsi:t	33	philosophy; wise
2175	tsi:t	33	worm ?
2176	$ts^{h}i:t$	33	displace, go through
2177	$ts^{h}i:t$	33	retreat
2179	$ts^{h}i:t$	33	wheel track
2183	tsi:t	33	bend, break; discount
2184	tsi:t	33	a province name?
2189	$ts^{h}i:t$	33	to design; establish
2196	tsi:t	33	break, bend
2218	$k^{h}i:t$	33	uncover
2227	hi:t	33	stop
2228	hi:t	33	scorpion
	$k^{h}i:t$	33 (also, in HK)	
2237	pi:t	33	hold breath
	pi:t	22 (also, in HK)	
2239	$p^{h}i:t$	33	to branch; abandon, cast away
2248	$t^{h}i:t$	33	iron
2267	tsi:t	33	holiday; a knot; chapter
2269	$ts^{h}i:t$	33	cut
2273, 2274			
	si:t	33	fragment

2275	si:t	33	wedge
2282	ki:t	33	connect; a knot
2283	ki:t	33	clean
2297	ji:t	33	hiccup; choke
2302	pu:t	33	container (mug)
2320	mu:t	33	to mop, rub
2325	tsy:t	33	pick up
2326	tsy:t	33	arrange
2328	$t^{h}y:t$	33	take off (clothes)
2340	ly:t	33	to stroke, scrape
(HK)	ly:t	22	
2347	$ts^{h}y:t$	33	bring together, pinch
2362	$k^{h}u:t$	33	include, enclose
2363	kuA:k	33	din, clamor
(HK)	$k^{h}u:t$	33	
2366	fu:t	33	broad, wide
2371	$k^{h}u:t$	33	open; clear
2388	(w)uA:t	33	dig, excavate
2394	$ts^{h}A:t$	33	to brush
2397	kuA:t	33	to scrape
2407	ly:t	33	bad, inferior
2413	sy:t	33	snow

2426	tsy:t	33	unskillful, clumsy
2432	sy:t	33	say
2458	fA:t	33	hair
2459	fA:t	33	send out; proceed
2476	k^hy:t	33	lacking
2477	k^hy:t	33	stubborn
2481	k^hy:t	33	a piece; half
	ky:t	22 (also, in HK)	
2502	k^hy:t	33	determine, decide
2503	k^hy:t	33	farewell (words)
2505	k^hy:t	33	to lack; a defect
2506	hy:t	33	blood

Zhen

2528	pat	55	pen, brush
2529	pat	55	finish
2530*	pi:t	55	must, certainly
2531	p^hat	55	(classifier) measure for horses
2553	ts^hat	55	seven
2554	ts^hat	55	paint
2563	sIk	55	comprehend; completely
2564	sat	55	knee; lap
2576	sat	55	cool, cold (wind)
2577	sat	55	louse; bug; flea
2583	tsat	55	quality, matter
2590	sat	55	lose
2591	sat	55	room
2606	kat	55	fortune
2614	jy:t	33	the second of 10 stems
2615	(j)iat	55	one
2624	hat	55	beg
2635	pat	55	no, not (check on brackets)
2667	tsØt	55	soldier
2671	ts^hy:t	33	hurried, urgent
2681	kuat	55	bones

2685	fat	55	opening; hut
	(w)uat	55 (also, in HK)	
2689	fat	55	to neglect; suddenly
2713	sØt	55	the 11th of the 12 branches
2714	sØt	55	sympathize, pity
2721	sØt	55	to guide; follow
2722	sØt	55	cricket
2728	$ts^hØt$	55	go out
2743	kuat	55	orange
2755	fat	55	resembling
2775	(w)uat	55	bend

Dang

2795	pO:k	33	extensive; to gamble
2797	pA:k	33	to moor; stay
2822	$t^hO:k$	33	entrust
2823	$t^hO:k$	33	support with the hand
2853	tsO:k	33	do
2856	$ts^hO:k$	33	a mistake; incorrect
	$ts^hO:$	33	
2862	tsA:k	33	an oak
	(HK only, no GD given)		
2869	sO:k	33	ask for; a rope
2878	kO:k	33	each
2879	kO:k	33	a cabinet; mezzanine
2880	kO:k	33	put aside
2881	kA:k	33	upper arm
2890	$k^hO:k$	33	put, place
2897	O:k	33	bad, mean
2921	tsoe:k	33	nobility
2922	tsoe:k	33	small birds
2925	tsoe:k	33	magpie
2928	tsoe:k	33	chew
2938	soe:k	33	deprive of

2950	tsoe:k	33	to clothe
2975	tsoe:k	33	pour wine; consider; feast
2981	ts^{h}oe:k	33	magnanimous; spacious
2983	ts^{h}oe:k	33	blanch
2996	tsoe:k	33	spoon, ladle
	soe:k	33 (also, in HK)	
2997	ts^{h}oe:k	33	a flower
3012	koe:k	33	foot
3014	k^{h}oe:k	33	yet, but; decline
3028	(j)ioe:k	33	agreement
3045	kuO:k	33	(a name); outer wall; suburb; rim
3047	k^{h}uO:k	33	wide, surrounding
3052	fO:k	33	sudden
3053	fO:k	33	a fragrant plant
3074	pO:k	33	fasten, tie up
3083	k^{h}y:t	33	pickax
	(no HK form)		

Jiang

3096*	mO:k	55	to strip, peel
3097	pO:k	33	argue
3100	p^{h}O:k	33	plain, simple
3101	p^{h}O:k	33	a kind of wood
3108	tsoe:k	33	a table, stand
	ts^{h}oe:k	33	(HK only ts^{h}oe:k 33)
3109	ts^{h}oe:k	33	distinguished
3110	toe:k	33	to cut (gems)
3111	toe:k	33	to peck; preen
3112	toe:k	33	to drip; trickle
3113	ts^{h}O:k	33	stab
3117*	tsUk*	33	arrest, catch
	tsUk	55 (C in HK)	
3120	tsUk	55	get wet
3123	sO:k	33	first day of the moon
3132	kO:k	33	feel; aroused
3133	kO:k	33	corner
3136	k^{h}O:k	33	really
3137	k^{h}O:k	33	rainbow
3138	hO:k	33	husks, shells; dipper, ladle
3147*	A:k	55	to hold

Zeng

3149	pak	55	north
3158	tak	55	get, gain; can, may
3159	tak	55	virtue, morality
3160	t^{h}Ik	55	err; too much
3175	tsak	55	a rule, law; then
3182	sak	55	block up, obstruct
3184*	hak	55	time
	hA:k*	55 (C in GD)	
3185*	hak	55	carve, engrave
	hA:k*	55 (C in GD)	
3186*	hak	55	to overcome
	hA:k*	55 (C in GD)	
3187*	hak	55	black
	hA:k*	55 (C in GD)	
3190	pIk	55	to crowd; press upon, force; cf. 3264
3192	nIk	55	to hide; secret, anonymous
3197	tsIk	55	immediately
3198	tsIk	55	a kind of fish
3199	sIk	55	to rest; a breath
3200	sIk	55	extinguish
3201	sIk	55	daughter-in-law
3204	ts^{h}Ik	55	type of calligraphy
3211	tsak	55	lean against; a side

3212	ts^{h}ak	55	to estimate; measure
3213	sIk	55	color
3214	sIk	55	stingy, sparing
3219	tsIk	55	weave
3220	tsIk	55	duty, position
3233	sIk	55	knowledge
3234	sIk	55	form, rule
3235	sIk	55	ornament, decoration
3250	(j)iIk	55	remember, reflect
3251	(j)iIk	55	100 million
3252	(j)iIk	55	restrain; or else
3256	kuO:k	33	country

Geng

3261	pA:k	33	100
3262	pA:k	33	cedar
	$p^hA:k$	33 (HK)	
3263	pA:k	33	father's older brother
3264	pIk	55	to force; imminent
3266	$p^hA:k$	33	to hit, pat
3267	$p^hA:k$	33	soul, spirit
3282	$ts^hA:k$	33	pull down, destroy
3283	$ts^hA:k$	33	
3290	tsA:k	33	narrow, compressed
3307	kA:k	33	a pattern; to reach
3309	hA:k	33	guest, visitor, customer
3313	hA:k	33	bright, fiery
3314	hA:k	33	to frighten, threaten
3321	mA:k	33	to separate
3322	$p^hA:k$	33	Chinese herbal medicine
3333	tsA:k	33	to blame; duty
3334	$ts^hA:k$	33	whip a horse; a plan
3335	$ts^hA:k$	33	volume of a book
3339	kA:k	33	leather; to revolt

3340	kA:k	33	divide, separate
3348*	ak	55	grasp, seize
	A:k*	55 (HK)	
3349*	A:k*	55	yoke, collar; restrain
3354	pIk	55	greenish or blueish jade
3373	kIk	55	halberd; lance
3389	pIk	55	a piece of jade
3391	p^hIk	55	depraved; secluded
3392	p^hIk	55	to burt (sic) forth; open up
3401	tsIk	55	store up, accumulate
3402	tsIk	55	trace; footprint
3403*	tsIk*	33	backbone
	tsE:k	33 (C)	
3417	sIk	55	to regret, pity
	sE:k	33 (HK, also)	
3418	sIk	55	former, ancient
3434	tsE:k	33	one, single (classifier)
3435	tsE:k	33	to roast
3436	$ts^hE:k$	33	red, naked, barren
3437	ts^hIk	55	expel, scold
3438	$ts^hE:k$	33	Chinese foot, ruler
3442	sIk	55	suitable; just now
3443	sIk	55	explain; release

3455	(j)iIk	55	benefit, advantage
3463	pIk	55	wall, defense
3466	p^hIk	55	to chop, split open
	$p^hE:k$	33 (C)	
3481	tIk	55	actual; possessive pronoun
3482	tIk	55	to drip; drops
	tIk	22 (C)	
3483	tIk	55	legally related wife
3488	$t^hE:k$	33	to kick
3489	t^hIk	55	scrape off; pick out
3516	tsIk	55	merit
3519	ts^hIk	55	be related to; pity
3524*	sIk	33	tin, pewter
	sE:k	33 (C in GD)	
3525	sIk	55	distinguish, analyze
3529	kIk	55	strike, attack
3530	kIk	55	excite, encourage
3532	hE:k	33	eat
3539	kuIk	55	

Tong

3565	pUk	55	to foretell
3566	$p^hO:k$	33	to strike down
3567	$p^hO:k$	33	mold on vinegar or soy sauce
3568	p^hUk	55	fall down (check asterisk)
	fu	22 (HK, also)	
3588	t^hUk	55	bare, hairless
3619	ts^hUk	55	fast; speed
3626	kUk	55	grain; cereals
3627	kUk	55	valley, ravine
3632	hUk	55	cry, weep
3644	Uk	55	a house, room
3646	tUk	55	sincere, honest
3647	tUk	55	supervise, direct
3659	(j)iUk	55	to water; fertile
3664	fUk	55	happiness, fortune, luck
3665	fUk	55	a roll of map or pictures
3666	fUk	55	a bat
3667	fUk	55	double
3668	fUk	55	abdomen, belly
3670	fUk	55	to reply
3685	sUk	55	solemn, reverential

3686	sUk	55	to spend the night
3690	tsUk	55	bamboo
3691	tsUk	55	to construct
3692	ts^hUk	55	raise or feed animals
3698	sUk	55	to shrink, draw back
3701	tsUk	55	bless, pray
3702	tsUk	55	porridge
3705	sUk	55	father's younger brother
3714	kUk	55	chrysanthemum
3715	kUk	55	irritate; rouse; force
3716	kUk khUk	55 (GD) 55 (HK)	leaven, barm; "mother" (sic)
3719	ts^hUk	55	cattle, beasts; to rear
3720	ts^hUk	55	to save (money)
3721	(j)iUk	55	(a name)
3745	tsUk	55	foot; enough
3747	ts^hUk	55	urge; hurried
3750	sUk	55	corn, grain
3767	tsUk	55	candle
3768	tsUk	55	to instruct; order
3770	tsUk ts^hUk	55 55	to strike, oppose

3773	ts^hUk	55	restrain, tie up
3788	k^hUk	55	bent; a song

Part Two

Colloquial, Onomatopoeic and Loanword forms from Hashimoto (1972)

Codes:

C = character used only in Cantonese
L = loanword
N = colloquial form with no character
O = onomatopoeic
E = exception to the Upper Entering tone-vowel pattern

pA:k	55	(O)
phA:k	33	to park (L)
(E) mA:k	55	to mark (L)
fA:k	33	to whisk (N)
pat	55	to ladle (N)
mat	55	what (C)
mak	55	trademark, mug (L, C)
pIk	55	(O)
(E) mi:t	55	to pinch, peel off (C)
(E) pO:k	55	to hit on the head with something hard (N)
(E) phO:k	55	blister (C)
mUk	55	eat slowly (e.g. seeds) (C)
(E) pu:t	55	car sound (O)
(E) tA:p	55	to taste (O)
lA:p	33	gather together (C)

tA:t	33	classifier for place (C)
tA:t	33	to slap against (C)
tA:t	33	to fall down (N)
(E) thA:t	55	tart (L)
thA:t	33	dirty (N)
nA:t	33	to burn (C)
(E) tA:k	55	(O)
(E) lA:k	55	cracking noise (O)
(E) lA:k	55	armpit (C)
lA:k	33	naked (C)
tap	55	drop the head (C)
tap	55	even (N)
tat	55	fat (C)
tat	55	put down (rudely) (N)
lat	55	come off (C)
lak	55	knotty, rugged (C)
tE:k	33	chase away (N)
(E) lE:k	55	smart (N)
tIk	55	(O)
thIk	55	make a check mark (N)
nIk	55	carry (C)
(E) thi:p	55	tip (L)

li:t	33	a knot (C)
(E) tO:k	55	(O)
(E) lO:k	55	remove teeth (N)
(E) lO:k	55	corner (C)
lO:k	33	sentence particle (C)
tUk	55	to prick (N)
tUk	55	bottom, end (C)
lUk	55	to roll (C)
lUk	55	classifier for long and slender objects (N)
(E) ty:t	55	(O)
(E) ly:t	55	slippery, smooth (O)
(E) sA:p	55	coarse (N)
sA:p	33	to irritate (C)
iA:p	33	to tuck up (C)
iA:k	33	to eat (vulgar) (C)
tsap	55	a small bunch of (C)
sap	55	miscellaneous (C)
tsat	55	cork (C)
sak	55	great grandchild (C)
(E) tsE:k	55	sentence particle (C)
(E) tshE:k	55	check (L)
tshE:k	33	painful (C)

iIk	55	to hiccup (C)
iIk	55	stale taste (N)
si:p	33	to wedge (C)
ii:p	33	(?)
(E) tsi:t	55	to tickle (N)
sØt	55	to set (hair) (L)
(E) tshO:k	55	chalk (L)
tshO:k	33	to shake (N)
sO:k	33	to suck (C)
sUk	55	stale (N)
iUk	55	to move (C)
ngA:p	33	to tuck (C)
(E) khA:t	55	card (L)
ngA:t	33	stench (C)
(E) ngA:k	55	deceive (C)
(E) kap	33	agree
khap	55	to cover (C)
ngap	55	to tattle (C)
hap	55	doze (C)
kat	55	to pierce (C)
ngat	55	to stuff (C)
kak	55	knotty, rugged

khIk	55	knot (C)
(E) ki:p	55	bag, suitcase (may be L)
(E) ngi:t	55	creaking sound (O)
(E) kO:t	55	court (L)
kUk	55	swell up (C)
(E) khwA:k	55	loop (C)
(?)ap	55	to cover (C)
kwat	55	quarter (L)
(?)at	55	press down (C)