A Study of Tones and Initials in Kam, Lakkja, and Hlai

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This study describes the linguistic interaction of initial consonants, phonation types, and tones in three Kadai languages (Benedict 1942) of southern China: Kam, Lakkja, and Hlai.[1] This interaction will be analyzed using both a developmental-comparative perspective of a type that has distinguished Professor Gedney's work on Tai, and a phonetic approach that utilizes computer-assisted acoustic techniques. Recently, there has been more interest in comparing the Kadai languages. Yet, to my knowledge, quantitative research methods of the type used here have not been applied to any significant extent to this group of languages. Please note that not all three of the languages under discussion here are treated equally. Because the tones and initials in the varieties of Lakkja and Hlai examined here appear to preserve fewer tonogenetically revealing features (Matisoff 1973), I will concentrate more on Kam and regard Lakkja and Hlai as foils against which the Kam features may stand out. In this regard, three aspects will be singled out for special emphasis: (a) the so-called tonal tripartition in Kam is probably reducible to a sequence of two bipartitions; (b) Lakkja, Hlai, and Kam have fundamental frequency shapes generally resembling the descriptions of their respective tones with some unexpected anomalies; and (c) the breathy phonation in Kam is probably responsible for the second bipartition.

The course of the exposition begins with a brief summary of past scholarship on the qualitative properties of the three languages; then examples of tone-initial interaction using Gedney's (1972) checklist procedure are given. The next portion of this essay provides a computer-aided, quantitative description of the tonal contours produced from collapsing multiple repetitions of the same lexical item into a single tonal

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[1] I would like to express my thanks to the Central Institute for Nationalities, Beijing, China, and its staff members Su Defu, Wen Mingying, and Yang Quan for providing me the informant help needed for this study; to Professor Elliott D. Ross, Behavioral Neurology Lab, University of Texas Health Science Center, Dallas, Texas, who developed the programs for the PDP-11 used here, and to Professors C-J Bailey, Paul K. Benedict, André Haudricourt, David Strecker, and Graham Thurgood for their comments on a version of this paper. A part of this research was supported by the Organized Research Fund of the University of Texas.

composite plot. It is unfortunate that tone tokens from only one speaker for each language could be included. In future work it is hoped that these results can be augmented with data from multiple subjects. In the interim, however, I will report on the treatment of data already gathered from the native speaker experts at the Central Institute for Nationalities, Beijing: (a) Yang Quan (Kam) from Tongdao, Hunan; (b) Su Defu (Lakkja) from Jinxiu Yao Autonomous District, Guangxi; and (c) Wen Mingying (Hlai) from a site on the southern coast of Hainan Island in Ya Township. Each was kind enough to assist me in the summer of 1985 in making a series of high-quality recordings with multiple tokens of the distinctive sounds of their respective languages and to point out to me particular features of each.

Introduction

Demography, Geography, and Status

While I employ the names Kam, Lakkja, and Hlai for these languages, they are often referred to by their Chinese names: Dong, Lajia, and Li, respectively, though native speakers prefer to be called by their own designations. The Kam people, who numbered more than 1,425,000 at the last census, reside mostly in eastern Guizhou in northern and southern settlements geographically separated from each other. A smaller number of speakers also live in southwestern Hunan near Tongdao and in northeastern Guangxi at Sanjiang. They are recognized as one of China's fifty-five official minorities. The Hlai, like the Kam, have a relatively large population. For that reason, they show geographic variation and constitute the majority in the local areas of habitation in the southern half of Hainan Island. The recent count of peoples in China put the Hlais at over 600,000 speakers. They are also an officially recognized minority and, like the Kam, possess a new romanized writing system of which they are justly proud. The Lakkja are much smaller in number (8,000 speakers) and are usually treated together with the Yao minority (Haudricourt 1967; Mao, Meng, and Zheng 1982). See figure 1.

Settlement Areas

Figure 1

A Sketch of Previous Research

Detailed research on linguistic aspects of these languages is only now beginning to appear in large amounts. Indeed, there has been a dramatic increase of information about Kam and Hlai in the last five years. Li (1965) reported having conducted fieldwork on Kam before the Second World War. Yet, until 1980 there was very little written about Kam; the comprehensive bibliography of Chinese materials (1949-1982) in *Minzu yuwen yanjiu wenji* (1982) lists only five items. Aside from a 1958 report on the new Kam orthography, the earliest published works listed are *Dong-Han jianming cidian* and *Han-Dong jianming cidian*, both from 1959. Haudricourt (1972) cites the former as the source for his information about Kam tonal tripartition. An introduction to Kam by Liang Min appeared in 1965 and *Dongyu Jianzhi* [Sketch of the Kam language] in 1980. Generally, research on Kam seem to have been more limited than that on other minority peoples of comparable size (Haudricourt 1972: 68 n.19, emphasis mine).

> Since the Kam are called in Chinese "Tung" (= Dong J.A.E.), I think it is preferable so to name this people of 712,000 souls, *whose language has not been recorded by any European traveller.*

Information about Hlai outside of China has been available in greater abundance and for a longer time. A few foreigners worked on Hlai during the Republican period; most significant is the important work of Stübel (1937) and especially Savina (1931). After 1949 there is the important contribution of Wang Li and Qian Sun (1951) on Baisha (White Sands) Hlai as well as thirteen other works listed in *Minzu yuwen yanjiu wenji* (1982) and especially Ouyang and Zheng (1980, 1983).

Lakkja, probably because of its size, has received much less attention. Haudricourt (1967: 165) states that he learned of its existence only in 1962 from work by the Russian linguist Yakhontov and then from a work on Yao from 1959. Lexico-statistic studies from this period suggested that Lakkja may occupy a position between Kam and Hlai (Solnit 1988; Thurgood 1988). In fact, the names Kam and Lakkja themselves suggest a relationship; *nomen est omen*. Yang Quan believes that Lakkja in reality may be cognate with the name Kam. Lakkja, he says, is a compound from *la:k*^{10} 'child/people' and *ȶa*^{1}, a variant of *kam*^{1}, for example, *kja(m)*^{1}. Were the name to be rendered in Kam, it would be *lak*^{10}*kjam*^{1}.[2] This etymology is lent more credence from the fact that in some places the Kam employ the names *kjam, kjam, ȶam, lam,* or *kəlam* for themselves. Wang and Zheng in the *Sketch of Mulam* (Wang Jun 1984:

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[2] Another account suggested to me, however, is that *kja*^{3} in Lakkja means 'mountain'.

413) as well as Thurgood (1988) also point out that other groups of Kam-Sui speakers, the Luocheng Mulam, and the Then use *kjam* as autonym.

After 1980, the most accessible descriptions of these languages are contained in the outline grammars by Liang (1980), Mao et al. (1982), and Ouyang and Zheng (1980) for Kam, Lakkja, and Hlai, respectively. These sketches for Kam and Hlai and several other Kam-Sui languages are conveniently reprinted together in Wang Jun (1984), who has provided it with an introduction and a glossary for the comparatist. For Hlai, Ouyang and Zheng (1983) report in great detail on the inventory of sounds, number, and contour of tones and geographic variation sampled at ten locations on Hainan. There is also recent work in Matisoff (1988) and Thurgood (1989). There are volumes of similar scope about the Kam language in preparation by Professors Yang Quan and Edmondson. Again, material on Lakkja is more difficult to unearth. I know only of the descriptions given in the above mentioned Mao et al. (1982), Haudricourt (1967), Solnit (1988), and my field notes. The most extensive discussions in English on these and related languages are found in Edmondson and Solnit (1988).

Distinctive Sounds of These Languages

Because of their phonological and lexical similarities to each other and differences to Common Tai, Li Fang-kuei (1943) proposed that languages such as Kam, Sui, Then (Yanghuang), Mak, and Ai-Cham be named Kam-Sui (Dong-shui). Chinese scholars have since related Lakkja to this branch as well (Mao et al. 1982).

Tone Splitting in Kam-Sui

Kam-Sui languages are assumed to have undergone tone development and splitting in a manner widely attested in East Asia. Haudricourt (1972), for example, suggests that the original proto-tones of the common Kam-Tai—called A, B, C, DS, and DL—were subject to phonologically conditioned change according to the state of the larynx at syllable onset, that is, whether the initial consonant was a voiceless friction sound (Gedney 1972), voiceless unaspirated stop, glottalized consonant, or voiced consonant. Whether tone splitting is due purely to an automatic, attendant circumstance of coarticulation and if so what the exact physiological mechanism of this phenomenon is, remains contentious; see Hombert et al. (1979) for discussion of three accounts, as well as Ballard (1984), and Rischel (1986) for some reasons why physiologically motivated solutions may be inadequate. Since two tone categories usually result, Brown (1975) has spoken of the Great Tone Split (also see Strecker 1979). Although The Great Tone Split had the potential to produce from the A, B, C, DS, and DL proto-tones as many as twenty A, B, C, DS, and DL times four initial consonants (refer to the checklist in Gedney 1972), the number of the tone contrasts is always reduced in the daughter languages, as mergers or subsequent splits act on tonal categories in a complex manner, which then become the distinctive characteristic of that regional variety (Brown 1965, Tienmee 1985). In Tai, the usual effect of the splitting process takes place for all the tones of a given language according to the principle voiced-low (and voiceless-high), the original voiced initials tending to lower a tone and the original voiceless initial tending to remain high (Brown 1975: 33); the opposite voiced-high (voiceless-low) also occurs widely. The usual number of reflexes in daughter languages after the split is two (bipartition). Bipartition in Haudricourt's data is attested about three times as often as more complex splitting.

While the Great Tone Split leading to bipartition seems to have been the majority pattern of development, Haudricourt (1972: 68-76) describes what he calls tonal tripartition or three-way splitting in the Kam-Sui group as well as for some varieties of Miao-Yao. For example, Mak and Ai-Cham evidence the tripartition of the A tone, see Li (1965) and Haudricourt (1972). Some varieties of Nung are said to possess it too. Haudricourt also cites Mun of the Cao Bang District of Vietnam as having tripartition of B and C tones. In *Miaoyu gaikuang* (1962: 30) it is reported *that Jiaotuo Hmong possesses an uncoalesced tripartition.*

The Great and Second Tone Splits in Kam

Haudricourt (1972: 70) also notes of Kam that it, too, has developed *tripartition in the categories A, B, and C.* Moreover, he observes that it would be "...rare for such a heavily loaded tonal system to be retained"; usually there is a coalescence or merger of some of the contrasts. In spite of this tendency, Liang (1980) shows that the tripartition does, in fact, occur not only in the open syllable tones discussed by Haudricourt but also in the two closed-syllable D Tones. However, Shi (1981) and Yang Quan (p.c.) from comparative reconstruction across twenty lects of Kam conclude that the tone system in Kam is the result of two distinct historical events: the Great Tone Split and a subsequent Second Tone Split. The odd-number tones divide again into prime and non-prime reflexes (see below on tone labels).

Two Tone Splits in Kam

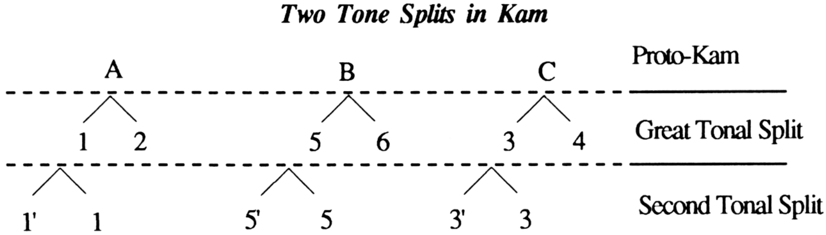

Figure 2

The evidence in support of this claim rests largely on the pattern of the tone-initial interaction across different varieties of the language. First of all, there are lects of Kam such as at Sanjiang Heli, Liping Shuikou, Liping-Pingtu, Congjiang-Guandong, and Rongshui-Zhaihuai that have *not undergone the Second Tone Split, as they fail to show tone distinctions* between aspirated and unaspirated initials, that is, these have only six tonal reflexes of A, B, and C instead of nine. To say it another way, there are no prime tones; lexical items of an original tone class, for example A, with an aspirated initial and those with an unaspirated stop have exactly the same tonal contour, for example, *p'a*^{35} 'gray' and *pai*^{35} 'to go' at Sanjiang-Heli. Secondly, there are varieties of Kam such as at Tianzhu-Shidong, Jianhe-Xiaoguang, and Sansui-Kuanchang in which the initials have merged after tone division; the aspirated initial stop series has coalesced with the unaspirated stop series, for example, *ko*^{35} 'to laugh' and *ka*^{11} 'ear' at Tianzhu-Shidong. Nevertheless, the majority of the lects manifest both a difference in initials and in tones, for example, *p'a*^{35} 'gray' and *pa*^{55} 'fish'. One can clearly see a progression of development from no split, to a split with the conditioning factor still present, to a split with the conditioning factor leveled. Yet, no such variation can be found in the progress of the Great Tone Split; it has run its course and has become totally general in all lects. This non-uniformity suggests, at the very least, that the Second Tone Split began at a much later date than the Great Tone Split.

In comparison, Lakkja has undergone only a bipartition of the proto-system; while in the variety of Hlai discussed here A, B, and C have not split at all, and D has divided in accordance with principles other than voiced-low. Ouyang and Zheng (1983) have found, however, that some varieties of Hlai have split, resulting in as many as ten categories (Matisoff 1988).

Qualitative Descriptions of Kam Initials and Tones

It is common practice to classify and compare different varieties of a language with tables of tonal mergers and coalescences. In figures 3-5, I have given the tonal contours in each box of the chart as reported for the variety studied. Below the numbered categories 1-10 along the horizontal are the tone group numbers given to these tones by Chinese linguists and the letters A-D the tonal class in the proto-language from which these presumably came assigned to them by Kadai linguists. In the vertical, 1-4 correspond to the laryngeal states: (1) voiceless friction sounds, original aspirated stops, and voiceless continuants; (2) unaspirated stops; (3) glottalized sounds, and (4) voiced sounds (in the manner of Gedney 1972).

Jinxiu Lakkja initial-tone interactions. Beginning with the language that shows the more common bipartition pattern, consider the coalescences for Jinxiu Lakkja shown in figure 3.

Lakkja Tone-Initial Correspondences

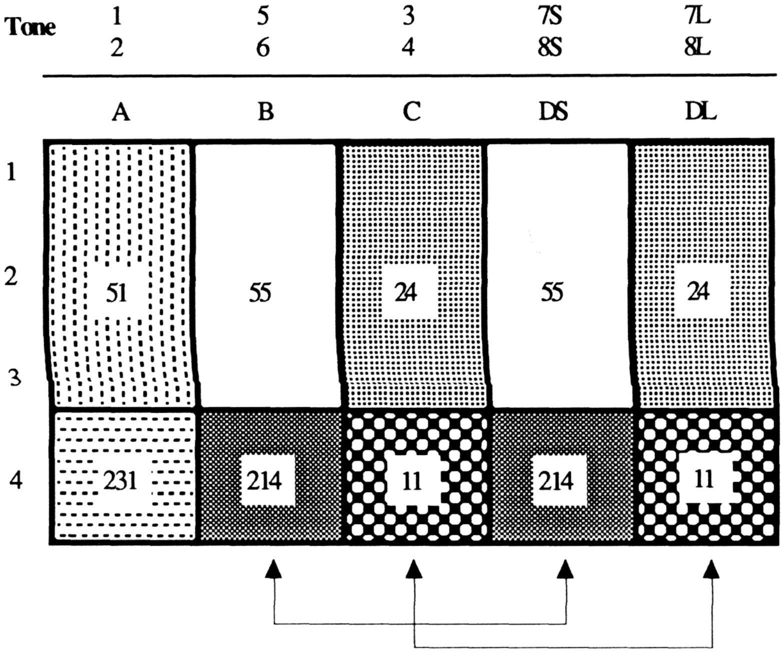

Figure 3

In the vertical dimension, two categories result from the four original laryngeal states; voiceless friction, unaspirated stops, and glottalized consonants have merged, while the voiced series survives intact. Because voiceless friction sounds (aspirated stops and voiceless continuants) have changed little in Lakkja native words, we find examples of these only in odd-numbered tone, that is, those in the left column below. In the wordlist in Mao et al. (1982) I found no exceptions to this rule. Consider the following representative examples (Gedney 1972; Li 1977).

A1/A2/A3: *khwə̃*^{1} 'dog'/*pei*^{1} 'year'/*bie:n*^{1} 'month' A4 *mie*^{2} 'hand'

B1/B2/B3: *thon*^{5} 'inch'/*kai*^{5} 'chicken'/*fei*^{5} 'four' B4: *ti*^{6} 'dry field'

C1/C2/C3: *ba:n*^{3} 'village'/*ka:m*^{3} 'cave'/*fa*^{3} 'cloud' C4: *ma*^{4} 'horse'

DS1/DS2/
DS3: pet^{7} *'duck'/tap*^{7} *'liver'/thet*^{7} *'seven' DS4: kjak*^{8} *'to steal'*

DL1/DL2
/DL3: *pa:t*^{7} 'eight'/*hjie:t*^{7} 'to rest' DL4: *lie:t*^{8} 'blood'
DL tones are lower than their short counterparts.

Baoding Hlai initial-tone interaction. A similar presentation of the pattern of differentiation and coalescences in Hlai is given in figure 4 (data from Ouyang and Zheng 1983). Notice that the splitting of D tones does not follow the pattern found in the other two languages.

Hlai Tone-Initial Correspondences

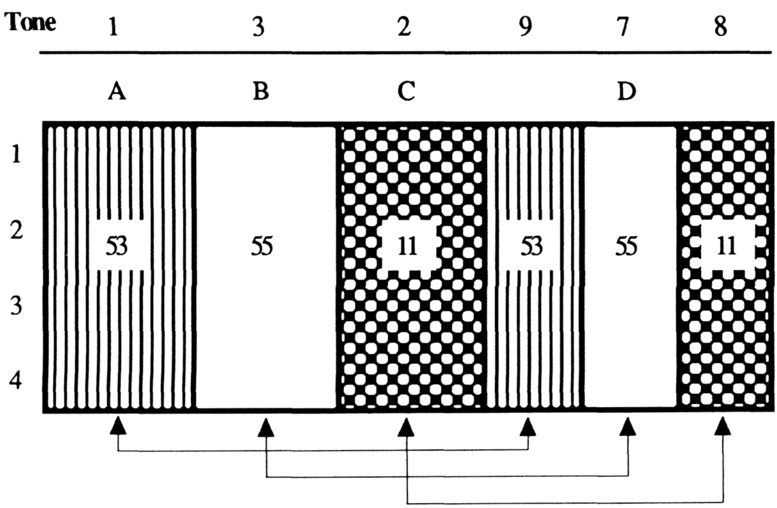

Figure 4

A: *ku:n*^{1} 'road'/*then*^{1} 'wasp'/*beñ*^{1} 'fly'/*fan*^{1} 'tooth'/*meur*^{1} 'hand'

B: *pa*^{3} 'proclamation'/*pha*^{3} 'father'/*bai*^{3} 'already'/*fun*^{3} 'rain'/*nam*^{3} 'water'

C: *ta*^{2} 'ricefield'/*tha*^{2} 'rice, food'/*da*^{2} 'register'/*ła:u*^{2} 'die'/*ma*^{2} 'that'

D7: *pat*^{7} 'take'/*phat*^{7} 'method'/*bak*^{7} 'north'/*vat*^{7} 'socks'/*mat*^{7} 'flea'

D8: *te:p*^{8} 'to shout'/*phe:k*^{8} 'to press with the foot'/*be:k*^{8} 'fishing tool/ *rat*^{8} 'beads'/*map*^{8} 'pure'

D9: *ko:p*^{9} 'put close together'/*kho:p*^{9} 'to meet'/*bop*^{9} 'sound of things falling on ground'/*łop*^{9} 'suddenly'/*ñok*^{9} 'trend'

Chejiang Kam initial-tone interactions. Having seen an example of bipartition and of no partition, let us now consider the most complex tonal system of all—the pattern of tonal differentiation and coalescence in Kam (contours represented here are from the Chejiang variety). The prime labeled tones correspond to aspirated initials.

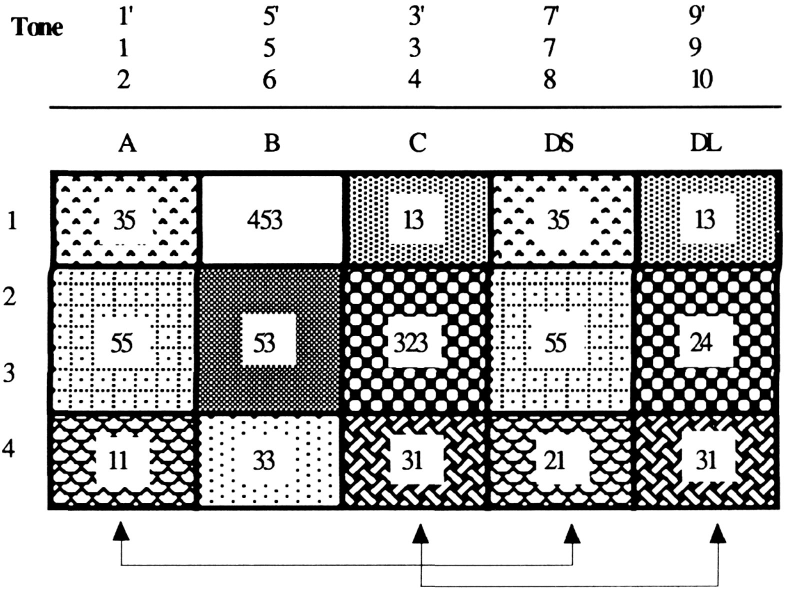

Figure 5

The arrows below the diagram represent the coalescence pattern of closed syllable tones with open syllable tones.

Representative examples are:

A1: *ŋwa*^{1} 'dog' A2/3: *ta*^{1} 'eye' A4: *mja*^{2} 'hand'
kha^1 'ear'

B1: *məi*^{5} 'new' B2/3: *ʔai*^{5} 'chicken' B4: *ti*^{6} 'dry field'
thəu^5 'bark'

C1: *həɪ*^{3} 'sea' C2/3: *pa*^{3} 'aunt' C4: *ma*^{4} 'horse'
ŋwau^3 'alcoholic beverage'

DS1: *ŋwat*$^{7'}$ 'flea' DS2/3: *ʔəp*^{7} 'frog' DS4: *ljak*^{8} 'to steal'
thət$^{7'}$ 'seven'

DL1: *khe:k*$^{9'}$ 'guest' DL2/3: *ʔa:p*^{9} 'to bathe' DL4: *mit*^{10} 'knife'
pha:k$^{9'}$ 'hit'

Kam has developed and maintained a full nine tone load (in open syllables) without coalescences. And, in fact, the divisions across A, B, and C are made in the same initial environments. But, the usual sign that a displaced contrast in a tone split has occurred, that is, the loss of the consonantal distinction causing the change, has taken place in a non-uniform manner. I have already examined this variation briefly. In Chejiang Kam, aspirated stops are found only in the first column; other sounds are not so limited. It does appear, however, that [voice] has largely disappeared in Kam as a consequence of the Great Tone Split; the feature is no longer distinctive.

Phonetic Results

Having presented an account of the initial-tone interaction based on descriptions and auditory impressions, I now turn to the experimental procedures I used in investigating these lects instrumentally.

Methods Used in This Study

The native speaker helpers were requested to repeat each of a minimally contrastive set of tone-initials five to ten times. A series of examples of the phonological contrasts allowed me the freedom to select one of the middle tokens in the sequence for spectral analysis and also made it possible to construct tone composites from the set (see below). In figures 6-8, I present tonal plots for representative examples of the sets gathered. However, a wide range of data with various initial and final forms were analyzed.

The data for this analysis were recorded on a Sony TCM-5000 cassette tape recorder using a Unisound EM-84 electret condenser microphone attached to a headset with adjustable boom and high-quality recording tape in order to assure nearly flat frequency response over a range of 50-5000 Hz. The microphone was placed in a position just outside the airstream so that the resulting recordings demonstrated a very high signal-to-noise ratio. This technique obviated the need for a soundproof booth. The data were subsequently analyzed at the Behavioral Neurology Laboratory of the University of Texas Health Science Center at Dallas with a PM Pitch Analyzer (Voice Identification, Inc.) digitally interfaced to a PDP11/23 (Digital, Inc.) computer for studying tone contours and energy distribution across the syllable.

The major function of the computer was to construct tonal composites from the fundamental frequency (pitch) from the repetition of each minimal contrast. Tapes of the tone tokens were played into the PM Pitch Analyzer, which produces output in digital form. The results were also displayed as upper and lower traces on the CRT of the Pitch Analyzer.[3] At the same time, the PDP 11/23 was programmed to access the fundamental frequency (in Hz) and intensity data (in dB) every centisecond (csec) through a 16 bit parallel interface. For each utterance analyzed the data points were first stored sequentially in a data matrix and displayed on a computer terminal so that stray data points arising from microphone artifacts, voice breakups, or sampling errors, which are easily observed in the intensity and F_0 curves on the screen of the PM Pitch Analyzer, could be removed via a subroutine program from the matrix. The matrix of data points for fundamental frequency in Hz was then converted by the program into a matrix of data points in semitones.[4] The semitone and intensity data matrices were saved as files.

As was stated above, multiple tokens of each contrastive lexical item were elicited to produce a tone set for every tone category in each of the three languages. The tone tokens were played individually into the Pitch Analyzer and analyzed as described above until all the tokens of that set had been digitally processed and stored as separate files on disk. Once all the raw data had been analyzed, converted, and stored, then the normalized composite tone was computed by a second computer program that operated over the set of data files of the tone category. First, the mean length in csec, overall mean fundamental frequency in semitones, and intensity in decibels of all the tokens were computed. Then, the semitone and intensity data of all the utterances were time-adjusted to the calculated mean length of the utterances, maintaining the relative relationships within the F_0 and intensity contours (isomorphic mapping). In addition, each time-adjusted semitone data point was then adjusted for register by adding to it a constant, calculated to be the difference between the mean

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[3] Fundamental frequency is generally regarded as the most reliable acoustic concomitant of tone from the original work of Abramson (1962).

[4] This transformation is mandatory because many of the acoustical parameters we have developed for this study rely on measuring and comparing pitch intervals that occur around different mean frequencies. Because the perception of equal pitch intervals is not constant with increasing Hz, another pitch metric is needed. In music, maintenance of equal pitch intervals is traditionally accomplished by the use of chromatic scales. The physics underlying chromatic scales assumes that doubling frequency will preserve the pitch interval as an octave change (see below). The Hz scale may be converted into a useful, interval-preserving pitch scale according to the following relation (Fairbanks and Pronovost 1939: 94):

$$N \text{ (semitones)} = [\log_{10} f_1(\text{Hz}) - \log_{10} f_0(\text{Hz})]$$

If the equal–tempered chromatic (musical) scale (Hodgman 1961: 2503) is used as the standard, where A_4 - 440 Hz and C_0 = 16.35Hz (0 semitones), then the above relation becomes:

$$N \text{ (semitones)} = 39.86 \times \log_{10} f(\text{Hz})/16.35.$$

One obvious advantage to using the semitone conversion is that tone tokens from speakers with vastly differing natural fundamental frequencies, for example those of adult males and women or children, can be amalgamated into tone composites.

F_o of *all* the tokens and the mean F_o of that *particular* utterance. An analogous procedure was carried out to time-adjust intensity data points. Having been normed for time and register, the individual digitized curves were averaged point for point, as long as no data points were zero. The resulting set of normalized points was then written to disk and simultaneously printed out for subsequent plotting. The idealized data from the PDP-11/23 was transferred to an Apple Macintosh running Microsoft Inc.'s Chart. These F_o data were plotted on a line graph with a y-axis in semitones and an x-axis in time (csec).

In order to optimalize the presentation of results, I have indicated the laryngeal state of the putative, historical initial consonant in the chart (not necessarily the state in the contemporary language) by means of the following mnemonic: open squares signify original unaspirated stops and glottalized consonants, unfilled diamonds signify original voiceless friction consonants and, filled squares signify original voiced consonants. By using this kind of convention it is possible to identify at a glance whether or not a language has had a voiced low past.

Lakkja Tone Plots

Five to eight tokens each of the Lakkja lexical items were elicited and compressed by computer into tonal composites. The items displayed here are: *ta:ŋ*¹ 'to serve in the army', *ta:ŋ*² 'a classifier for courses', *ta:ŋ*³ 'to prevent access to', *ta:ŋ*⁴*ta:ŋ*² 'open, public', *ta:ŋ*⁵ 'to pawn', *ta:ŋ*⁶ 'to bury', *thok*⁷ 'to flatten a stack of paper', *tho:k*⁷ 'to rest the head on a table', *thok*⁸ 'term of endearment for a child', and *tho:k*⁸ 'to read aloud'.

In Lakkja, only bipartition has taken place and much of the assumed original initial consonant system is preserved (except for voiced and glottalized initials). Moreover, the voiced-low principle has operated without exception, as the solid box graphs in each of the tonal plots indicate. The instrumental results obtained for Lakkja confirm the general character of Lakkja A, B, and C tones as they have been described in Mao et al. (1982). Notable in the plots is tone 6, which, as in the Vietnamese *ngã* tone, has a creak or glottal closure throughout its middle third. The F_o curve clarifies the interrupted character of tone 6 (B4), which is somewhat misleadingly described as having contour 214, because there is no gradual decline in the F_o but rather a discontinuous stoppage of voicing or an abrupt change at 12 csec. If one regards this kind of voicing feature as the product of an original final consonant, then an interrupted tone may reflect a tendency in Lakkja to transport syllable-marginal prosodies to the mid-syllable position. David Solnit following Haudricourt (1967), has suggested, for example, that the nasalized vowels that contrast with plain vowels in Lakkja have originally been located at syllable initial, for example, Lakkja *khwə̃*¹ vs. Kam *ŋwa*¹ 'dog'. One other point of difference between the description in Mao et al. (1982) and my finding is the contour of the dead tone 7S. Although this tone is described as high level, I have found its contour to be rising.

Lakkja Tones

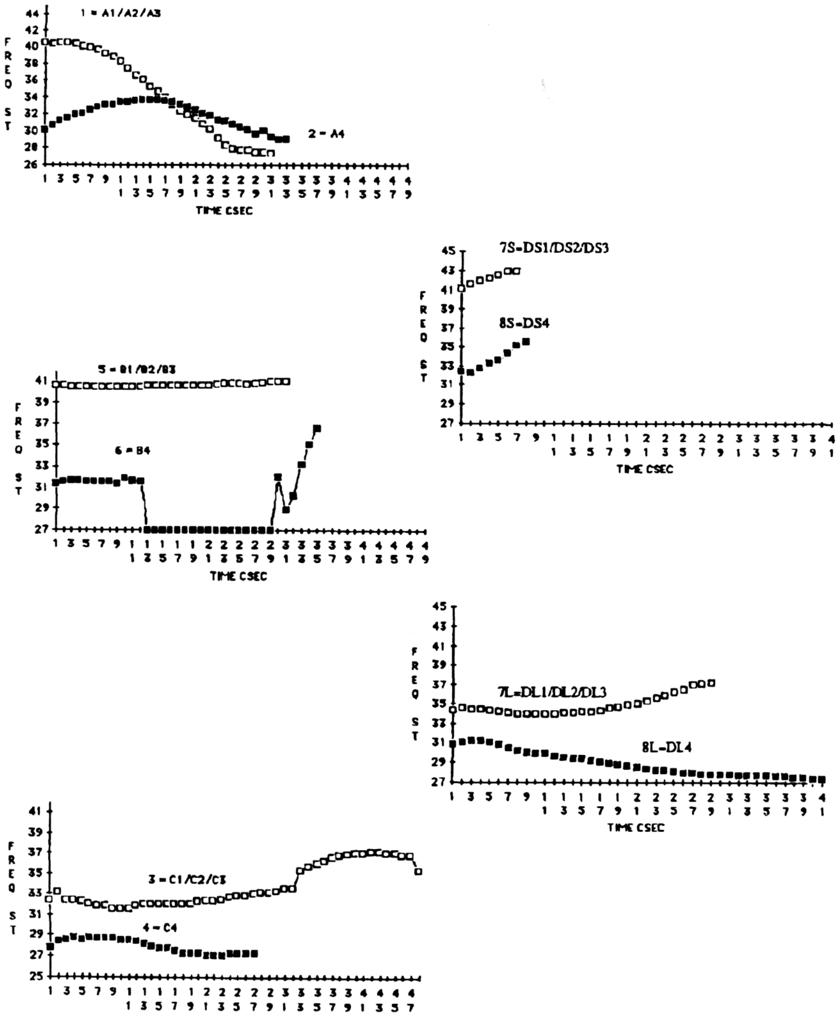

Figure 6

Hlai Tone Plots

The Baoding Hlai forms displayed in the following plots are: *ta*^{1} negation marker, *ta*^{2} 'ricefield', *ta*^{3} 'maternal grandmother', *lo:p*^{7} 'a set of something', *lo:p*^{8} 'knot', and *lo:p*^{9} 'okay'.

Hlai Tones

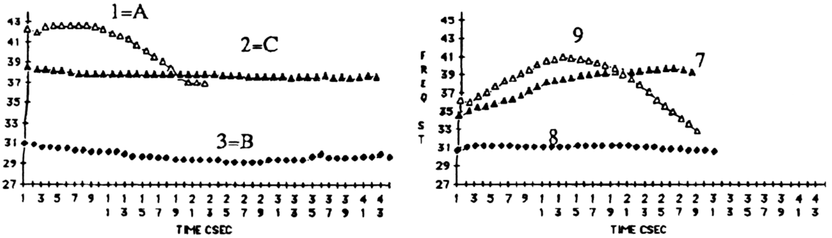

Figure 7

Although the D tones 7, 8, and 9 are supposed to resemble the open syllable tones, there is a considerable amount of depression of the fundamental frequency at the beginning of the syllables of tones 7 and 9 compared to their open syllable counterparts. Though they had been described to me as "somewhat higher," I did not find them to be so.

Kam tone plots

The following represent composite plots of the nine tones of Kam employing the examples given in Liang (1980): *pa*^{1} 'fish', *pha*$^{1'}$ 'grey', *pa*^{2} 'harrow', *pa*^{3} 'aunt', *phja*$^{3'}$ 'turn over', *pa*^{9} 'locust', *pa*^{5} 'leaf', *pha*$^{5'}$ 'break', *pa*^{6} 'husk', *pak*^{7} 'north', *phok*$^{7'}$ 'pour out', *pak*^{8} 'radish', *pa:k*^{9} 'mouth', *pha:k*$^{9'}$ 'hit', *pa:k*^{10} 'white'. These examples are representative of a wide range of initial consonant types in the various tones. So that the pitch contours maintain the same relative size, I have plotted the A, B, C, DS, and DL tones with x and y coordinates of the same scale.

As far as figure 8 is concerned, it is easy to ascertain that a tonal *tripartition has, indeed, taken place. The three open-syllable tones A, B,* and C evidence distinctive contours that approximate Liang's description quite well. Open-closed-syllable correspondences present an especially interesting area, as the shape of DS and DL match A and C very closely. The only surprise is that the syllables with final consonants are 3.87 ± .32 semitones higher than open syllable tones, even though they are assigned the same value on the "scale-of-five" system of tone transcription. The great consistency of this rise is apparent because the fundamental frequency is measured in semitones, a unit that is interval-preserving and not absolute (see below). Another anomalous result is that the C tone, which

I expected to be voiced-low as are A and B, is reversed; C4 is higher than C2 or C2/3 and, correspondingly, DL4 is higher than DL1 or DL2/3.

Kam Tones

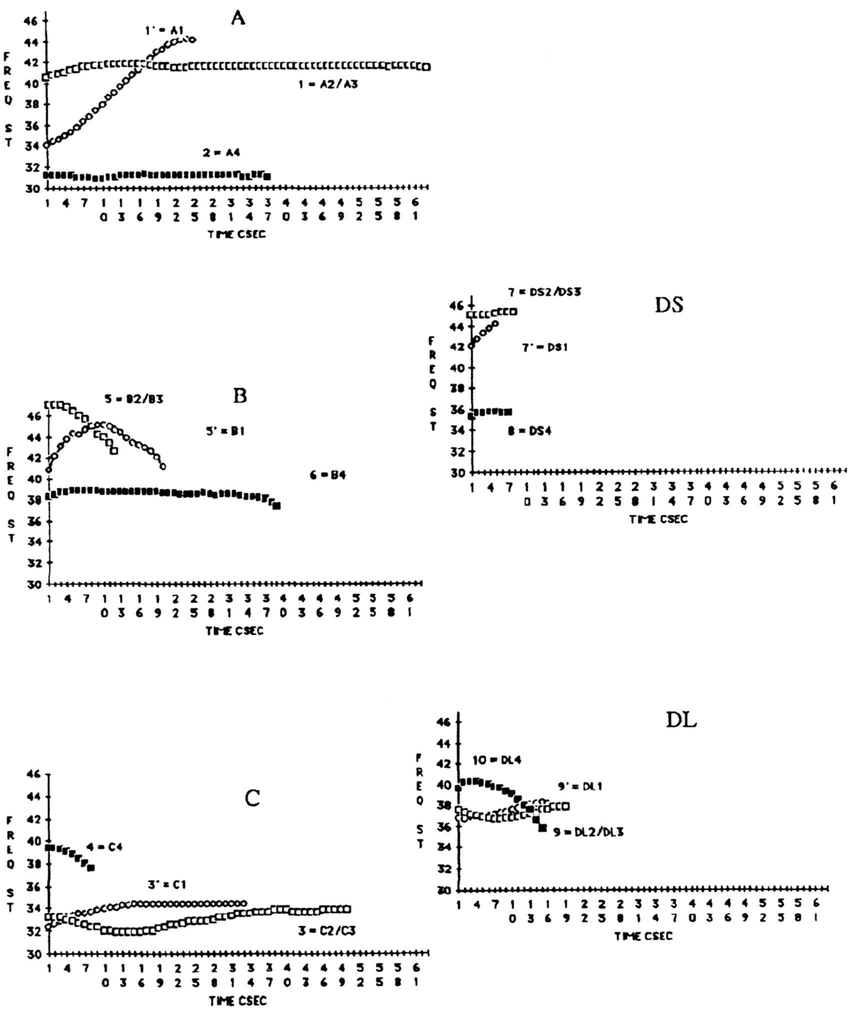

Figure 8

Breathy Initial Consonants in Tongdao Kam

As I have already pointed out, Chejiang Kam tones with prime marks are, according to Liang (1980), associated with syllables beginning with "aspirated" stops and modally voiced continuants (from original voiceless continuants). At one point in his description, however, Liang notes that in Tianzhu-Shidong Kam the tone-initial correspondence is different. The Tongdao variety, which Mr. Yang speaks, also proved to be one of these more complex and, for tonogenesis, more revealing varieties. Following Liang (1980) and Shi (1981), Tongdao may be compared to Chejiang as in figure 9.

Chejiang Kam

	stops	continuants
non-prime tones	//p pj t ȶ k kw ʔ//	//m mj n ȵ ŋ ŋw l lj s ç h w j//
prime tones	//pʻ tʻ ȶʻ kʻ kʻw ɦ//	

Tongdao Kam

non-prime tones	//p pj t ȶ k kw ʔ//	//m mj n ȵ ŋ ŋw l lj s ç h w j//
prime tones	//pɦ pɦj tɦ ȶɦ kɦ kɦw ɦ//	//mɦ mɦj nɦ ȵɦ ŋɦ ŋɦw lɦ lɦj sɦ çɦ vɦ vɦj zɦ jɦ//

Figure 9

Liang and Shi are thus reporting that a division between the HIGH (non-prime) and RISING (prime) tones exists for *all* initials not just stops in Tianzhu Shidong and, as I found, in Tongdao. However, to confirm that this difference exists, it is necessary to look not only at the fundamental frequency of a syllable but also to investigate the nature of the phonation of the initial. To this end, I subjected a wide range of such initials with various points and manners of articulations to spectrographic analysis using the VII Series 700 Sound Spectrograph (Voice Identification, Inc.). I had elicited a series of minimal initial-tone contrast from Mr. Yang, and once he had grasped my intention, he was able to utter a large set of tone-initial combinations, some of which do not exist in the language. In other words, the relationship between tones and initials still appears to be very close.

The spectrograms of initial stops, nasals, and fricatives in prime and non-prime syllables are grossly similar in their appearance. The contour, location, number, and distributions of formants for the two types are virtually identical. It also seems clear that difference is not basically a difference of voice onset time, that is, aspiration, at least for this speaker.[5] The near identity in the configuration of formants suggests that the utterances do not differ in the shape of the vocal tract (the resonance filter) but rather in the mode of phonation (acoustic energy source). Although the global structure of formants was similar, aspects of the phonation perceivable in spectrograms are quite distinctive. The RISING register syllables (that is, those called "aspirated") evidence irregular glottal vibration as is seen in the formant striations. In stops these began before release and lasted well into the vocalic part of the syllable. Moreover, the formants were often superimposed upon a background bottom-to-top white noise, the sign of friction that lasted for the first third to half of the syllable. Both of these are consistent with a phonatory quality of breathiness or murmur, a sound produced by vocal chords characterized as flapping in the airstream without touching and thus having an irregular component in their oscillation (Catford 1977). The heightened airstream flow also produces some friction of the sides of the folds. By contrast, initials from non-prime (HIGH) syllables showed formant bands with the regular striations of glottal pulsing and a lack of accompanying acoustic friction. Two examples of these spectrograms are given in figure 10. More definitive tests of breathy or murmur phonation are now being carried out on these data.

Breathy phonation is a phonetically more reliable depressor of vowel fundamental frequency and could, therefore, much better account for the fact that prime tones in Kam always have a lowered onset (that is, are rising) whereas all non-prime tones are falling or flat (Henderson 1982). The effects of murmur in Kam is the subject of Edmondson (1990).

Conclusion

In this study, I have found instrumental confirmation that there has been no voiced low/voiced-high split of tones in Baoding Hlai, that Jinxiu Lakkja shows simple voiced-low bipartition of all its tones, and that Tongdao Kam possesses nine contrasts of tone in A, B, and C categories. I have also argued that in Kam the panlectal data are suggestive of a sequence of two tonogenetic splits, the second of which is still in progress at some places. The most likely cause of this second split is not the aspiration but murmur phonation of the initial consonant. While Kam-Sui is known for retaining glottalized initials, breathiness is not widely

[5] The VOT of primed tones did seem, for many utterances, to be somewhat longer but not markedly and consistently so.

reported in this family. It seems relatively certain, nevertheless, that this feature has played a role in the second split of Kam tones. It cannot be said that this Kam-Sui data definitively lay to rest whether tone splitting is low-level, universal, and automatic or whether high-level, language-specific, and phonological factors are involved. That Kam possesses *murmur* voicing in some varieties suggests that the physiological fact of coarticulation can cause splitting, but that Hlai in some varieties has not undergone splitting suggests that it need not. In any case, it appears that soon we will know more about a language group that has until recently been swathed in darkness.

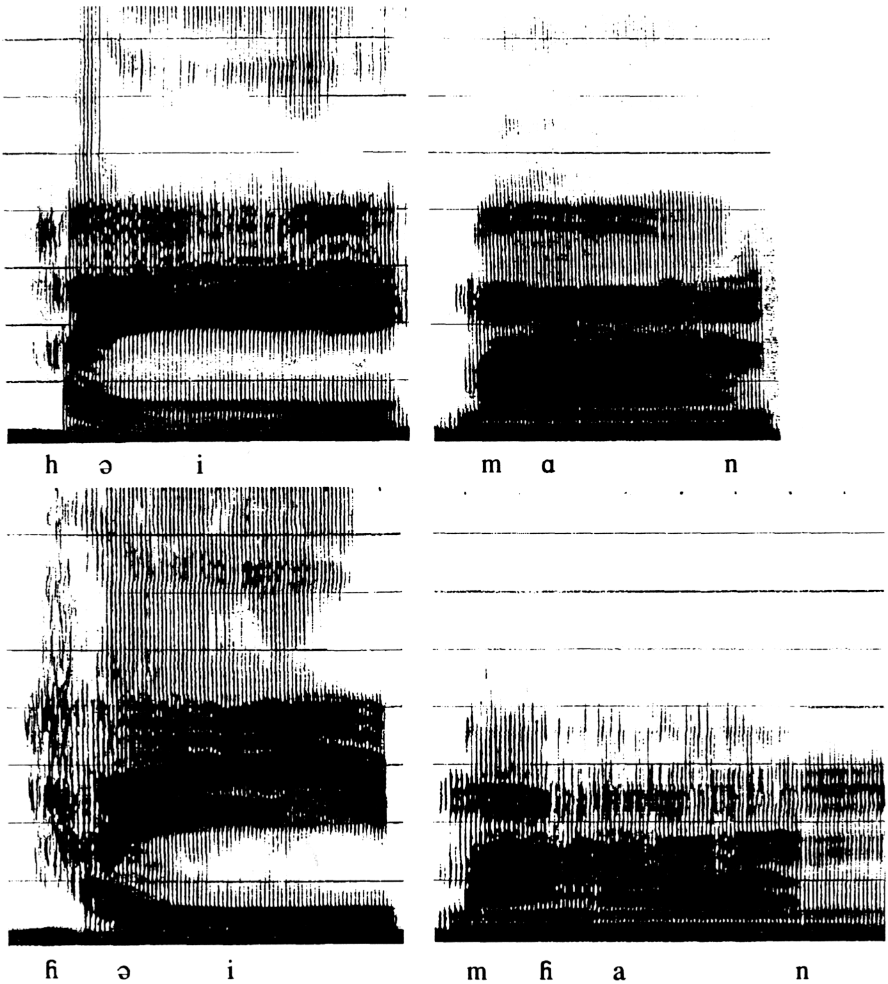

Figure 10

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Part III: Syntax and Semantics