High Tone - Low Tone

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อยู่ อยู่

You. You. Readers may recognize this common way Thai children greet foreigners along streets or canals, but how many readers know what reaction is caused in the foreigner's heart or mind? Humiliation and resentment, and there are two reasons for this: (1) "you" as a single word called out is rude in English; (2) any word called out with a loud falling intonation has the potential of signalling a strong emotion like impatience, accusation, warning or anger. Put together, (1) and (2) have the effect of ไอ้บ้า, ไอ้เหี้ย. If (2) were changed, perhaps to อยู่ อยู่, we would still not be at the level of polite speech, but the reaction for most foreigners would be much less strong, only มึง....ไอ้....

So even though English is not a "tone language", rising and falling intonation are very important and have the power of penetrating into the inner heart and mind. In fact, as far as research indicates,[N(1)] every language in the world makes some systematic use of change in pitch. In the following sections we will consider some basic features of tone and how they relate to the Thai language.

1. Classification.

Broadly speaking, languages can be classified into four groups depending on how tonal features are used.

In languages of Type I, tonal characteristics are not inherently part of individual words, but are added to words in a speech segment according to what type of emphasis is desired, what type of feeling to be evoked, or what kind of sentence construction is being used. The difference between a positive and negative sentence in some African languages is a matter of sentence intonation only.[N(2)] The majority of the world's languages are Type I, such as French, Spanish, English, Hindi, Malay, etc. We cannot make perfect equations between words of a language of Type I. and Thai words according to sound, because we cannot determine which of the Thai five tones is "correct"--the question is meaningless. The English word "cow" may be pronounced approximately, คาว, ข่าว, ข้าว, คาว etc., according to context:

(a) Is that a cow (วัว) or a buffalo?

(b) It looks more like a cow (วัว).

(c) What kind of cow (วัว) is it?

For English, there are social and regional differences in intonation. In New York, a polite request usually rises:

```
                                        the jam?
                                pass |
                      please |
        Could you |
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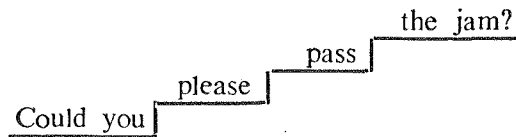
In London, the same polite request usually falls:

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                          pass
        Could you please |
                            | the
                              | jam?
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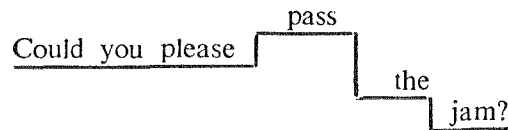
Americans not aware of this difference may feel an unintended emotional message. They may hear àn Englishman's request as haughty and conceited.[N(3)]

In languages of Type II, tonal characteristics are inherently attached to one syllable of two-syllable words. Usually a system of stress and perhaps vowel length is involved too. In Japanese **hana** can mean "flower", "nose," or "beginning" depending on which syllables have normal or higher pitch.[N(4)]
In Norwegian, compare:

(a) ăksel (rising pitch) "shoulder"

(b) âksel (falling pitch) "axle" [N(5)]

Or in Swedish:

(a) andên (falling pitch) "soul"

(b) andèn (low pitch) "that duck"

Sometimes tone characteristics of this type are associated with noun or verbal endings. Serbo-Croatian has cases meaning "ให้" and "ก" indicated by falling and rising tones. ——— Lithuanian and Ancient Greek also have tones associated with certain endings, as in this Ancient Greek example where tones were probably similar to Thai "tri" and "thoo" : [N(6)]

(a) O'L KOL (อ้อนกอน) at the house (locative singular)

(b) O'L KOL (อ้อนกอน) houses (nominative plural)

The ancestor language of Greek, Sanskrit, Pali, English, French, etc. is called Indo-European and was probably a Type II language. Traces remain in Vedic Sanskrit, where three pitch accents were recognized:

udatta	อุทาตต (สูง)
anudatta	อนุทาตต (ต่ำ)
svarita	สวริต (สูง-ตก)

These had to do with religious chanting and were identified with musical pitches in a scale.[N(7)]

Only languages of Type III, which includes Thai, can be counted as true **tone languages.** Here every word, — normally every syllable — has a specific tone assigned to it.

Most of the world's Type III languages are in one of three broad locations: (a) East and Southeast Asia, like Thai, Chinese, Karen, Meo, Yao; (b) Africa, like Mende and Ewe to the west, Xosa and Tswana to the south, and Kikuyu, Somali and Luganda to the east; (c) among American Indian tribes, like Ticuna in Brazil, or Mazateco in Mexico.

In Mazateco, tones play such an important role that even without consonants and vowels, a message can be understood if only the correct tones are indicated. Mazateco men have a "whistle speech" system. Here is an account by Dr. Geroge M. Cowan:[N(8)]

> *Eusebio was observed one day standing in front of his hut, whistling to a man a considerable distance away. The man was passing on the trail below, going to the market to sell a load of corn he was carrying. The man answered Eusebio's whistle with another whistle. The interchange was repeated several times with different whistles. Finally the man turned around, retraced his steps a short way and came up a footpath to Eusebio's hut. Without saying a word he dumped his load on the ground. Eusebio looked the load over, went into his hut, returned with some money, and paid the man his price. Not a word had been spoken.*

Also, certain drum signalling systems in Africa are based on the tonal features of speech.

Languages of Type III differ as to how many tones are used to distinguish words. Also individual characteristics of pitch differ. Some examples:[N(9)]

language	number of level or rising tones	number of falling tones	total
Mende	2	0	2
Karen (Palaychi)	1	1	2
Tswana	2	1	3
Luganda	2	1	3
Mazateco	3	0	3
Mandarin Chinese	3	1	4
Ewe	3	1	4
Somali	4	0	4
Xosa	4	0	4
Thai (Bangkok)	4	1	5
Kikuyu	4	1	5
Ticuna	5	0	5
Yao (Yanglae)	3	3	6
Canton Chinese	4	2	6
Amoy Chinese	4	3	7
Black Meo	7	1	8

Some Type III languages have a high proportion of one-syllable words, like Ewe[N(10)]:

(a) tò   (ໄທ)   buffalo

(b) tó   (ໄທ)   car

(c) tŏ   (ໄທ)   mortar

Other languages favor words of two or more syllables, such as Igbo, spoken in Nigeria[N(11)]:

(a) àkwà   bed

(b) ákwá   cry

(c) àkwá   egg

(d) ákwà   cloth

Type IV includes a few languages, such as some in the Mon-Khmer group. Here two **registers** are distinguished, which are not simply a matter of pitch difference alone. The "chest register" and "head register" of Mon are described by Professor H.L. Shorto as follows:[N(12)]

The register distinction is inherent in all Mon words....Chest register, characterized by breathy voiced quality in association with a general laxness of speech organs and a somewhat centralized articulation of vowels, is shown by the grave accent as in kèt (to rotate, เกิด)....Head register, characterized by a clear voice quality, is left unmarked, as in ket (to get, เกิด)....In chest register words, k, c, p, s are partly voiced in initial position and fully voiced in medial position.

In some languages of this group, like Khmer, registers are only used by some speakers in careful styles of speech to distinguish words: otherwise vowel differences are the means of distinguishing such words.

In Europe, the languages Latvian and Danish distinguish words by laryngeal sension, which probably indicates classifying them as type IV In Danish, vowels with this tension are called stød, and the Danish letter ø indicates this sound. (N13)

Several languages in the Tibeto-Burman group are of Type IV. Some Tibetan dialects have a two-way register distinction, (most clear when words are pronounced in isolation) while others do not have register but compensate by added initial clusters. Burmese should probably be classified as Type III, but it shows interesting Type IV characteristics, as in this description by Professor Robert B. Jones: N(14)

All dialects have....two pitch levels--high /ꞌ/ and low/ˎ/, each of which has rising, level and falling allophones....With high pitch, vowels terminated by a glottal stop are relatively long, tend to have a slightly higher allophone, are laryngealized....With low pitch vowels terminated by a glottal stop are short, high vowels are lowered, low vowels are raised, mid vowels are....diphthongized... The voiceless nasals produce a pitch allophone higher than....voiced nasals ....Thus the syllables/mà ham mà? hmà?má hmá má? hmá?/ represent eight onset points from lowest to highest.... In general, (vowels) which do pitch not terminate in a glottal stop are distinctively open in quality, with low pitch even somewhat 'breathy'

2. Tones and other linguistic systems.

For languages of Type IV above, we observe interactions between different constituents of the syllable such as register, consonants, and vowels. Also in Type III languages pitch may interact with other syllabic features.

Xosa was counted above as having four tones, but actually these tones are realized in two different ways depending on two different sets of initial consonants. So one might claim there were really eight tones.

Final consonants also interact with tone in important ways. We know that Thai has five possible tones for live syllables (คำเป็น):

เสียงสามัญ	เสียงเอก	เสียงโท	เสียงตรี	เสียงจัตวา
คา	ข่า	ข้า ค่า	ค้า	ขา

Dead syllables can easily be matched with live ones having the same pitch characteristics. Vowel length is sometimes relevant.

$$\text{ขัด, ขาด like ข่า}$$
$$\text{คาด like ค่า}$$
$$\text{คัด like ค้า}$$

In most types of Cantonese, six tones are possible for open syllables, but, unlike Thai, dead syllables cannot always be easily matched with live ones. Depending on which matches are accepted, there are from six to twelve tones.

Vowels also interact with tone, as in the Thai and Burmese cases above. In Foochow Chinese, the vowel เอ becomes อ and โอ becomes อ for high-tone syllables.[N15] In some dialects of Southern Thai, the opposite change seems to have happened in dead syllables and those spelled in the writing system with maay eek or maay thoo. The same pattern usually applies to เออ-ออ Thus :

|				
มิด,	ท้,	เก้า	บางท้องถิ่นได้ออกเสียงเป็นสระ	เอ
ลูก,	ก้,	สู้	,, ,,	โอ
คืบ,	อ้น,	ซ้อ	,, ,,	เออ, เอ-
(แต่	มิ,	บิ,	ก้,	หู, ถือ ฯลฯ ไม่ได้เปลี่ยน สระ)

In connected speech, when words of a tone language come together into compounds, phrases and sentences, often certain changes are made. In careful Thai speech a word like หนังสือ may be pronounced with two "cattuwaa" tones as หนัง+สือ but in faster usual speech the tone of the first syllable is shifted upwards. Changes of this sort are referred to as *tonal sandhi*, although in Thai there is also a question of spelling pronunciation or the influence of writing on speech.[N16]

In Mandarin Chinese a similar rule of tonal sandhi goes further, and in one case leads to loss of contrast and to the confusion of words.

tone 3 (low rising)	+	tone 3 (low rising)	→	tone 2 (high rising)	+	tone 3 (low rising)

Thus the compound $\text{fen}_3\text{-chang}_3$ gets to be pronounced $\text{fen}_2\text{-chang}_3$, and words meaning "flour factory" (3+3) and "grave yard" (2+3) are now pronounced the same way (2+3)[N17]

In Amoy Chinese there is a tone–sandhi circle, where four tones replace each other in certain contexts :
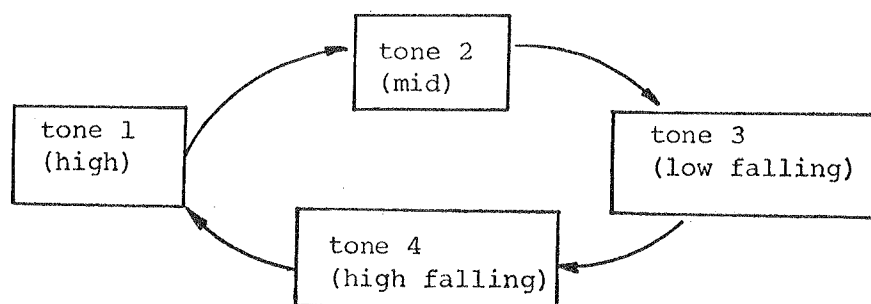
saa$_1$ "three" $\longrightarrow$ saa$_2$kho$_1$ "three coins"

go$_2$ "five" $\longrightarrow$ go$_3$kak$_3$ "fifty cents"

si$_3$ "four" $\longrightarrow$ si$_4$kak$_3$ "forty cents"

hou$_4$ "good" $\longrightarrow$ hou$_1$ciaq$_1$ "good eating"[N18]

Linguistic structures beyond the sound system may also be involved in tones, as we saw above in the Ancient Greek example.

In Ngbaka, a Type III language spoken in Zaire in Africa, different tenses or times of action of the verb "to put" are shown by changing tones approximately similar to the Thai syllables :[N19] อื่า อา อ้า อ๋า Add Conkundo (Nartihet P.78) อะทะโอะ { หมุ่า / มา

In Ewe a tone approximately like Thai "siang tri" is changed to "siang cattuwaa" to show a command :[N20]

    (a) วั๋า   (มา)

    (b) เม วั๋า   (ฉั๋น มา)

    (c) หวา   (มา เถ่ด)

    (d) เม นั๋า   (ฉั๋น ให้)

    (e) หนา   (ให้ เถ่ด)

Tone in Ewe depends on an interaction of word characteristic, rules of tonal sandhi, grammatical meaning, and sentence structure.

In Chinese some scholars have noticed verb–noun pairs like these in Mandarin :

shu$_4$ – number   shan$_4$ – a fan   lian$_4$ – chain

shu$_3$ – to count   shan$_1$ – to fan   lian$_2$ – to connect

Here shift to tone 4 makes a verb into a noun. Some scholars think this may reflect an earlier stage of the language when tones, or something that later caused tones, had direct influence on the grammatical system.

In Thai also we find pairs like เขียว-เคียว, เคียว-เกี่ยว but there are not many. At present the most important use of tonal shifting, besides phenomena like tonal sandhi, is in emphasis: ดี ดี etc. [N21]

3. The production and perception of tones.

Having seen some ways tones occur in language, we might wonder how they arise. Readers are probably aware that certain sounds of language are associated with different parts of the mouth, for example, ป with the lips; but what part of the mouth accounts for tones? The answer is actually no part, since all important features of tone are produced before sound reaches the mouth.

In the neck are located the vocal cords, or thyrovocalis muscles. These are movable organs which can open and close a gap in the windpipe. This gap, called the glottis, can be opened about 8mm wide and as for length can be stretched from about 12 to 20 mm long for men. For women, there is a 20% reduction.[N22]

The brain, where language functions are mainly concentrated in the left front part, can send commands down the Vagus nerve to the vocal cords. It can order them to close abruptly, which is the characteristic of อ. It can order them to stay open quite wide, letting air go through and up out the mouth, which is the characteristic of ห and of all aspirated sounds. Also there can be a command to the vocal cords to open and close, open and close, very quickly as air passes up towards the mouth. This sets up a pattern of vibrations which can be studied through high-speed moving pictures. This vibration causes two important linguistic features: voicing and pitch.

A man is usually able to open and close the gap in his windpipe at a speed from 90 times a second for low pitch up to 160 times a second for high pitch. In general, the more the vocal cords are stretched and the faster the speed of vibration, the higher will be the pitch that results. This rate of vibration is called fundamental frequency (abbreviated f_o) and it is usually measured in cycles per second (abbreviated cps or HZ).

f_o for a woman is about 150-320 HZ in normal speaking, but in singing some women can reach about 1500 HZ.

It is possible to regulate not only the rate of vibration, but other details of method, which are perhaps important for languages of Type IV, where a raspy sound may be an important linguistic characteristic.[N23]

In Thai, the difference between saying the words เทา and เท่า depends of two different messages sent by the brain down the Vagus Nerve to the vocal cords. The following messages are characteristic for an average Thai man:[N24]

(a) "for เท�า, open and close vocal cords 130 times per second;"

(b) "for เท่า, open and close vocal cords 110 times per second."

Then as air passes upwards, the fast opening and closing of the vocal cords makes a sound wave with matching f_0. The wave is altered in the mouth and nasal cavity to give it vowel and consonant characteristics. These mainly consist of added frequencies over 300 HZ. The basic f_0 of the vocal cords, mainly under 300 HZ, remains as the basis of the sound wave as it leaves the mouth. One could compare this basic f_0 with the sweetness of sugar which remains the same no matter what shape is given to the sugar lumps or grains.

Sound waves have a characteristic length, which is found by dividing the speed of sound by f_0. For เท�า this would be about 2.8 meters using the data above; for เท่า about 3.7 meters. Such waves travel through the air and enter the ear of the listener.

Scientists are still investigating the exact details of how we hear different pitches. For the present, it is clear that sound waves are converted into perceptible vibration by three small bones in the ear named for their shapes, the "hammer", the "anvil", and the "stirrup". The vibrations are transmitted into the inner ear, or cochlea, which is an organ about 31mm long rolled up somewat like a snail.

Inside the cochlea is the coiled basilar membrane which has about 24,000 hair fibres, and to which about 30,000 neurons of the Auditory Nerve are attached. The Auditory Nerve sends messages up to the brain.

But how does the basilar membrane send the correct message? A person with normal ears can hear and distinguish pitches from 20 HZ to 20,000 HZ, and this seems like a great feat, since the perceiving organ is so small.[N25]

Dr. Georg von Békésy is one of the leaders in hearing research, and has put forth a plausible theory. We might illustrate his theory by comparing it to a ฆ้องวง, where different pitches are arranged around a circle from low to high. Similarly, different parts of the coiled basilar membrane are sensitive to particular frequencies, although the shape is more a spiral. The two points (or "ฆ้อง") sensitive to f_0 given above for เท�า and เท่า are located respectively at 27 mm and 28mm from the beginning of the coil.
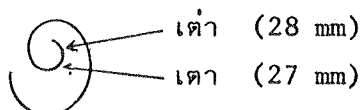
เท่า (28 mm)
เท�า (27 mm)

As for the production and perception of tones, two additional important points should be made. One concerns the *relative characteristic nature* of pitches associated with siang saaman, eek, thoo, etc. Between men, women and children (and even between individuals within these groups) f_o values for specific tones will differ. Thus, for example, *for any one speaker* siang tri will normally always have a higher pitch than siang eek, but the exact values of f_o will vary from speaker to speaker. Also, even for a given single speaker, f_o characteristics for any particular tone may shift somewhat depending on type of emphasis and on environmental considerations like tonal sandhi. Part of the automatic and subconscious work of the listener is to calculate a correlation system between perceived f_o and intended tone for every segment of speech.

A related issue involves feedback. Current research seems to indicate that neural communication between the ear and brain is not all inward. The Auditory Nerve probably screens out and edits away much incoming information, and, depending on the language being used in a particular act of speaking, is especially sensitive to some information while ignoring other. Thus the perception system of a foreigner is not used to listening for tones on each individual word, and when he first hears a language like Thai, ขา, คา, ข่า, ข้า will all sound like the same word to him. A Central Thai speaker is used to listening for just five tones. When he encounters another language with six tones, he will have quite a long period of learning to listen to the tones of the new language before he can hear them correctly, as Dr. Udom W. has observed.[N26]

4. Comparing the tonal systems of Thai dialects

For someone used to distinguishing only the five tones of Central Thai, from the discussion above we can predict a degree of difficulty in distinguishing additional and/or different tones. This is both because of habits of hearing based on the neurological processes of pitch perception and probably also because of patterns of thought established by formal education, where the five tones of Central Thai are considered standard.

But as we saw in section two there is nothing necessary or "magical" about a five-tone system. Many languages have more, many less.

Among languages and dialects of the Tai family, published sources indicate a range of four to seven distinct tones for open syllables. (In this section it is convenient to limit attention to open syllables.) Some examples:[N27]

> *(a) four-tone dialects*
> Korat, Phu Thai

(b) five-tone dialects

> Central Thai, some Northeastern Thai like Luang Prabang, Vientianne, Shan

(c) six-tone dialects

> Northern (or "Kammuang") Thai like Chiengmai and Nan, some Northeastern Thai like Ubon, Khün, Lü, White Tai, Black Tai, Saek, most Tai dialects spoken in Southern China (Chuang)

(d) seven-tone dialects

> Some Southern Thai like Nakhon Srithammarat and Songkhla, some Northeastern Thai like Roi-et and Mahasarakham

When we turn to comparing dialects in greater detail, certain confusion is apt to be encountered. For Southern Thai, (which will be emphasized by way of example in this section, although general principles hold for all dialects) one may hear people say, "the Southern dialect has no tones", or "there is no siang eek" or "siang eek and siang trii are reversed" or other confusing contradictory suggestions. As noted above, such confusion is natural and to be expected.

Linguistics has developed methods which can help in analyzing the problem and in arriving at the truth of the matter. Linguistic theory makes an important distinction: there are two *different* ways of comparing tonal systems, phonemic and phonetic comparison. Unless we are very careful, these methods of comparison can get confused and chaos will result.

To illustrate these two different sorts of comparison, we might draw a parallel case of comparing dramatic productions. Suppose at a temple fair a likee troop performs one show on Friday night and one show on Saturday night. Now we might make two different *sorts* of comparison:

(i.) We can compare the *roles* that appear in each night's show, such as—"on Friday there is a king, a queen, a prince, and a giant; on Saturday there is a king, a prince, a hermit and a beautiful girl, etc." So depending on the story scripts, some roles might occur on both nights, but some only on one night.

(ii.) We can compare *actors* who play roles, such as, "on Friday naay ก. plays the king and naay ข. plays the prince; on Saturday naay ข. plays the king and naay ค. plays the prince."

Obviously (ii.) depends on (i.) to some extent, in that a role must occur in order for an actor to play it, but in other respects the two types of comparison are quite separate.

Notice especially that there is no necessary connection between particular actors and roles. Two shows might have the same story script and roles, but completely different actors. Or exactly the same set of actors might perform in two completely different plays.

In Central Thai, although words in the category (กลาง)�seริ, such as บ้าน, cannot be completely the same as words in (สูง)⁼ and (ต่ำ)' because of different initial consonant sounds, nevertheless the tone sounds the same. We can say the tonal sound "siang thoo" in Central Thai includes all words from the categories (กลาง)⁼ + (สูง)' + (ต่ำ)', e.g., words like ก้าง, ข้าง and ค่าง.

In the same way, siang saaman includes (กลาง)° + (ต่ำ)°. We can show how the various categories of the ไตรยางค์ merge into the five tones of Central Thai as follows:

เสียงสามัญ   เสียงเอก   เสียงโท


เสียงจัตวา   เสียงตรี
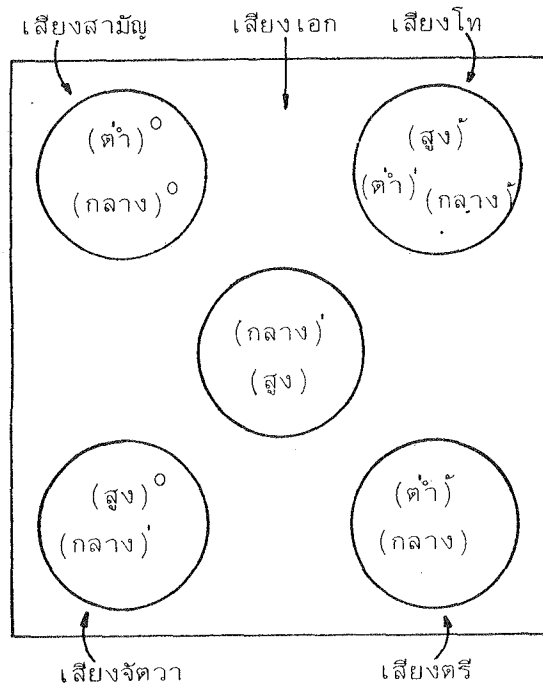
Merger diagrams of this sort were suggested by Dr. J. Marvin Brown (in a slightly different form) and are a convenient way to show dialect differences, since the categories of the ไตรยางค์ combine differently in different dialects. Here comparison is still phonemic only, not phonetic.

Many Northeastern and Southern dialects have tonal systems with phonemic systems having the mergers indicated below. (Dotted lines indicate certain differences within each area. Also, for clarity it is convenient to ignore the categories (กลาง)⁵ and (กลาง) + which are mainly Chinese loan-words, etc., and do not affect tonal systems in any important way).
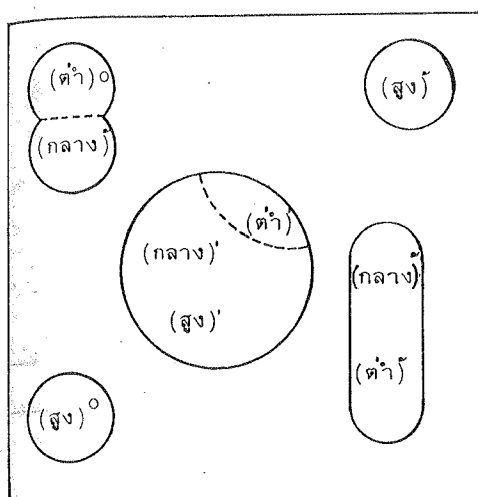
Northeastern.
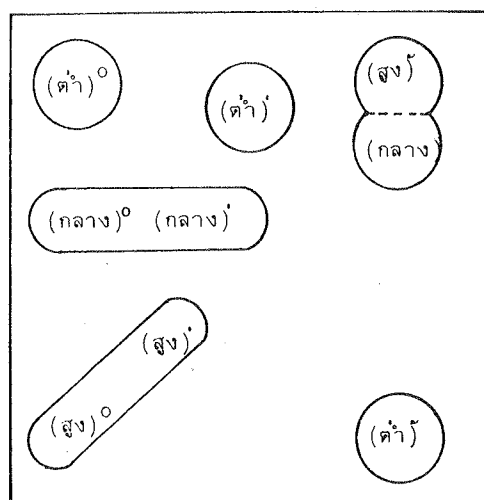
Southern

(กลาง)ʼ + (สูง)ʼ and (กลาง)ʸ + (สูง)ʸ fall together in Central Thai. This also happens, along with the falling together of (กลาง)° + (สูง)° in many of the six-tone dialects like White Tai, Black Tai, Chuang dialects, and a few places in Narathiwat. For Northern dialects this is usually the case too, but the category (กลาง)° often splits into two categories which merge differently, and the ไตรยางศ์ classification system now begins to have problems.

These problems increase for languages like Saek and Nung, where there are more splits of categories. By the time we reach distantly-related Thai languages in the Kam-Mak-Sui group[N30], the ไตรยางศ์ classification is no longer useful for direct comparison.

So far we have considered phonemic comparisons. Now we can turn to phonetic comparison and pay attention to the "actors"--to the actual details of how the tones sound. But we must try to lay prejudice aside in making comparisons: as we noted above, there is no logical reason to expect that all, some, or none of the Central Thai tonal sounds siang saaman, siang eek, etc., will appear in other dialects. Whether they do or not is an empirical question to be decided by collecting data carefully and analyzing it. Two types of data can be used, objective and subjective.

For objective data, we can use a sound-spectrograph[N31] or a computer linked to special equipment to analyze f_0 of different tones.

The writer recently analyzed f_0 for several Southern Thai dialects using equipment at Cornell University. When comparing frequencies, slight adjustments must be made to account for individual differences. Results for adult male speakers saying words in isolation (not in sentences) can be summarized as follows:

หมวดคำ
ตามไตรยางค์

F. ของเสียงวรรณยุกต์

	สงขลา	นคร	ภูเก็ต	สุราษฎร์ฯ	เกาะสมุย	ชุมพร	กรุงเทพฯ
(สูง)°	140-160	150-160-140		160-130			115-150
(สูง)'							110-105
(กลาง)'	120-135	130-135-120		135-115			
(กลาง)°							130-125
(ต่ำ)°		130-110		125-110			
(สูง)ˇ			150-140				
(กลาง)ˇ	135-135						155-115
(ต่ำ)'	115-120		115-150				
(ต่ำ)ˇ	120-105		110-105				145-150

Total Tones: 7   7   6   6   6   5   5

Subjective data can be obtained from people who speak Central Thai and another dialect fluently. Take for example a Southerner who speaks correct Central Thai (five tones) and the Songkhla dialect (seven tones). We can ask the question: "How many *total* tonal sounds does this speaker use in speaking both dialects? What is his "tonal inventory"? If *none* of the Songkhla tones are like Central Thai ones, the answer must be $5 + 7 = 12$. If *all* of the Central Thai tones have exact copies in Songkhla tones, then the individual would be using a total of 7 tones (the five of Central Thai, plus two extras occurring only in Songkhla). So we know that for Songkhla the answer to the question above must lie between seven and twelve.

In a series of experiments at Sri Nakharinwirot University, students helped in obtaining subjective data of this sort. Subjects in the experiments were requested to identify the particular dialect and the meaning of isolated words from two dialects mixed for presentation. For example, they might be presented with the Central Thai

syllable ว่า (not knowing which dialect it was from) and they would have to correctly identify it as ว่า (Central Thai), not ค่า (Southern Thai, which appears to be very similar).

The results are psycholinguistically interesting, as they indicate that Southerners vary considerably in their "tonal inventories". Most operate with a total of nine or ten tonal sounds. A few operate with eight, eleven or even twelve. No cases of seven were found. The variation depended on area, as would be expected, since seven-tone, six-tone and five-tone Southern dialects were all represented in the experiments. But even within each area, a certain degree of individual variation was observed. The variation can best be summarized by means of percentages as follows:
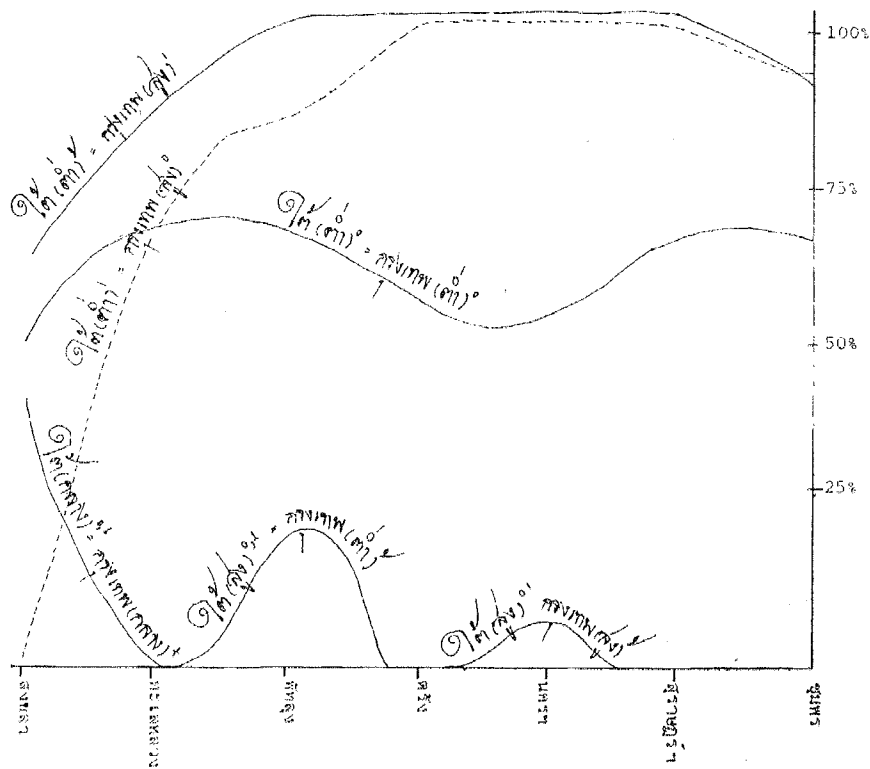
In most cases the results of the subjective "tonal inventory" testing accord fairly well with what we would expect from examining and comparing f_0 from objective analysis.

This type of research of course could also be conducted for Northeastern and Northern Thai, and other dialects.

5. Some issues for further research.

Many questions about tones in general and about Thai tones in particular remain to be explored.

The origin of tones is one such problem. Do languages of Type III. like Thai *somehow evolve from other* type languages ? Foreign scholars have practically *all held this view*, following mainly from Professor Bernard Karlgren's research and theories about the evolution of Chinese. In Karlgren's theory some Chinese tones arose when an earlier set of voiced consonants became unvoiced and *lower left behind-pitched syllables*. The general tendency has been to assume that this was true for Thai also, and that พ used to sound like บ, ท used to sound like ด, and ค used to sound like English g. By this theory, when words with พ changed their sound from บ to present พ *a lower tone was left behind*. But there are many problems with this theory, and more research and analysis must be done before any conclusion can be reached.[N32]

Another way tones may arise is through the loss of final consonants. This may involve kham taay, which were not discussed in section 4.

In certain Thai dialects we find *three processes relevant to* tonal birth :

(1) There may be a change of -k to - ʔ (glottal stop), especially after long vowels. This happens in Surat, Phuket and also in White Tai and Bui, where ยาก → ยา ? ปาก → ปา ? หมอก → หมอ ?

(2) In some dialects there is vowel lengthening and loss of final ʔ. This may result in merger with kham pen. Thus many speakers in Nakhon Srithammarat pronounce ปะ as ป๊า or ทะ (กระทะ) as ท๊า

(3) In a few dialects, kham taay do not share the same tonal sounds as kham pen.

In the case of (1), (2) and (3) all occurring in the same dialect the situation is appropriate for the birth of a new tone.

This is happening in some dialects near Chumphorn. For example, หมื๊อก → หมื๊อ ? → หมื๊อ where the new kham pen *does not coincide with either* หมอ or หมื๊อ. So a new kham pen is born from an old kham taay, and instead of these dialects having five tones for kham pen as formerly, they now have six.

One wonders if processes like this *might have been at work in the past to make Type III languages like Thai arise.*

Another set of problems involves interpretation of the writing system in relation to mergers in Central Thai.

For example, two trees are spelled ยาง in Central Thai: *(1) Ficus elastica*, the rubber tree; *(2) Dipterocarpus alatus*, the timber tree bored for oil. Although they have the same pronunciation in Central Thai, in many dialects of Southern Thai (1) has the tone (กลาง)°ʹ, like กาง and (2) has the tone (ต่ำ)° like คาง. Similarly, in Central Thai the two words spelled หยิก meaning "curly" and "to pinch" are pronounced the same way, but are differentiated in many Southern dialects, having (สูง) and (กลาง) tones respectively. We begin to suspect that Central Thai tonal mergers are hiding some ย- words which *should be considered as having earlier aksorn klang initials instead of aksorn suung or tam.* Perhaps the few words spelled อย– are survivors.– The list includes : ยิม, ยืน, เย็น, ยัน, หยั่ง, ยา, หย่อน, หยอง, ยอง, เหยียบ, หยุด, หยับ, หยวก, หยอก

Another merger in Central Thai of interest is (สูง)ʷ + (ต่ำ)ʹ which along with (กลาง)ʷ accounts for siang thoo. In dialects where (สูง)ʷ has not merged with (ต่ำ)ʹ Central *Thai spelling in most cases predicts the correct tone.* Thus in Southern Thai ถ้า is correctly predicted as (สูง)ʷ (the same tone as ผ้า) and ท่า is correctly predicted as (ต่ำ)ʹ (the same tone as ว่า). *But for about 65 items the prediction is not correct.* Thus words like คว้า, ฆ่า, เฒ่า, น่า, ม้ว, ย่อง, ล่ม, เล่ม, ว่าย ๆลๆ are spelled (ต่ำ)ʹ but in Southern Thai (and other dialects) are pronounced as (สูง)ʷ It is interesting that in ลิลิตพระลอ these words are also (สูง)ʷ, that is, they are spelled ขว้า, ข้า, เถ้า, หน้า, หม้ว ๆลๆ. The usual explanation is that these words were spelled incorrectly on purpose (thoo thoot) according to the rules of poetry. This *explanation is all right as far as it goes,* but there is no reason to assume that the tonal systemof Central Thai in the Ayudhya Period was exactly the same as now. Perhaps the merger (ต่ำ)ʹ + (สูง)ʷ had not yet occurred, or had not occurred for all words. What ever the situation was, it would *be interesting and valuable to study early Thai poetry, keeping in mind* the possibility that *there may be* structures in the poetic system that relate to earlier tonal situations different from that of modern Central Thai.

6. The discovery of tones.

How did our understanding of tonal distinctions in language evolve?

We noted in section I that Vedic Sanskrit and Ancient Greek had pitch-accent systems (Type II). Since these had influence on poetry and religious chanting, scholars in both areas *became aware and devised systems to show pitch differences.* For Greek, Aristophanes of Byzantium used the marks ʹ and ^ by about B.E. 350, and

these marks are still used in writing Greek today, although the pitch differences they *used to show have long since disappeared. For Sanskrit,* scholars in the tradition of Panini used various means to indicate pitch, including the mark' to indicate the falling-pitch svarita accent.

Among true tone languages (Type III), it is amazing that the Chinese for a long time seemed unable to understand that their language was tonal. (The most obvious things are usually the most difficult to see.) It was Buddhist missionaries from India in about B.E. 1000 who first successfully analyzed Chinese tones and were able to classify Chinese vocabulary into rhymed lists by this principle, although no way was invented to show the sounds in writing.

The first successful adaptation of a ปรัง alphabet to a Type III language was the Vietnamese dictionary of Alexander de Rhodes in B.E. 2194, which clearly showed the tones of Vietnamese and is the basis for the writing system to this day.

But we must not think that this was the first time that tones were successfully writen down. We have good evidence that Thai in the Sukhothai period was a tonal language, and we know that Pho Khun Ramkhamhaeng showed these tonal distinctions by the symbols ' and + (modern-day ' and "). We noted above that the symbol ' was regularly used in Sanskrit texts to show the svarita accent, and this may have provided Pho Khun Ramkhamhaeng with an idea. *Whether or not this is so, one thing is certain : the subject of linguistics must give to* Pho Khun Ramkhamhaeng the honor of being the first person to use a consistant system for writing down the tones of a true tone language.

Notes and references

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3. Professor Gerald B. Kelley, personal communication.

4. Bloomfield, Leonard, *Language* (Holt, Rinehart and Winston, 1933) p.116.

5. ibid.

6. Lehiste, op. cit., p. 83. Buck, Carl D., *Comparative Grammar of Greek and Latin* (University of Chicago Press, 1933) p.62. The Sanskrit terms for these cases are
   (a) สัตตมีวิภัตติ-เอกพจน์   (b) ปฐมาวิภัตติ-พหุพจน์.

7. (Banchop 62)
   See also the *Paniniya Siksa* edited by Manomohan Gosh (University of Calcutta, 1938).

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Wang, W. S.-Y., "Phonological features of tone",
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10. Hall, op. cit., p. 114.

11. Henderson, Eugenie, "Phonology", in *Linguistics at Large* edited by Noel Minnis (Viking Press, 1971) p. 43.

12. Shorto, H.L., *Dictionary of Modern Spoken Mon* (Oxford, 1962), p. x-xi.

13. Lehiste, op cit., p. 89. In Thai there is certainly laryngeal tension in the tone siang tree. This can be proved by trying to whisper the five Thai tones. Siang tree is usually understood quite clearly, showing that something beyond pitch is involved.

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15. Wang, W. S.-Y., "The many uses of f_o". Paper presented at the 1968 Kyoto Speech Communication Symposium.

16. For example, ไหม, นั่น, and เขา usually shift from เสียงจัตวา to เสียงตรี in colloquial speech.

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21. See also note

22. For more detail, cf. Zemlin, Willard, *Speech and Hearing Science* (Prentice-Hall, 1968):
Lieberman, Philip, *Intonation, Perception and Language* (M.I.T. Press, 1967);
Ladefoged, Peter, *Elements of Acoustic Phonetics* (University of Chicago Press, 1962).

23. The work of Professor J.C. Catford is outstanding in this area.

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24. These values are based on Abramson, Arthur S., *The Vowels and Tones of Standard Thai* (Indiana University Research Center in Anthropology, Folklore and Linguistics #20, 1962). The informant was Dr. Ekawit na Thalang. As we see below, there may be individual variation in f_0 values.

25. (on text)

26. (Udom, p. 93)

27. Brown, J. Marvin, *From Ancient Thai to Modern Dialects*, (Social Science Press of Thailand, 1965): Jones, R.B., "On the Reconstruction of Proto-Thai", Lingua 14.194–229 (1965). Professor Jones' analysis makes use of laryngeal constriction in setting up phonemic tonal categories, and it is then possible to reduce the number of tones below what is stated here.

28. The pioneer researcher in this field was Henri Maspero, who wrote an important article about comparative Thai dialects in B.E. 2454. See also Vichin Panupong....

29. In farang works about comparative Thai, two differents systems are used. Haas, et al., use H, M, L for (สูง), (กลาง), (ต่ำ) and 0, 1, 2 as used here. Li, et al., use 1, 2, 3 for (สูง) (กลาง) (ต่ำ) and. A, B, C for , , . For example, the tone of หา is equivalently (สูง), H2, or 1C.

30. Li Fang-Kuei, "The Tai and Kam-Sui Languages", Lingua 14.148–176 (1965). See also the Ph. D. dissertation (University of Michigan). of Beatrice Oshika. For Saek, cf. (Wilaiwan–)

31. A description of the sound spectrograph is found in Udom, p.52.

32. One problem is raised by words like บาป in Thai, which seem to show a sound change ป → บ (from Pali ปาป). These words have the opposite sound change from the one following Karlgren. We need to remember that the pronunciation of Pali and Sanskrit words coming into Thai at the time of the Ram Khamhaeng inscription may have been influenced by Singhalese, Khmer, or other languages. If we consider only comparative dialect data, there is no evidence at all that aksorn tam consonants were at one time voiced.