中央研究院

歷史語言研究所集刊

第五十一本

紀念 李濟、屈萬里兩先生論文集

第一分

目 錄

中華民國六十九年三月

中華民國 臺 北

中央研究院
歷史語言研究所集刊
第五十一本
紀念　李濟、屈萬里兩先生論文集
第一分
定價新臺幣壹佰元正

編輯者　中央研究院歷史語言研究所出版品編輯委員會
發行者　中央研究院歷史語言研究所
臺北市南港區
印刷者　大進印刷有限公司
臺北市西藏路251巷8號
代售處　臺灣商務印書館
臺北市重慶南路一段
學生書局
臺北市和平東路一段198號
三民書局
臺北市重慶南路一段61號

中華民國六十九年三月出版

中央研究院

歷史語言研究所出版品

編輯委員會

編輯委員

高去尋（主席）	陳　槃（常務）	芮逸夫（常務）
李孝定（常務）	黃彰健	張以仁
丁邦新	龍宇純	石璋如
管東貴	張秉權	李壬癸（秘書）
宋光宇（助理）	何大安（助理）	

中央研究院

歷史語言研究所集刊

第五十一本

紀念　李濟、屈萬里兩先生論文集

第一分

目　錄

中華民國六十九年三月

中華民國　臺　北

LARYNGEAL FEATURES AND TONE DEVELOPMENT*

Fang Kuei Li

Consonants and vowels are known to influence each other in many ways and in many languages. The consonant may influence the quality and pitch of the preceding as well the following vowel, and the vowel may similarly influence the consonant, through palatalization, rounding, etc. In this paper I shall limit myself to the relationship between the consonant and the fundamental frequency of the syllabic nucleus.

It is generally known that in tonal languages, particularly in Asian languages, a consonant in the initial position of a syllable influences the tone of the syllable. This paper, then, is further limited to the relationship of the initial consonant and the tone. It is assumed that tones existed before the consonantal effect takes place. For this reason this is not a discussion of the developmental process whereby tones arise from a toneless stage. The term tonogenesis has recently been applied to this type of inquiry. Theories have been offered to show how rising and falling tones came into being through the loss of different types of final consonants.[1] It is not for me to discuss these theories here. The final consonant may differ somewhat from the initial consonant in its effect on tone. My purpose is to examine in some detail how the initial consonant influences the tone, chiefly from a comparative point of view.

The consonants which exert an effect on tone are usually not isolated con-

* Hermann Collitz Lecture, 1977 Summer Meeting, Linguistic Society of America, held in conjunction with the 1977 Linguistic Institute cosponsored by the University of Hawaii and the East-West Center, Honolulu, Hawaii.

1. For details, see Haudricourt (1954, pp. 69-82), Maran (1973, pp. 97-114), Matisoff (1973, pp. 71-95), Hombert (1976, pp. 39-47), Erickson (1975, pp. 100-11); but according to Lehiste (1970, p. 74), 'the final consonants showed no regular influence on the fundamental frequency of the syllabic nuclei.'

sonants, but rather form groups from which certain features may be abstracted. From one group we may abstract the feature of voicing contrasting with the voiceless consonants. From another group we may abstract the feature of aspiration, contrasting with the unaspirated consonants. From a third group we may abstract the feature of glottal closure, contrasting with the unglottalized ones. This paper will be chiefly concerned with these consonantal features, which may be called laryngeal features; for they are characterized by the opening or closing of the glottis, and the tension and vibration of the vocal cords. The exact muscular mechanisms which control these features, particularly in relation to tone production, is complex and not yet clearly understood.[2]

The experimental phoneticians are interested in discovering certain correlations between the pitch and the different types of consonants. Sometimes they are able to explain why certain types of consonants raise or lower the fundamental frequencies of the syllabic nuclei. Their findings are important and have some universal implications. The linguists, on the other hand, find also certain influences of the consonant on tone through their investigations on different dialects. The result sometimes agrees and sometimes disagrees with that of the experimental phoneticians. Apparently there remains a good deal of work to be done.

We may also observe that the consonantal features mentioned above need not influence different tones in the same way. They may cause the tone to split, or may cause the tones to merge. They may influence one tone in one way and another tone in another way. May we assume that the effect varies, at least in part, according to nature of the tones themselves? For instance, the feature of voicing may influence a high tone differently from a low tone, or a rising tone from a falling tone. If any significant difference can be found, we may have some natural phonetic basis to work on, and we may, perhaps, be well on our way to reconstructing the tones of the older languages.

In this paper I shall draw examples from languages and dialects I know best, namely Chinese and Tai dialects. I have no doubt that similar examples can be

2. See Ohala (1973, pp. 1-14), Erickson (ms. Ph. D. dissertation).

drawn from other East Asian languages.[3]

THE FEATURE OF VOICING

In Chinese the contrast of voiced and voiceless initials has been known for a long time to differentiate all tones into two series, called in Chinese *yin* and *yang*. The two series may not be phonemic at first, but after the contrast of voiced and voiceless consonants was lost, they became phonemic and contrastive. The best example is the tone system of the Canton city dialect, which reflects the fact that syllables with original voiced initial consonants always exhibit lower tones than the corresponding syllables with voiceless initials.[4] Historically, since the sixth century, Chinese was known to have four tones: 1. *level*, 2. *rising*, 3. *departing*, and 4. *entering*. (The names given to these tones are the common translations of the Chinese names, but the phonetic nature of these tones is not exactly known.) The modern representation of these tones in Cantonese may be given as follows:

The tone system of Cantonese.

1. *level*	voiceless	53	Ex. kou 53 'high'
	voiced	11	khau 11 'to beg'
2. *rising*	voiceless	24	kau 24 'nine'
	voiced	13	khau 13 'maternal uncle'
3. *departing*	voiceless	44	kau 44 'enough'
	voiced	22	kau 22 'old'
4. *entering*	voiceless	55 or 44	hak 55 'black', haak 44 'guest'
	voiced	22	luk 22 'green', hook 22 'to learn'

Quite a number of experiments have been conducted to show that syllables with voiced consonants in Chinese and Tai are indeed lower in pitch than those with

3. See particularly the Occasional Papers of the Wolfenden Society on Tibeto-Burman Linguistics, vol. 3, pt. 1-4, 1970; vol. 4, 1971.

4. The tones are denoted according to Y. R. Chao's system (1930), where pitches are denoted by numerals 5, 4, 3, 2, and 1, from the highest to the lowest, and tones are usually denoted by two or three digits, such as 55 for high level, 11 for low level, 53 for high falling, 31 for low falling, 35 for high rising, 13 for low rising, 535 for high falling-rising, etc.

voiceless ones. The experimental proof is important in showing that the Cantonese tones have some natural phonetic basis. However, tones in modern dialects need not reflect this situation as neatly as the Cantonese tones. For instance, the *level* tone class is represented in standard Mandarin (Peking dialect) by a high level tone 55 in syllables with an original voiceless consonant, and by a rising tone 35 in syllables with an original voiced consonant, but in many neighboring dialects the situation is almost reversed. For example:

	Peking	:	T'ientsin
voiceless:	thien 55	:	thien 11 'day'
voiced:	thien 35	:	thien 55 'field'

This kind of conflicting phenomenon is not uncommon, and must have been due to other causes which are difficult to formulate at this moment. It also demonstrates that we must take the modern tones cautiously. They do not necessarily reflect our theory on phonetic grounds. A satisfactory explanation of the development of tones must be based on natural phonetic grounds, but there are many factors which we are not too certain about, but which we must eventually reckon with.

The tones may also influence the consonant initial. We know that there was only one series of voiced stops in Ancient Chinese (roughly 600 A. D.), but by and perhaps even before the eleventh century, the voiced stops split into two series, as shown by the work of Shao Yung (1011-1077).[5] One series apparently aspirated (perhaps with a voiced aspiration) is grouped together with and contrasted with the voiceless aspirated stops, and the other series is grouped with and contrasted with the voiceless unaspirated stops. The split was dependent on tone. The *level* tone gave rise to the aspirated type, and the other tones to the unaspirated type. They may be shown by the following table:

level tone: bh, dh, gh, contrasting with ph, th, kh

other tones: b, d, g, contrasting with p, t, k

The split agrees with most Mandarin dialects, as well as with many others.

5. Shao Yung's work is difficult to read. A summary of it in tabular form can be found in Chou (1966, pp. 586-96), and in Li Jung (1952, pp. 165-74).

When the unvoicing process took place later, the *level* tone gave rise to voiceless aspirated stops, and the other tones to unaspirated ones. The relation of the voicing feature to tone is quite evident here,[6] but we shall see later that aspiration also influences tone.

Furthermore, the voicing feature may be different in its influence on tone according to whether the initial consonant is a voiced stop or a sonorant (namely, liquid or nasal). In the eleventh century Shao Yung again gave two series of sonorants, one was marked *clear* and the other *muddy*. (The terms *clear* and *muddy* are generally interpreted as voiceless and voiced respectively, but they must be given here a slightly different interpretation.) The *clear* sonorant existed only in words with the *rising* tone, and *muddy* sonorants in words with other tones. The split is reflected in many Mandarin dialects, where the sonorants did not influence the *rising* tone in the same way as did the voiced stops. The voiced stops caused the *rising* tone to merge with the *departing* tone, while the sonorants produced the same tone as the voiceless initials. Thus in the feature of voicing, there may be a difference between the sonorant and the voiced stop. It is not clear to me what causes the difference, but I would like to suggest that perhaps the difference in supraglottal and/or subglottal air stream pressures may be investigated.

The feature of voicing influences the tone in many, if not all, Tai dialects. The Tai dialects are spoken in Burma, Laos, Thailand, Vietnam, and a large part of southwestern China. The tone systems of many Tai dialects are known. We may take for example the tone system of the Lungchow dialect, spoken in Kwangsi, where the original contrast of voiceless and voiced consonants is reflected in the split of all four Proto-Tai tones, A, B, C, and D, into two series, namely A1 and A2, B1 and B2, etc. The tones are usually lower in pitch in words with original voiced initials than those with voiceless ones, as we have seen in the Cantonese dialect. All Proto-Tai voiced stops became voiceless, unaspirated in some dialects

6. In the study of African languages, Hyman (1973, p. 171) concludes that 'consonants affect tone, but tone does not affect consonants···. There are no examples I know of where tones interfere with natural consonantal assimilations.'

as in Lungchow, and aspirated in others, as in the Thailand dialects:

The tone system of Lungchow[7]

A.	voiceless	A1:	33	Ex. pii 33 'year'
	voiced	A2:	31	pii 31 'fat'
B.	voiceless	B1:	55	kau 55 'year'
	voiced	B2:	11	pii 11 'elder sibling'
C.	voiceless	C1:	24	kau 24 'nine'
	voiced	C2:	21ʔ	maa 21ʔ 'horse'
D.	voiceless	D1:	55	tuk 55 'to fall'
	voiced	D2:	21	luk 21 'child'

THE FEATURE OF ASPIRATION

Besides the feature of voicing, there are other features which modify tone in many dialects. They usually influence some but not all of the tones. One of them is the feature of aspiration. It has in some Chinese dialects the effect of lowering the tone. For example in the city dialect of Wuchiang in Kiangsu, the lowering effect of aspiration is quite evident.

Tones in Wuchiang[8]

	rising	*departing*	*entering*
Unaspirated:	51	423	44
Aspirated:	323	323	34

In the dialect of Nanch'ang in Kiangsi, it is reported that aspiration caused a split of the departing tone among words with original voiceless initials:

The *departiug* tone in Nanch'ang[9]

Unaspirated: 35 Ex. tsoŋ 35 'curtain'

Aspirated: 313 tshoŋ 313 'to sing'

As a matter of fact, aspiration caused the *departing* tone to merge with the old *rising* tone.

7. For the phonetic system of Lungchow, see Li (1977, pp. 9-12).
8. According to Yeh Hsing-ch'in, 'Wuchiang fangyen' in Fangyen p'ut'ung hua chik'an (1958, pp. 8-11). The original article is not available to me, but is quoted in Chang (1975, pp. 673-4).
9. According to Yang (1971, pp. 403-32), cf. also Yuan (1960, pp. 128-39).

The lowering effect of aspiration on tone, as illustrated by the preceding examples, has not been definitely proven by experimental phoneticians, as far as I know. It is directly opposed to the situation in the southern dialects of Thailand, where aspiration seems to be associated with high tones.[10]

The traditional Thai phonologists classify the consonants into three groups, namely high, middle, and low. The high consonants consist of, among others, the original aspirated voiceless stops and h. The middle consonants consist of the original unaspirated voiceless stops, and the low consonants consist of all original voiced consonants. The voiced consonants have been devoiced in Thai, become aspirated, and merged phonetically with the original aspirated voiceless stops. This secondary aspiration which derived from the voiced stops, however, does not influence tones in the same way as the original aspiration. (A possible explanation is to assume that the aspiration effect on tone took place before the secondary aspiration came into being.) We will not go into the details of this classification, but the terms high, middle, and low seem to refer to the pitch with which these consonants are associated, as illustrated by the dialect of Nakhonsi-thamarat. For example:

The tone system of Nakhonsithamarat[11]

A.	aspirated voiceless:	high falling	Ex. maa 'dog'
	unaspirated voiceless:	mid gliding	kin 'to eat'
	voiced:	low falling	maa 'to come'
B.	aspirated voiceless:	high falling	sii 'four'
	unaspirated voiceless:	mid gliding	kai 'chicken'
	voiced:	rising	phɔ 'father'

10. However, see Ohala (1976, p. 96), where he says 'These patterns, then, seem to provide no support for the claim that aerodynamic factors cause the pitch perturbation after obstruents and are completely unable to account for the fact that voiceless unaspirated stops raise pitch as much as or more than voiceless aspirated stops.'

11. According to Haas (1958, pp. 817-26). In her examples quoted here for the high consonants, she does not often give words with original voiceless aspirated consonants contrasting with the unaspirated ones, but often gives words with original voiceless fricatives and voiceless sonorants (voiceless nasals and laterals), which are also classified according to Thai tradition as high consonants.

C.	aspirated voiceless:	high	haa 'five'
	unaspirated voiceless:	mid	kaau 'nine'
	voiced:	low	maa 'horse'
DS.	aspirated voiceless:	high	sip 'ten'
	unaspirated voiceless:	rising	cɛt 'seven'
	voiced:	low	nɔk 'bird'
DL.	aspirated voiceless:	high	chiik 'to tear'
	unaspirated voiceless:	mid	pɛɛt 'eight'
	voiced:	rising	luuk 'child'

If the traditional classification of the consonants reflects the actual situation of the tones, the dialect of Nakhonsithamarat and several other southern dialects may be considered as faithful representatives. The original aspirated voiceless stops are always associated with the high tones, the original unaspirated stops with the middle tones (rarely rising), and the original voiced initials with the low or rising (low rising?). Not all Thailand dialects reflect the same situation, and if aspiration tends to raise the pitch, it has not been definitely proven either.

Tone D is here divided into DS (short) and DL (long). Apparently short and long syllabics effect the tonal development also, not only in the dialect of Nakhonsithamarat but also in quite a number of Tai dialects. As to whether vocalic length plays a part in tone development there is no definite answer, for some other factors may be involved. Lehiste (1970, p. 82) says that 'there is no evidence to my knowledge that greater length of a segment would automatically result in either higher or lower fundamental frequency.'

THE FEATURE OF GLOTTAL STOP

The glottal stop and the so-called preglottalized initials (Li 1943) form one group, and are usually considered as unaspirated voiceless consonants in their effect on tone in many Tai languages. However, in a number of Tai dialects their influence on tone is different from the other voiceless consonant. The simple glottal stop is normally kept in most dialects, but the preglottalized consonants often underwent various changes, while their influence on tone remained the same as that of the

glottal stop. The tone system of Po-ai in Yünnan may be cited as an example.

The tone system of Po-ai[12]

A.	voiceless:	24	Ex. pii 24 'year'
	glottalized:	31	ʔau 31 'to take'
	voiced:	55	naa 55 'rice field'
B.	voiceless:	22	kau 22 'old'
	glottalized:	22	ʔim 22 'satisfied'
	voiced:	31	taa 31 'river'
C.	voiceless:	44	kau 44 'nine'
	glottalized:	44	ʔaa 44 'to open mouth'
	voiced:	33	tuŋ 33 'stomach'
DS.	voiceless:	55	tɔk 55 'to fall'
	glottalized:	44	ˈak 44 'chest'
	voiced:	44	lɔk 44 'bird'
DL.	voiceless:	22	paak 22 'mouth'
	glottalized:	22	ʔook 22 'to go out'
	voiced:	31	lïït 31 'blood'

Notice that the original voiced consonant shows a high tone in Tone A, instead of the low tone we would normally expect. The glottal stop shows an influence on Tone A, different from the original voiceless as well as the voiced consonants. It shows the same influence as the original voiceless consonants in Tones B, C, and DL, but it has the same influence as the original voiced consonants on Tone DS. It appears that the tones themselves have some influence in determining how the initial consonants should effect the tones.

The preglottalized consonants follow the rule of the glottal stop, although the original glottal stop has since disappeared, for example:

A. nii 31 < *ʔdii 'good'

B. maau 22 < *ʔbau 'young man'

C. maan 44 < *ʔban 'village'

12. See Li (1977, pp. 12-14).

DS. nip 44 < *ʔdip 'raw'

DL. jiik 22 < *ʔjïak 'hungry'

If we believe that the preglottalized consonants are implosives, as they are in some dialects, we should note that implosives are known to be pitch raisers (Ohala 1976, p. 102). But as shown from the Po-ai examples, the implosives actually lower the tone in some instances. As far as I know, no phonetic experiment shows definitely the glottal stop's effect on the pitch of the following vowel, either raising or lowering, although there are experiments showing the effect of the final glottal stop on the preceding vowel.[13]

Finally another example may be offered, which shows that the original unaspirated voiceless stops, the original aspirated voiceless stops, the original glottalized, and the original voiced consonants all have slightly different influences on tone. This is the dialect of T'ienpao in Kwangsi. Its tonal development may be illustrated by the following table:

The tone system of T'ienpao[14]

A.	voiceless unaspirated:	353	Ex. pei 353 'ear'
	voiceless aspirated:	353	khaau 353 'white'
	glottalized:	31	ʔdai 31 'good'
	voiced:	31	naa 31 'rice field'
B.	voiceless unaspirated:	42	kau 42 'old'
	voiceless aspirated:	33	thaan 33 'charcoal'
	glottalized:	33	ʔəm 33 'satisfied'
	voiced:	33	mee 33 'mother'
C.	voiceless unaspirated:	24	paa 24 'aunt'
	voiceless aspirated:	24	khaa 24 'to kill'
	glottalized:	24	ʔdai 24 'to get'
	voiced:	13	tooŋ 13 'stomach'

13. See Hombert (1976, pp. 39-47).

14. See Li (1966, pp. 82-8), also Li (1977, p. 20).

DS.	voiceless unaspirated:	45	to? 45 'to fall'
	voiceless aspirated:	45	phja? 45 'vegetable'
	glottalized:	45	?dəp 45 'raw'
	voiced:	33	no? 33 'bird'
DL.	voiceless unaspirated:	42	peet 42 'eight'
	voiceless aspirated:	33	phyy? 33 'yam'
	glottalized:	33	?duut 33 'hot'
	voiced:	33	luut 33 'blood'

It is interesting to note that the four Proto-Tai tone classes, A, B, C and D (S and L) each split into two tones, but the way they split differs according to the different types of consonants. Thus, in Tone A the voiceless consonants, aspirated or not, show one tone, while the glottalized join with the voiced in showing a depressed tone. In Tone B, the voiceless unaspirated consonants show one tone, while the voiceless aspirated and the glottalized join with the voiced in depressing the tone; similarly for Tone DL. In Tones C and DS, the original voiceless, aspirated or not, and the glottalized form one group showing one tone, while only the voiced depress the tone. It is quite evident that the laryngeal features have different effects on tone depending upon the phonetic nature of the tones themselves.

The implication of this is that Tones B and DL may have had the same pitch or contour, and that Tones C and DS may have also had the same or very similar pitch or contour. This opens the way to reconstruct tones, perhaps only of the immediate past. Dialects or dialect groups may have developed different pitch levels and contours before the effect of the consonants took place. It is a well known fact that tones differ from one locality to another, from one village to another in China and Thailand. This would not be so, if no other secondary tone changes intervened. We are not certain what these secondary tone changes are or what causes them.

SUMMARY

This paper is chiefly concerned with the initial consonants and their effect on

tone. The effect seems to differ according to whether the consonants are aspirated, glottalized, or voiced. We may abstract three main features, namely aspiration, glottal closure, and voicing against the simple unaspirated voiceless consonants. It is my belief that these features have some physiological basis for their influence on tone. It is also my belief that the phonetic nature of the tone has some bearing on their effects. Not being an experimental phonetician, I can offer no more than some data from a purely linguistic and comparative point of view, but I trust that experimental phoneticians will play an ever important role in solving the problem.

REFERENCES

Chang, Kun. 1975. 'Tonal developments among Chinese Dialects.' BIHP 46, pp. 636-710.

Chao, Y. R. 1930. 'A System of Tone Letters.' Le Maitre Phonetique 45, pp. 24-27.

Chou, Tsu-mo. 1966. Wen hsüeh chi, 2 vols. Peking.

Erickson, Donna (ms.). Laryngeal Mechanism and co-articulation Effects in the Tones of Thai. Ph. D. dissertation, Univ. of Connecticut.

_____. 1975. 'Phonetic Implications for a Historical Account of Tonogenesis in Thai.' Harris, J. and Chamberlain, J. R. (ed.): Studies in Tai Linguistics in Honor of William J. Gedney. Bangkok. pp. 100-11.

Haas, Mary. 1958. 'The Tones of Four Tai Dialects.' BIHP 29, pp. 817-826.

Haudricourt, André-G. 1954. 'De l'origine des tons en Vietnamien.' JA 242, pp. 69-82.

Hombert, Jean Marie. 1976. 'Phonetic Motivation for the Development of Tones from Postvocalic [h] and [ʔ].' Report of the Phonology Laboratory, no. 1, University of California, Berkeley, pp. 39-47.

Hyman, Larry M. (ed.). 1973. Consonant Types and Tone. Southern California Occasional Papers in Linguistics, no. 1.

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

Li, Fang Kuei. 1943. The Hypothesis of a Pre-glottalized Series of Consonants in Tai. BIHP 11, pp, 177-188.

_____. 1966. 'Relationship between Tones and Initials in Tai.' Zide, Norman H. (ed.); Studies in Comparative Austroasiatic Linguistics, pp. 82-88.

_____. 1977. A Handbook of Comparative Tai, University Press of Hawaii.

Li, Jung. 1952. Ch'iehyün Yinhsi, Peking.

Maran, La Raw. 1973. 'On Becoming a Tone Language, a Tibeto-Burman Model of Tonogenesis.' Hyman (ed.) 1973, pp. 97-114.

Matisoff, James A. 1973. 'Tonogenesis in South East Asia.' Hyman (ed.), pp. 71-95.

Ohala, John J. 1973. 'The physiology of Tone.' Hyman (ed.), pp. 1-14.

_____. 1976. 'A Model of Speech Aerodynamics.' Report of the Phonology Laboratory, no. 1, University of California, Berkeley, pp. 93-107.

Yang, Shih-feng. 1971. 'Kiangsi fangyen shengtiao ti tiaolei.' BIHP 43, pp. 403-432.

Yuan, Chia-hua. 1960. Hanyü fangyen kaiyao, Peking.

ABBREVIATIONS

BIHP Bulletin of the Institute of History and Philology, Academia Sinica, Taipei.

JA Journal Asiatique, Paris.