TONE SPLITS AND VOICING SHIFTS IN THAI: PHONETIC PLAUSIBILITY

Arthur S. Abramson
Professor of Linguistics
The University of Connecticut and Haskins Laboratories
Storrs, CT 06269-1145, U.S.A.
and
Donna M. Erickson
Senior Research Associate
Division of Speech and Hearing Science
Ohio State University
Columbus, OH 43210-1372, U.S.A

Introduction.

If the distinctive tones of present-day Central Thai (Siamese) are the outcome of a series of developments over the centuries from an early simpler Proto-Tai tone system, or even a pristine state of tonelessness, we are beset with a problem common to all diachronic phonology. Can the causes of sound change be found? For Thai, as for some other Asian languages, this problem is complicated and made even more interesting by an apparent intersection of changing tonal features and shifting voicing states of word-initial consonants. It is our wish here to try to shed phonetic light on this aspect of the history of Thai.

In learning their language, children are likely to deviate ever so slightly in pronunciation habits from their adult models in ways that are largely unnoticeable at the time (Vendryes, 1923; Gray, 1939). Insofar as these shifts are not random, they may accumulate gradually over the generations, resulting in sound changes with phonological consequences. Linguists have concentrated on these structural alterations, describing them systematically and purporting to show that, by and large, they are so regular that they can be stated in terms of "laws" for individual languages or language families. Except for noting that most of these changes, once they have been traced, are not phonetically improbable—e.g., /m/ is not likely to become /g/—they seldom find underlying phonetic mechanisms that might have brought these changes about.

With the recent advance of our understanding of the production and perception of speech, it is tempting for the experimental phonetician to believe that phonetic hypotheses on the causes of sound change should be testable in the laboratory (Ohala, 1974). For such research, without any way to resurrect long-dead informants for a brief stint of field work, the most that we can hope to do is to test the phonetic plausibility of these hypotheses by using present-day speakers. It must be stressed that it is only the plausibility of a posited causal relationship between sound change and particular phonetic mechanisms that can be tested.

A number of studies on the plausibility of postulated phonetic mechanisms of change have appeared in recent years. For example, Whalen and Beddor (1989) have published experimental data compatible with an explanation of the rise of a nasal feature in Eastern Algonquian. As for the emergence of distinctive tones, Hombert, Ohala and Ewan (1979) have provided an excellent critical review of the instrumental and experimental work on this topic.

The term *tonogenesis*, apparently first used by James Matisoff (1970, 1973), can mean the emergence of phonologically distinctive tones in a previously toneless language under the influence of certain contextual features. Another use of the term has been as a label for the splitting of old tonal categories into a larger number of tones. J. Marvin Brown (1975) speaks of the "great tone split…that swept through China and northern Southeast Asia nearly a thousand years ago."

During the time of the emergence of its daughter languages, Proto-Tai is generally said to have had four voicing categories for initial consonants and three phonemic tones on "smooth" syllables, i.e., those ending in a nasal, glide, or long vowel, which would all have been inherited by Old Thai (Siamese). If we make our focus for the moment not the tones but the initial consonants, we find the consensus of the various sources (e.g., Li, 1977) to be that the voicing states of some of these consonants changed under the influence of the pitch slopes as the tones emerged. We epitomize the situation with the labial stops:

Proto-Tai	*ʔb	*b	*p	*ph
Central Thai	b	ph	p	ph

We see that in modern Central Thai we have /ph/ from two sources, as is reflected in the Thai writing system. The correspondences are not exactly the same for all Tai va-

rieties; for example, in Chiangmai /*b/ > /p/. Our emphasis here, however, is on Central Thai. The phonetic nature of /*ʔb/ is problematic (see Erickson, 1975 for a discussion). Haudricourt (1956) makes the rather tempting suggestion of [b^h] as an intermediate stage in the shift from /*b/ to /ph/.

With help from the writing systems, study of correlations between tones and initial consonants has led to the positing of tonal splits conditioned by the shifting voicing states of those consonants (Maspero, 1911; Li, 1947, 1977; Haudricourt, 1956). That is, ignoring the special problem of one of the four classes of consonants, the so-called glottalized consonants (see Erickson, 1975), we find that for each tonal category of Old Thai words with initial voiced consonants developed a lower tone and words with initial voiceless consonants, a higher tone. Thus the three Proto-Tai tones on smooth syllables, named simply A, B. and C[1] in the absence of knowledge of their phonetic nature, would have split into six. In fact, given the vicissitudes of the spread of phonological change over related languages, we find that Central Thai, which is the dialect of the Bangkok region and the basis of the official language of Thailand, has only five tones, while other regional dialects and other Tai languages have six or more, with differences among them in pitch contours as well. In a chart adapted from the work of Fang Kuei Li (1977, pp. 24-33), we give an outline of the tonal shifts from Proto-Tai to Central Thai:

PROTO-TAI		CENTRAL THAI		
Tone	Initial	Tone	Examples	
A	Voiceless	Mid or rising	**paj** to go	**fŏn** rain
	Voiced	Mid	**naa** rice field	**wan** day
B	Voiceless	Low	**kàw** old	**phàa** to split
	Voiced	Falling	**phɔ̂ɔ** father	**nâŋ** to sit
C	Voiceless	Falling	**kâw** nine	**nâa** face
	Voiced	High	**thɔ́ɔŋ** belly	**máa** horse

[1] Li also posits tone D on syllables ending in a stop consonant. There is no way of identifying it with any of the other tones. The phonological treatment of modern Thai, however, generally aligns the tones on such syllables with certain tones that occur on smooth syllables.

Aside from these historical hypotheses, it has been known for some time that in human speech the fundamental frequency (F0)[2] of a syllable beginning with a voiced consonant is likely to be lower, for at least part of its duration, than that of a syllable beginning with a voiceless consonant (House & Fairbanks, 1953; Lehiste & Peterson, 1961). Indeed, it is remarkable that the early historical linguists logically inferred this likelihood without access to supporting physiological and acoustic phonetic research!

For Thai (Gandour, 1974; Erickson, 1975) and other languages (Hombert, 1975), it has been found that F0 is likely to rise upon release of a voiced initial and fall upon release of a voiceless initial; both of these perturbations tend to end and blend in with the prosodic pattern of the syllable as determined by the sentence intonation and, in tone languages, the lexical tone. Other studies (e.g.,Umeda, 1981; Kohler, 1982; Ohde, 1984; Löfqvist, Baer, McGarr, & Story, 1989) do not support a clearcut dichotomy between rising and falling perturbations. Rather,the F0 upon release of the voiced stop may in fact be on a level with, or at least not separable from, the rest of the contour; it may even fall a bit, or it may indeed rise; the crucial difference is that it is lower than the F0 onset upon release of a voiceless stop.

Physiological basis. As shown in literature reviews (Erickson,1975; Ohala,1978; Hombert et al., 1979), much ink has been spilled in support of various mechanisms that might underlie the F0 differences.Varying amounts of air flow governed by glottal size do not last long enough after stop release to account for the full effect. The role of myoelastic factors has long seemed much more probable. This would have to be some kind of difference in tension of the vocal folds. The problem has been to demonstrate this and tell what the mechanism is. One conjecture was vertical tension (Halle & Stevens, 1971), although it was hard to see how this might be executed, in spite of the finding of a higher position of the larynx for voiceless stops (Ewan & Krones, 1974). We are convinced by the recent work of Anders Löfqvist and his colleagues (Löfqvist et al., 1989; Löfqvist & McGowan, in press) that responsibility lies with varying degrees of contraction of the

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[2] The fundamental frequency of a complex sound wave is equivalent to the repetition rate of the vibrating source. Thus in speech the number of cycles of vibration per second of the vocal folds, given as a number of Hertz (Hz), is the fundamental frequency, which, of course, may vary continuously. It is the primary physical correlate of the sensation of pitch.