THE ACQUISITION OF CHINESE PHONOLOGY IN RELATION TO JAKOBSON'S LAWS OF IRREVERSIBLE SOLIDARITY

Heng-hsiung Jeng, National Taiwan University, Taipei, Republic of China

I. Introduction

This paper attempts to find out whether the laws of irreversible solidarity as proposed by Jakobson (1968; 1971) also apply to the acquisition of Chinese phonology by two Chinese children.

Chinese here refers to the Mandarin Chinese as spoken in Taiwan, Republic of China, today. This variety of Mandarin Chinese is different from the standard Mandarin in that the former generally does not have the retroflex affricates /tʂ/, /tʂ^{h}/, and the retroflex fricative /ʂ/ that can be found in the latter. As far as tones and other segmental phonemes are concerned, they are essentially the same.

The subjects are my first son Jeng Wei, born on October 15, 1969, and my second son Jeng Hung, born on June 5, 1975. The data selected for this study are those of my first son recorded between the age of 2 months when babbling started and the age of 20 months when I left for the U.S. and stopped recording, and those of my second son recorded between the age of 15 months when he began to utter the first words and the age of 31 months when he had more or less mastered Chinese phonology. All these data were recorded by the author, mainly in phonetic transcription and occasionally with a tape recorder. My first son's data were mainly used for the discussion of the acquisition of tones, and the second son's data for the discussion of the acquisition of segmental phonemes.

My wife's native Chinese dialect is Hakka, and my native Chinese dialect is the South Min dialect spoken in Taipei. Most of the time we converse in the variety of Mandarin Chinese spoken in Taiwan as characterized above. Only when my wife's relatives or mine come to visit us is Hakka or South Min heard more often. So my sons generally live in the native-speaking environment of Mandarin Chinese, with only occasional exposure to Hakka and South Min.

II. Acquisition of Chinese Phonology

A. Tones

It has been observed by Jakobson (1968, 21-22) and Lenneberg (1964, 119) that babbling is not directly related to the acquisi-

tion of speech sounds. However, they did not touch upon the acquisition of tones in a tone language.

Chao (1951) noted that most Chinese children acquire tones quite early, except some tone sandhi phenomena. Li and Thompson (1976) and Li (1978) also observed that the acquisition of tones by a Chinese child precedes the acquisition of segmental phonemes. Weir (1966, 156) even pointed out that a Chinese baby at about six months, that is, during its babbling stage, had already much tonal variation over individual vowels, while the Russian and American babies at about the same age seldom showed such variation.

The written records of my first son's babbling show that he had tonal variation over individual vowels or syllables at a very early age: [ə˧˥ə] (2 months); [ɛ˧˥ɛ] (3 months); [i˧˩˧i] (3 months); [kuɛ˧˥kuɛ] (3 months). And at 4 months, in response to my utterance [a˧˥a], he produced a similar tonal variation over the same vowels. The above examples show that at the very early stage of babbling, he not only could produce vowels and syllables with different tones, but also link such production to the perception of tones.

This evidence supports Chao's (1951), Li and Thompson's (1976) and Li's (1978) observations that tones are acquired quite early by Chinese children. With such ability to perceive and produce tones transferred from the babbling stage, a Chinese child usually sets out to acquire his first Chinese words with practically correct tones. My first son, at 11 months, uttered his first word [papa] correctly with a falling tone followed by a neutral tone. At one year, he produced the word [pa^{w}] 'to mix milk powder with water' correctly with the falling tone even though the aspirated voiceless bilabial stop /p^{h}/ was incorrectly pronounced as its unaspirated counterpart. At 15 months, he could recognize the difference between [ɕiɛɕiɛ] 'shoes' and [ɕiɛɕiɛ] 'thanks', [xua] 'flower' and [xua] 'painting' because of their different tone patterns, even though he could not produce them yet. My second son at 16 months, about one month after the utterance of his first word, produced a minimal pair with tones as the distinctive elements: [pa^{w}pa^{w}] 'bread; food' and [pa^{w}pa^{w}] 'hold in arms'.

Mandarin Chinese has four tones and one neutral tone, which occurs only in an unstressed syllable. Besides the above mentioned high level tone [˥] (55), namely the first tone, in such a word as [xua] 'flower', falling tone [˥˩] (51), namely the fourth tone, in such a word as [xua] 'painting', and neutral tone [˧] in the second syllable of the word [papa] 'father', there are the rising tone [˧˥] (35), namely the second tone, and the falling-rising tone [˨˩˧] (214), namely the third tone, which is realized as [˧˥] (35) when it occurs immediately before another third tone and normally realized as [˨˩] (21) elsewhere. Both my first and second sons acquired the second and third tones more or less simultaneously and without much difficulty: my first son had been able to produce the second-tone words [mai] 'buy', [niu] 'cow', and the third-tone words [tɕi] 'self' in [tsi tɕi lai] 'by oneself', [tɕ^{h}i] 'rise' in [tɕ^{h}i lai] 'get up' by the age of 19.5 months; my second son uttered the second-tone words [tɕien] 'money' at 17.5 months, [nai] 'come' at 18.5 months, and the third-tone words [ta kai] 'open' at 16.5 months, [pa pe] 'urinate' at 17 months. However, they occasionally mispronounced some second-tone words as third-tone words and vice versa, and this supports the view of Li and Thompson (1976, 189) concerning such occasional confusion.

As for tone sandhi phenomena, the data of my second son, contrary to Chao's (1951) observations, show that he generally had no problem with them. And this also supports the view of Li and Thompson (1976, 189) that "tone sandhi rules are learned, with infrequent errors". For example, the third-tone word /uo/ 'I' before another third-tone word was correctly changed to the second tone in the expression [uo ie iau tsu tsy] 'I also want to go out' uttered at 21.5 months, while before a neutral-tone word, it was correctly realized as [uo] in the expression [uo tɤ] 'mine', uttered at 21.5 months. And the fourth-tone word /pu/ 'not' before another fourth-tone word was correctly changed to the second tone in the expression [pu tsai] 'absent' uttered at 24 months, but before a third-tone word, it remained unchanged in the expression [pu ɕi xuan] 'don't like' uttered at 22.5 months.

Therefore, Chinese tones, unlike segmental phonemes which have to evolve slowly step by step, are perhaps acquired by a Chinese child during babbling before the utterance of the first word and assigned immediately to the first words acquired.

But why are tones acquired before segmental phonemes? Perhaps the answer may be found in the lateralization of the human brain. Fromkin and Rodman (1974, 312) state that after lateralization,

the right brain is specialized in pattern-matching and the left brain in analytical thinking. Probably that is why such discrete linguistic elements as segmental phonemes can be acquired by the left brain after lateralization, which takes place around the age of one, and before lateralization, when both sides of the brain are still symmetrical, only suprasegmental patterns such as tones can be acquired.

B. Consonants and Vowels

My second son's acquisition of Chinese segmental phonemes may be divided into two stages: i. minimal phonological system; ii. fully developed phonological system, which is almost identical with an adult Mandarin speaker's phonology.

The minimal phonological system consists of four stops, /p/, which has two allophones [m] and [b] as free variants, /t/, /k/, and /ts/, which has an allophone [tʂ] occurring before /i/, and four vowels, /a/, /a^{w}/, /i/, and /e/. All these segmental phonemes were acquired within 44 days, between September 25 and November 8, 1976. And the words uttered within this period are as follows:

(9/25)[1] [papa] 'people'; (9/26) [ka^{w}ka^{w}] 'older brother', [ie tʂi]~[te tʂi] 'eyes'; (10/4) [a tʂitʂi] 'dirty'; (10/12) [pa^{w}pa^{w}] 'bread; food'; (10/18) [pa^{w}pa^{w}] 'hold in arms'; (10/19) [tsatsa] 'dirty'; (10/26) [ta kai] 'open', [tata] 'candy', [te ta] 'fall down', [mapa]~[baba]~[papa] 'people'; (10/28) [piapia] 'don't want'; (10/29) [pa?pa] 'car'; (11/2) [βa] 'flower'[2]; (11/7) [tia] 'drop'; (11/8) [pa pe] 'urinate'.

Beyond this stage of minimal phonological system, nasals, aspirated stops, fricatives except /f/, and the retroflex liquid /r/ emerged almost simultaneously although they became stable at different times. The lateral liquid /l/ appeared later than all these sounds, and /f/ was the last sound to appear. The following table shows when these consonants first emerged and when they became stable. The first number under each consonant indicates the age (in months) when it emerged, and the second number the age when it became stable.

(1) Hereafter, the Arabic numeral before a slash indicates the month and the Arabic numeral after it indicates the day of the month.

(2) This voiced bilabial fricative [β], which evolved into /x/ later on, does not fit into the minimal phonological system proposed here.

Table 1

Emergence and stabilization of further consonants in the fully developed phonological system

	p^{h}	t^{h}	k^{h}	ts^{h}	m	n	ŋ	r	f	s	x	l
Emer.	19	21.5	17	20	17	17	19	17	29	18	18	20.5
Stabi.	22.5	22.5	22	22	17	23	22.5	17	29	18	18	20.5

The vowels that emerged in the fully developed phonological system are /u/, /y/, /ɨ/, and /o/, which has the allophone [ɤ] when occurring after a nonlabial sound or occurring as a word-initial vowel. Once these vowels were acquired, they were very stable afterwards, except /y/, which at one time lapsed into [i^{w}] for the word "fish", whose proper pronunciation is [y]. The ages when these vowels appeared are given in the following table.

Table 2

Emergence of further vowels in the fully developed phonological system

	u	ɨ	y	o	ɤ
Emer.	17.5	20.5	19.5	18	20

The division of Jeng Hung's phonological development into the minimal phonological system and the fully developed phonological system may appear to be rather arbitrary. However, because of the simple distinctive features involved in the minimal phonological system and the complex distinctive features involved in the fully developed phonological system, the division is not without justification: in the minimal system, each of the consonants has only two distinctive features, that is, [+stop] and point of articulation, and each of the vowels is distinguished from the other vowels by two features, [±high] and [±low], except /a^{w}/, which has an additional feature of [+labialized]; in the fully developed system, after the age of 17 months, more consonants are distinguished by

more complex manner features such as [±aspirated], [±nasal], [±fricative], [±liquid], and [±retroflex] even though their points of articulation remain more or less the same as those of the stops in the minimal system, and vowels are further distinguished by [±back] and [±round].

III. Jakobson's Laws of Irreversible Solidarity

Jakobson (1968; 1971) set forth the laws of irreversible solidarity to account for the chronology of the acquisition of speech sounds by children, sound changes, and loss of speech sounds by aphasics. Now the acquisition of Chinese phonology by my sons Jeng Wei and Jeng Hung will be discussed in the light of his laws.

1) Jakobson did not touch upon the acquisition of tones in tone languages. According to Li and Thompson (1976) and Li (1978), the acquisition of tones precedes the acquisition of segmental phonemes. The discussion in II.A further points out that babbling has an important bearing on the acquisition of tones.

2) In the minimal phonological system of Jeng Hung, the vowels /i/, /e/, and /a/ form a vertical split as Jakobson predicted, but the labialized vowel /a^w/, which developed into the diphthong /au/ at 17.5 months, does not fit neatly into the pattern, and the consonants /p/, /t/, /k/, and /ts/ deviate from his laws of first and second consonantal split.

3) The early appearance of /k/ in Jeng Hung's minimal phonological system and /k^h/ and /x/ in his fully developed phonological system forms a counterexample to Jakobson's law that back consonants presuppose front consonants.

4) Jakobson's law that back rounded vowels presuppose their corresponding front unrounded vowels is supported by Jeng Hung's early acquisition of /i/ and /e/ and late acquisition of /u/ and /o/. So is his law that /y/ presupposes /i/ and /u/.

5) The almost simultaneous appearance of the aspirated stops, nasals, fricatives except /f/, and the retroflex liquid /r/ cannot be accounted for by Jakobson's laws. One tentative explanation proposed here is that these aspirated stops, nasals, and fricatives except /f/, being identical with their corresponding unaspirated stops in the minimal phonological system with respect to points of articulation, are developed simultaneously on the basis of adding to the existent unaspirated stops one more distinctive feature from the different manners of articulation such as [+aspirated], [+nasal], and [+fricative]. The late acquisition of /f/, in the light of this explanation, may be due to the fact that its point of articulation is different from any of the unaspirated stops in the minimal phonological system, hence the substitution of /f/ by the voiceless bilabial fricative [Φ] in the words [i˥ Φu˥] 'clothes' and [Φei˥ tɕi˥] 'aeroplane'. As for the simultaneous acquisition of /r/ with aspirated stops, nasals, and fricatives except /f/, one possible explanation is that the additional distinctive feature of [+retroflex] is combined with the negative values of these manners of articulation as a clear-cut opposition.

6) Jakobson (1968) pointed out that the second liquid is one of the last sounds acquired by the child. The late acquisition of /l/ by Jeng Hung at 20.5 months, only before /f/, the last sound acquired, supports his view.

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