An Experimental Study on the Productivity of Taiwanese Tone Sandhi*

H. Samuel Wang
National Tsing Hua University
Hsin-chu, Taiwan, ROC

Taiwanese in this paper refers to the South Min dialect of Chinese spoken on the island of Taiwan. Taiwanese, as a variety of the South Min Dialect, has been observed to display tonal changes when words are put together. This phenomenon is commonly known as 'tone sandhi' in the literature. In the following section, we will briefly sketch the phenomenon. For more detailed discussions of the phenomenon, please refer to R. Cheng (1968, 1973).

1. The phenomenon of tone sandhi

Taiwanese is traditionally considered as having seven tones, two of which being entering and the other five non-entering. The entering tones are those in syllables ending in stops /p, t, k, ʔ/, while the non-entering tones are those in other syllable types, including syllables ending in vowels, glides and nasals.

Using a five-point tonal scale with 5 representing the highest pitch and 1 the lowest pitch, the Taiwanese tones and their sandhi changes are summarized in (1).

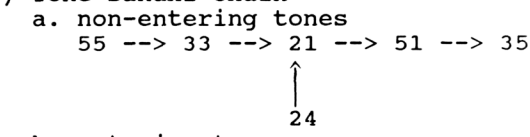
(1) Taiwanese tones

	isolation	sandhi	gloss
a. non-entering			
hue	55	33	'flower'
bin	33	21	'face'
ts'ai	21	51	'vegetable'
hai	51	35(55)[1]	'sea'
t'ao	24	21(33)[1]	'head'
b. entering			
tsap	4	3(2)[1]	'ten'
kɔk	3	4	'country'

When a word is said in isolation or is used in the final position of a tonal group, the isolation tone is used.[2] When it occurs in non-final positions of a tonal group, the sandhi tone is used. Such changes constitute sandhi relationships as diagramed below.[3]

(2) Tone sandhi chain

a. non-entering tones



b. entering tones

4 <--> 3

2. The psychological reality of tone sandhi rules

In the generative paradigm, as proclaimed by Chomsky and Halle (1968), the mission of a linguist is to construct, from the regularities observed in a language, a grammar which is a description of the speaker's competence. From this proclamation stem the many psycholinguistic experiments in the post-SPE era, testing the validity of linguistic rules as respresentations of the speaker's competence. One of the more noted experiments was done by H.I. Hsieh (1970) on the psychological reality of Taiwanese tone sandhi rules.

Because the standard assumption of a generative account is to have one basic phonological form posited for each lexical item, and the other alternate forms are all arrived at by the application of relevant rules, Hsieh wanted to test whether this assumption was valid for Taiwanese tone sandhi. More specifically, he wanted to find out whether Taiwanese speakers are psychologically aware of the tone sandhi rules and produce sandhi forms accordingly. Thus, following Berko (1958), he made up some nonsense syllables using the accidental tonotactic gaps in Taiwanese and presented them to the native speakers in proper environments to see if they could produce the predicted sandhi forms. Of the five non-entering tones tested, he found that the subjects produced only 10 to 30 percent correct sandhi forms in their answers. The great majority of the errors made resulted from not changing the tones at all. Hsieh thus concluded that the generative assumption does not provide satisfactory explanation for the phenomenon, and should therefore be abandoned. He proposed instead to list both the the isolation tone and the sandhi tone in the lexicon and choose the appropriate form in proper environments.

However, Liao (1972) considered Hsieh's proposal counterintuitive. He conducted another experiment in an attempt to verify the validity of Hsieh's claim. In his experiment he used written stimuli: the test items were

presented in Chinese characters. He asked the subjects to read two-morpheme compounds in one column and the reversed-order morphemes in anther column. The compounds in the first column are familiar to the subjects, while those in the second column, composed of the two morphemes in the first column but in reverse order, are unfamiliar. His assumption was that, if the tone sandhi rule is productive, then the unfamiliar compounds should demonstrate tone sandhi behaviors. The results showed that the predicted tone sandhi behavior was observed close to 100 percent of the time. In the second part of the experiment he used three-morpheme compounds were administered, among which some of the second two morphemes were identical to the second column of part one. The results also showed close to 100 percent correct response according to the tone sandhi rules. He therefore concluded that the tone sandhi rules as formulated by linguists are productive and hence have psychological reality.

Faced with this kind of contradictory evidence, one is certainly curious to know which conclusion is closer to the truth. Liao's experimental results do not really falsify Hsieh's theory, because Hsieh proposes for both isolation form and sandhi form to be listed in the lexicon. If such is the case, the subjects in Liao's experiment were still able to pick out the appropriate form facing the unfamiliar combination of morphemes, so long as he/she could identify the proper environments. But Liao's feeling that the phenomenon should be productive is not unfounded. We have at hand two pieces of evidence to that effect. One is the newly coined compound [kai51 sien55] 'someone who is good at witty talk' which appeared about twenty years ago and has become a normal expression. The corresponding verb for 'to engage in witty talk' is [kai21], such as in [i33 tsin33 gao33 kai21] 'He is good at witty talk'. The tonal alternation '21'-'51' is precisely one of the tone sandhi relationships described above. The second piece of evidence comes from loan words. In Taiwanese there are a number of loan words which were borrowed from Japanese. These words all bear Taiwanese tones for individual syllables. For example, [t'ɔ33 ma55 to?3] 'tomato' but [t'ɔ33 ma55 to?4 tsiap3] 'tomato juice'; [ɔ33 to55 bai51] 'motorcycle' but [ɔ33 to55 bai55 tiam21] 'motorcycle shop'. The alternations '3'-'4' and '51'-'55' all demonstrate sandhi behaviors.

Therefore, the controvercy is not settled by these two papers. Hsieh (1975) therefore conducted another experiment using both child and adult subjects to test

whether they could manipulate the tonal changes with unfamiliar morphemes or compounds with unfamiliar morpheme combinations. He concluded that whatever productivity demonstrated in the experiment was the result of familiarity of the morpheme or morpheme combination, and such familiarity provides the basis for lexical diffusion (W. Wang 1969) and analogical association of the relationships. In this way, Hsieh maintains his 'surface- forms-too' hypothesis for lexical representation as opposed to the generative assumption which he terms 'base-form-only'. This familiarity account can certainly accomodate the two pieces of evidence we presented in the previous paragraph, but it still falls short of explaining why, for example, the sandhi form for [kai21] is necessarily [kai51 (sien55)], because if both forms are listed in the lexicon, the isolation form can be associated with any other tone for its sandhi variant. There is obviously some more general principle that guides its association.

The purpose of this study is to explore whether familarity factor really plays a role in the tone sandhi phenomenon, and if so, how the phenomenon can best be characterized. In order to test the familiarity factor, a long-term experiment spanning over four months was conducted, using made-up words similar to Hsieh (1970) but differring in important ways.

3. The experiment

1) Subjects

Twenty-two native speakers of Taiwanese took part in this experiment, all of whom used the subdialect of Hsin-chu. Among these subjects three were male and the other 19 were female. Their ages at 1990 ranged from 46 to 72 (Mean=61.73, s.d.=7.38). They were paid for their participation.

2) Procedure

Two nonce words were made up for each of the seven tones, which constitutes a total of 14 words. These words are shown below:

(3) Nonce words and their made-up meanings

Tones	Nonce word	Meanining	Nonce word	Meaning
55	p'uai	'scissors'	ts'ã	'pen'
33	biu	'flute'	puē	'clothes'
21	sɔm	'necklace'	ts'ũãĩ	'rabbit'