

PRODUCTIVITY IN TAIWANESE TONE SANDHI *REDUX*

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ABSTRACT

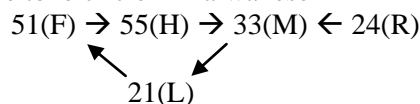
This paper aims to re-examine the issues of psychological reality of the Taiwanese Tone Circle with a novel experimental setting. Previous results from various wug tests all suggested that the tone sandhi rules should be unproductive, due to the obtained poor correct response rates (in general below 20%~30%; [3, 4, 6, 8]). But it is important to note that these results are confounded with the factor that not a single rating experiment has ever been conducted for those nonce words so it is reasonable to question whether the participants were really assimilated to those nonce words when in experiments (or, the “foreignness” quandary). This is because no linguistic computation would be possible if the speakers fail to come up with a proper lexical representation. To avoid this problem, we used real words to study this issue by means of “homophone resolver expression” and our results showed that the correct response rates can be as high as 75%, suggesting that Taiwanese tone sandhi rules may not be necessarily unproductive as is widely assumed.

Keywords: Taiwanese sandhi rules, psychological reality, wug test

1. INTRODUCTION

It is well-known that general tones sandhi rules in Taiwanese exhibit a pattern of the circular tonal chainshifts (or, the Tone Circle), as in (1). Citation or base tones occur in final positions in a phrase, while sandhi tones occur in non-final positions. For example, [be F] ‘buy’ vs. [beH hiR] ‘buy fish’; [hi R] ‘fish’ vs. [hiM t^hauR] ‘fish head’, etc.

(1) The tone circle in Taiwanese



Circular tonal chainshifts have been attracted a lot of attention in the tone sandhi literatures because of the analytical difficulties that are outlined in [1], for example. Also, since Hsieh’s [3] seminal work, it has been severely questioned

whether the above tone sandhi rules are productive or psychologically real because native speakers simply failed to apply these rules to nonce words. In general, the successful application rates for each rule are as low as 20%~30%. Hsieh’s findings were further formalized as the Allomorph Selection Hypothesis [5]. Tsay and Myers [5] argue that there are two allomorphs for each tone (or, the opposition of citation/juncture/base tone vs. context/sandhi tone), and the allomorph selection is determined by syntax (i.e. phase-final vs. non-phase-final positions). In other words, the tonal alternations in (1) are all memorized and listed in the lexicon. Recently, Zhang, et al.’s [7] results, again, showed that the “alternations” in (1) are memorized for the existing items, but not generalized to novel items. The effects of opacity are dominant in their wug tests, while the frequency effect is inconsistent between subject groups. In yet another experiment, Zhang, et al. [8] claimed that the effect of duration-matching plays a relatively strong factor on the productivity of the tone sandhi rules. Evidence came from the low application rate of the sandhi rule F→H, because the duration-increasing, most frequent H tone was the least preferred tone in sandhi-initial position (while F is the shortest tone throughout). In sum, it might be concluded that that the “unnatural” tone sandhi patterns in (1) are memorized and hence underlearned.

We believe that cannot be the entire story for Taiwanese tone sandhi, however. The reason is that the acceptability of those nonce words was never rated. That is not a trivial issue because if these words are not fully assimilated on-site, it is not expected that linguistic computation is possible without proper lexical representations. A further discussion of the results of Wang’s [6] experiments may be of help here. His result showed that the “foreignness” of nonce words to a certain extent did influence subjects’ “performances” in applying the Taiwanese tone sandhi rules. He conducted a longitudinal experiment, and found that there were more and more successful cases of rule application towards the end of the four-month long experiment,

suggesting that “familiarity” may play a role in this regard.

2. EXPERIMENTS

2.1. Stimuli

In this study, we investigate this old issue from a new angle. We used disyllabic monomorphemic words and Japanese loanwords as the test materials. Both are a combination of two meaningless, semantically opaque, or gibberish syllables. We asked native Taiwanese speakers to see a picture from the computer screen, and to produce those words in the frame sentence: [AB e A], which literally means “AB’s A”. That can be understood as a kind of homophone resolver expression across Chinese languages. In phrases like this, the second A is “forced” to appear in final position so that base/citation/underlying tones should occur if the tone sandhi rules are productive. Also, we employed a picture-naming task to avoid potential problems like orthographic influences.

Two types of monomorphemic words are used: native words such as [t^haiH koH] ‘leprosy’ and Japanese loanwords such as [suH si?M] ‘sushi’. For native words, the stimuli came into two varieties: i) semantically opaque monomorphemic words, such as [laM hio?H] ‘eagle’ in which, to our knowledge, no corresponding Chinese characters are ever available, and ii) semantically semi-opaque monomorphemic words in which the initial syllable is meaningless in isolation such as [kuH ts^haiL] ‘leek; or, literally, “leek-vegetable”’ (cf. “cranberry” in English).

All possible (non-checked) tonal combinations can be found in these disyllabic monomorphemic words, yielding a total number of 50 test words (5T*5T*2 tokens*1 reps=50 test words). As for the Japanese loanwords, only four possible tonal patterns are attested (4 patterns* 8 tokens* 2 reps=64 test words).

The subjects’ responses were recorded by a digital recorder (Edirol R09) and with a high quality headphone (NADY).

2.2. Participants

We recruited 12 native speakers of Taiwanese in our study: there are four old speakers (aged 80 to 90), four middle-aged speakers (aged 40 to 50 years) and four young speakers (aged 20 to 30). All of them speak Mainstream Taiwanese. The old speakers are all monolingual and illiterate, so no language interference would be expected for them.

2.3. Data analysis

The obtained responses were transcribed by two phonetically trained linguists. Since speakers were directed to embed test words within the frame “AB’s A”, it’s not difficult to find out if a certain tone sandhi rule correctly applies. If speakers successfully change a sandhi tone (i.e. the tone in the first A) “back to” the expected citation tone (i.e. the tone in the second A), then that count as an instance of correct response. Take [t^haiH] in [t^haiH koH] “leprosy” for example. We expect that speakers apply the sandhi rule F→H when uttering the second A. In other words, speakers are supposed to “recover” a Falling tone in final position in phrases like [t^haiH koH e t^haiF]. But if that rule is not “productive”, participants may do nothing and pronounce both words with same tone, for example, [t^haiH koH e t^haiH]. This is because tones may not be generated by rules hence no alternation is anticipated.

3. RESULTS

3.1. Experiment 1: Native words

Five (5) sandhi rules of non-checked, long tones were examined in this experiment. We see in Table 1 that the most “productive” rules are M→L and L→F (whose correct response rates (hereafter CRR) were 75% and 73%, respectively). By contrast, the result of F→H is the worst (44%), but it is important to note that 44% is still higher than above chance (=20%). An asymmetry emerges. That is, it seems that our speakers have difficulties in “recovering” the base/citation tone, when the sandhi/context tone is a high level tone. But they don’t have problems to “recover” a Low tone, when the sandhi/context tone is a Falling tone.

Finally, the rules R→M and H→M are considerably “recoverable”, too, (50% and 61 %, respectively). Note that the “expected” citation/base tones here were determined with the help of dictionaries or rime books since these syllables never occur in phrase-final position.

Table 1: Correct response rate (CRR) for monomorphemic words

Sandhi rules	“Surface” AB e A	“Citation” AB e A	CRR	No change	Others
L→F	F	L	73%	22%	5%
F→H	H	F	44%	35%	21%
M→L	L	M	75%	16%	9%
R→M	M	R	50%	22%	28%
H→M	M	H	61%	22%	17%
Total Average CRR: 61%					

There are two things to note in Table 1. First, $R \rightarrow M$ was the most productive tone sandhi rule in former studies [6-8], but it is not the case in this experiment. Second, the three highest application rates are found in the cases of $M \rightarrow L$, $L \rightarrow F$ and $H \rightarrow M$. It seems that our participants did a better job in recovering the underlying level tones.

A One-Way ANOVA was conducted for age (Old, Middle-aged and Youth) as an independent variable and correct response rate as a dependent variable. The results showed that the effect of age is not statistically significant except for the sandhi rule $M \rightarrow L$ ($P > 0.05$ for $L \rightarrow F$; $P > 0.05$ for $F \rightarrow H$; $P > 0.05$ for $H \rightarrow M$; $P > 0.05$ for $R \rightarrow M$; $p < 0.05$ for $M \rightarrow L$), indicating that the production of the five tone sandhi rules is consistent among three types of age groups.

3.2. Experiment 2: Japanese loanwords

Previous studies showed that in Taiwanese, tone assignments in Japanese loanwords are sensitive to rime structures [2]. The generalization is that in the loanwords, heavy syllables in Japanese carry a contour tone, while light syllables carry a level tone. We also found that participants treated CV as checked syllables and CVN as a long/non-checked syllable [2]. Hence, sandhi rules are different from the ones we saw in our previous experiment, using native words. Most of our speakers surprisingly pronounced CV syllable with an obvious glottal stop when in final position, for example, [suH si?M e su?L]. Since tone assignment of the Japanese loanwords is sensitive to rime structures, tone sandhi rule applications are also different in this regard. Two possible responses can be expected. If participants consider the CV in loanwords as a short syllable (with a checked tone), the checked tone sandhi rule will apply, e.g. $M \rightarrow H$ and $H \rightarrow L$, but if they treat them as a long vowel, then the five sandhi tones in (1) will apply. Therefore, for the first syllable in CVCV?, such as [suH si?M] ‘sushi’, we see 71% of the responses like [suH si?M e su?L], and 16% of the responses like [suH si?M e suH].

The average CRR is 52% for loanwords, which is lower than that for the monomorphemic native words (61%). But it should be noted that both are significantly higher than the results from previous studies (cf [3] 20%~30%; [6] around 50%; [8] 20%~40%).

Table 2: Correct response rates (CRR) for Japanese loanwords.

sy_stc	“Surface” AB e A	“Citation” AB e A	CRR	No change	Others
CVV/CVN	F	L/L?	45%	49%	6%
	H	F	50%	25%	25%
	M	H/R	41%	29%	30%
CV	F	L/L?	58%	32%	10%
	H	L?	71%	16%	13%
	M	H/R	40%	19%	41%
Total Average CRR: 52%					

4. GENERAL DISCUSSION

4.1. Psychological reality

The Taiwanese Tone Circle has long been claimed to be unproductive and psychologically unreal. In this study, however, our results instead showed better successful application rates. It is evident that the major difference between this study and the previous studies lie in the test materials. In our study, we used real words, rather than nonce words. So it suggests that wug-testing may be not a proper method to test for psychological reality of tonal chainshifts and other phonological phenomena in Chinese languages because speakers may not be able to nativize nonce words within a short time span. Consequently, it may well be the case that the low productivity in former wug tests is attributed to the “foreignness” problem. In our study, we used native monomorphemic words and Japanese loanwords to avoid this problem. At the same time, our test materials can be regarded as novel items, too. In this sense, our experimental design is indeed similar to those of the previous wug tests, but only with the important distinction: a combination of two meaningless syllables forms a real, meaningful word. Our results showed that the CRR of the sandhi rules is relatively higher than above chance (=20%), indicating that the General Tone Sandhi rules may not be so “unproductive” if familiarity of the test words is enhanced.

Previous wug-testing results are mostly correlated with opacity, acoustic properties, lexical frequency and so on. It is important to note that none of our results showed direct correspondence to the above factors. For example, the frequency information of rule applications in a spoken corpus is (adapted from [7, 8]):

- (2) Token frequencies in the spoken corpus:
H > R > M > F > L

- (3) Correct response rate in [8]'s work:
 AO R→M>H→M>L→F>M→L>F→H
 *AO R→M>H→M>M→L>L→F>F→H
 AG H→M>R→M>L→F>F→H>M→L
- (4) The results in the present study
 M > L > H > R > F

In (3), AO stands for existing Taiwanese syllables with actual occurring reduplications, *AO stands for existing Taiwanese syllables without actual occurring reduplications, and AG stands for accidental gaps in the Taiwanese syllabary. [7] showed that both the most productive sandhi rule (H→M) and the least productive sandhi rule (L→F) can explicitly correlate to the token frequencies in a spoken corpus of Taiwanese. Nevertheless, no direct relation was observed in our results, as in (3). Furthermore, the low productivity associated with a certain tone sandhi rule cannot be entirely due to matching of phonetic duration. On the one hand, the mid tone, for example, is not the durationally longest tone (either in final or non-final positions) but the tone sandhi rule M→L is the most “productive” one in our experiment. On the other hand, interestingly enough, the most productive rule R→M in [7, 8] is not equally good in the present study, indicating that the durationally longest rising tone may not be always preferred in phrase-final position. Finally, it is noteworthy that L→F has long been regarded as the least faithful mapping among the rules in (1). Yet this particular rule has one of the highest productivities in the current experimental setting.

In sum, it is evident that our results do not confirm those from previous wug tests. What is even more problematic is that there are many mutually conflicting results, as mentioned above. It remains to be seen why that would be the case.

5. CONCLUSION

In this study, we showed that unnatural patterns like Taiwanese tone sandhi may be generalized to novel items. In other words, our results showed that better correct response rates can be obtained in an experiment that resembles the classic wug-tests in many ways as long as real words are used. Our study also indicated that (extra-)linguistic factors such as opacity, frequency, acoustic properties and the like play a considerably limited role in the current experiments. The present study calls for new protocols of experiments of this sort in the future. Importantly, the “foreignness” problem

must be adequately controlled for before a classic wug test is conducted.

6. ACKNOWLEDGEMENTS

This work is supported by the project grant “Multicultural studies in Monsoon Asia” awarded to National Tsing Hua University from the Ministry of Education of Taiwan.

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