

Tone Change in Taiwanese: Age and Geographic Factors

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1. Introduction

1.1. Purpose of the study

1.2. Traditional tonal categories

A: Traditional Taiwanese tonal categories according to Cheng.

Samples	君 [kun] gentle	滾 [kun] boil	棍 [kun] stick	骨 [kut] bone	裙 [kun] skirt	-	近 [kun] near	滑 [kut] slippery
Traditional Tone Categories	陰平 im-peng	陰上 im-siong	陰去 im-khi	陰入 im-jip	陽平 iong-peng	陽上 iong-siong	陽去 iong-khi	陽入 iong-jip
Traditional Tone Numbers	1st	2nd	3rd	4th	5th	6th	7th	8th
Tonal Values of Five Scales	55	53	21	32	13		33	54
Graphical Five Scales	⌋	⌋	√	·	∟		⌋	·
Descriptions	Hl	Hf	Lf	Ms	Lr		Ml	Hs
	HH	HM	ML	Mc	LM		MM	Hc

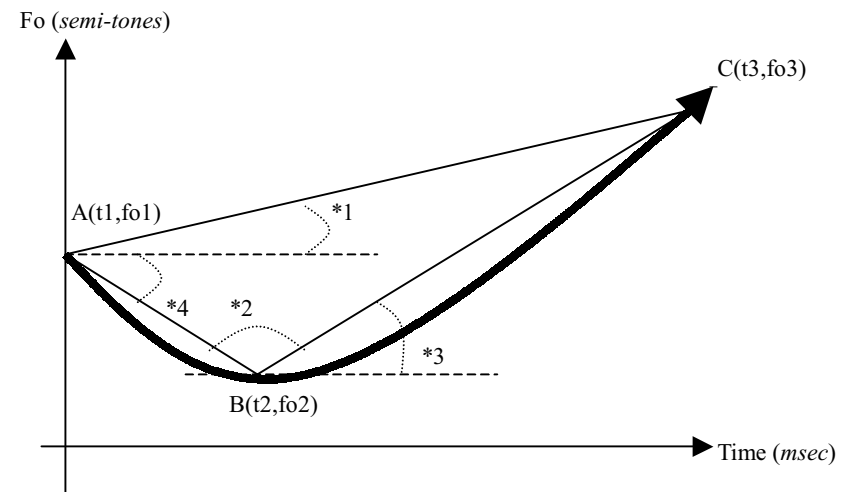
H=High (or +High, -Low); M=Mid (or -High, -Low); L=Low (-High, +Low)

l=level, f=falling, r=rising, s=short, c=checked (when p,t,k,h in the final)

2. Methodology

2.1. Method of Tonal Triangle Analysis (MOTTA)

Five criteria to be measured. Angle *1, *2, **ROP** (Ratio of Pitch), **BOP** (Beginning of Pitch), and **DOP** (Duration of Pitch).



A: the beginning point of tonal contour

B: the turning point (the lowest point of Fo) of tonal contour

C: the ending point of tonal contour

2.2. Word list (only last syllable was measured)

國軍, 水在滾, 真好睏, 排骨, 短裙, 命運, 路真滑.

2.3. Speakers

AGE * PLACE Crosstabulation

Count		PLACE				Total
		North	central	South	other	
AGE	under30	11	4	3	1	19
	30-50	3	2			5
	over50			6		6
Total		14	6	9	1	30

14 females and 16 males. Five informants were monolingual of Taiwanese, and others were bilingual of Mandarin and Taiwanese.

2.4. Procedure

5 repetitions of each word were recorded in a cassette → PC with Computerised Extraction of Components Intonation of Language (CECIL) → MS Excel → SPSS.

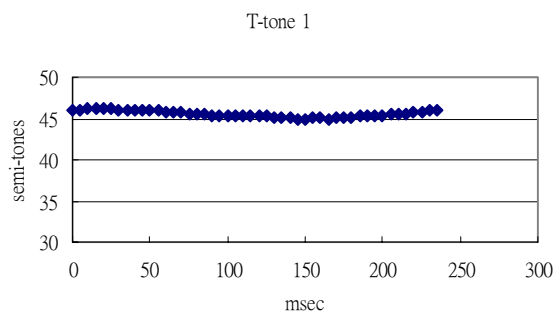
2.5. Data analysis

SPSS univariats ANOVAs. Five percent of significance level.

3. Results and Findings

3.1. Tonal descriptions of Taiwanese

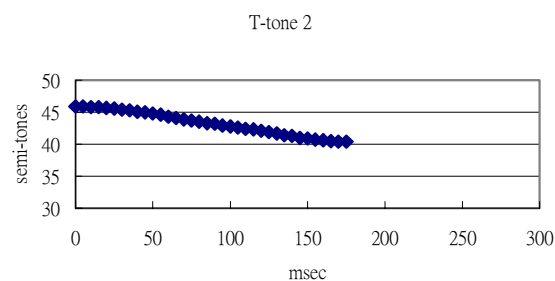
Traditionally, **tone 1** was described as a straight line. However, measurement of *2 reveal that the shape of Tone 1 should be phonetically described as a curve rather than a straight line. That is, tone 1 is slightly falling and then rising. The value of *2 in tone 1 ranges from the lowest 0 to the highest 2.188, and the mean is 0.718 degree of MOTTA.



T-Tone 1	ROP	*1	*2	BOP	DOP
mean	0.830	-0.025	0.718	41.7	224.2
sd.	0.990	0.203	0.711	3.5	58
highest	3.272	0.303	2.188	47.5	385
lowest	0.000	-0.417	0.000	34.1	140

Tone 2

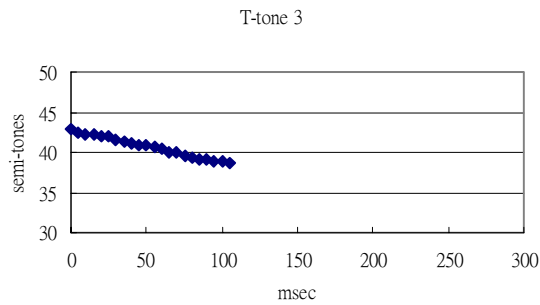
Tone 2 is a high falling tone with *1 value at an average of -2.187 degree, and BOT value at an average of 42.4 semitones.



T-Tone 2	ROT	*1	*2	BOT	DOT
mean	0.030	-2.187	-0.507	42.4	120.3
sd.	0.071	0.791	1.256	3.6	38
highest	0.231	-1.094	0.000	51.0	205
lowest	0.000	-3.890	-5.291	35.7	50

Tone 3

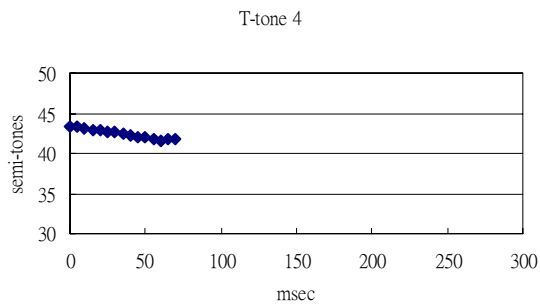
Tone 3 is a mid or low falling tone (in contrast to the high falling of tone 2) with *1 value at an average of -2.414 degree, and BOT value at an average of 39 semitones. Tone 3 is relatively lower and shorter than tone 2.



T-Tone 3	ROT	*1	*2	BOT	DOT
mean	0.002	-2.414	0.225	39.0	91.6
sd.	0.012	1.262	1.189	4.5	40
highest	0.063	-0.573	6.296	48.3	165
lowest	0.000	-5.458	0.000	33.2	20

Tone 4

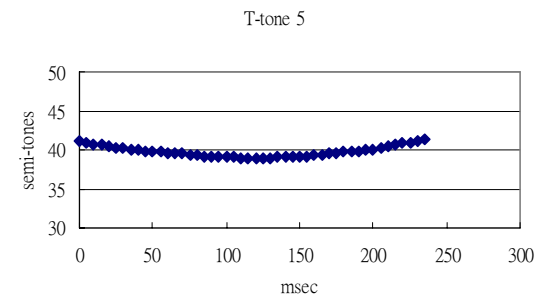
Tone 4 is a short and abrupt falling tone, with *1 value at an average of -1.214 degree and DOT value at an average of 71 msec. Tone 4 and tone 8 are in contrast to each other. Tone 4 is relatively lower, and tone 8 is higher. For example, speaker *ca* in this study produced tone 4 at the value of 38.9 semitones, and tone 8 at the value of 43.4 semitones.



T-Tone 4	ROT	*1	*2	BOT	DOT
mean	0.046	-1.214	-0.216	39	71
sd.	0.122	0.634	0.615	3.6	18
highest	0.444	-0.246	0.000	47.0	95
lowest	0.000	-2.545	-2.578	31.3	25

Tone 5

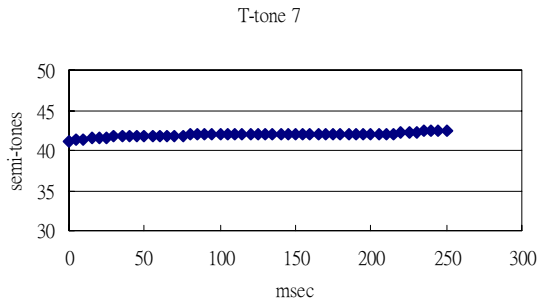
Traditionally, Taiwanese tone 5 is described as a low rising tone (12). However, my measurements suggest that tone 5 should be a low falling and then rising tone (212). The mean value of angle between falling and rising (i.e. Angle 2) is 1.493 MOTTA with a standard deviation of 1.093. The mean value of ratio of falling to rising (i.e. ROT) is 1.498 MOTTA with a standard deviation of 2.052. Among the 30 subjects, 21 of them show low falling-rising contour, only 5 show low rising shape. The most surprising finding is that 3 of them produced a low falling shape.



T-Tone 5	ROT	*1	*2	BOT	DOT
mean	1.498	-0.332	1.493	36.6	212.4
sd.	2.052	0.733	1.093	4.7	93
highest	9.000	1.175	3.535	44.7	450
lowest	0.000	-2.555	0.000	29.1	35

Tone 7

Tone 7 is a level tone with relatively lower pitch than tone 1. In this study, tone 7 has a BOT (Beginning of Tone) mean value of 37.5 semitones. In contrast, tone 1 has a mean value of 41.7 semitones.

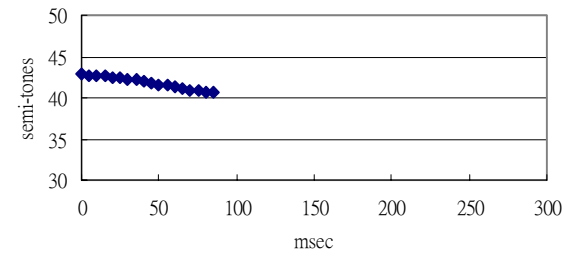


T-Tone 7	ROT	*1	*2	BOT	DOT
mean	0.067	0.285	-0.035	37.5	244.3
sd.	0.365	0.488	0.192	4.1	64
highest	2.000	2.454	0.000	46.2	390
lowest	0.000	-0.337	-1.050	30.5	110

Tone 8

Traditionally, tone 8 and tone 4 are assigned to the same phonological category *Jip-sia*ⁿ or Entering. They are all short and abrupt falling tones, but the pitch of tone 8 is relatively higher than tone 4. Although they are two distinctive tones, it has been documented that tone 8 and tone 4 are merging together in some areas, such as in *Taitiong* city of central Taiwan. For example, the informant *ab* in this study did not distinguish tone 4 and tone 8.

T-tone 8



T-Tone 8	ROT	*1	*2	BOT	DOT
mean	0.135	-0.843	-0.091	39.9	77.7
sd.	0.426	1.448	0.762	3.8	37
highest	2.000	4.086	1.337	48.9	210
lowest	0.000	-2.934	-2.864	30.4	20

3.2. Preliminary findings of tone change in Taiwanese

Tone 5

Age (over 50 vs. under 50) and geographic area (central vs. north and south) may contribute to the change of tone 5.

Tests of Between-Subjects Effects

Dependent Variable: ANGLE2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.589 ^a	3	3.196	3.290	.038
Intercept	39.190	1	39.190	40.341	.000
AGE	2.099	1	2.099	2.160	.155
PLACE	4.047	2	2.023	2.083	.147
AGE * PLACE	.000	0	.	.	.
Error	23.315	24	.971		
Total	93.016	28			
Corrected Total	32.904	27			

a. R Squared = .291 (Adjusted R Squared = .203)

- Younger generations (age under 50) tend to have the falling-rising feature, and older generations tend to have the low-rising feature.
- People in central Taiwan tend to have a small angle between falling and rising pitch contour. In contrast, people in northern and southern Taiwan have a larger angle.

Tone 4 & 8

- People in southern Taiwan are more likely to distinguish tone 4 from tone 8. In contrast, tone 4 and tone 8 are more likely to be merged among northern and central Taiwanese speakers.
- Older generations (age over 50) are more likely to distinguish tone 8 from tone 4; however, tone 4 and tone 8 are more likely to be merged in younger generations.

	North	Central	South	total
distinct	0	1	5	6
Merging	14	5	4	23
total	14	6	9	29

Table 1. Observed numbers of each category by place and tone feature.

	Under 30	30-50	Over 50	total
distinct	1	0	5	6
Merging	18	5	1	24
total	19	5	6	30

Table 2. Observed numbers of each category by age and tone feature.

4. Conclusion

T5 → becoming low falling – rising

Language contact?

T4&8 → merging together

Consequence of losing Taiwanese-speaking ability?

Tests of Between-Subjects Effects

Dependent Variable: BOT

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	603.723 ^a	19	31.775	6.539	.000
Intercept	52414.052	1	52414.052	10786.603	.000
SEX	190.548	1	190.548	39.214	.000
TONE	8.120	1	8.120	1.671	.204
PLACE	21.674	3	7.225	1.487	.233
AGE	12.814	2	6.407	1.319	.279
SEX * TONE	2.404	1	2.404	.495	.486
SEX * PLACE	9.579	1	9.579	1.971	.168
TONE * PLACE	18.707	3	6.236	1.283	.293
SEX * TONE * PLACE	.129	1	.129	.027	.871
SEX * AGE	.000	0	.	.	.
TONE * AGE	1.581	2	.790	.163	.850
SEX * TONE * AGE	.000	0	.	.	.
PLACE * AGE	25.135	1	25.135	5.173	.028
SEX * PLACE * AGE	.000	0	.	.	.
TONE * PLACE * AGE	.851	1	.851	.175	.678
SEX * TONE * PLACE * AGE	.000	0	.	.	.
Error	194.367	40	4.859		
Total	94650.240	60			
Corrected Total	798.090	59			

a. R Squared = .756 (Adjusted R Squared = .641)

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