Taiwanese and Taiwan Mandarin Tones: Tonal Drift?

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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)

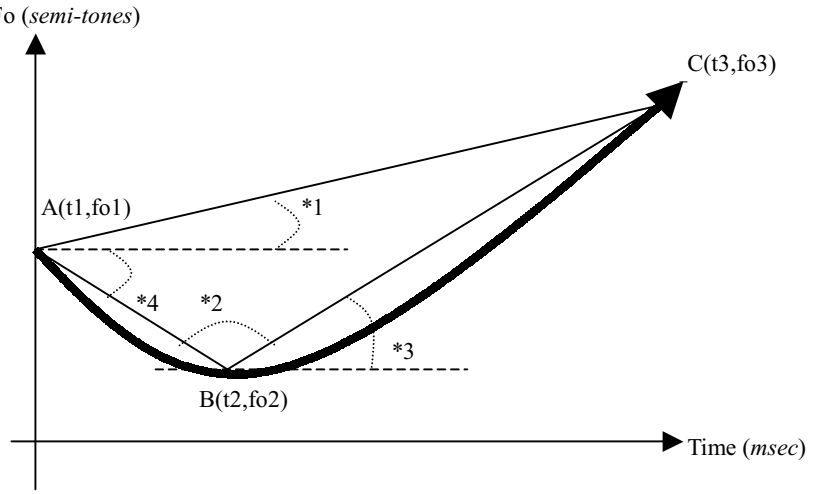
B: Traditional Mandarin tonal categories according to Chao.

Samples	媽 [ma] mother	麻 [ma] sesame	馬 [ma] horse	罵 [ma] blame
Traditional Tone Categories	陰平 im-peng	陽平 iong-peng	上聲 siong	去聲 khi
Traditional Tone Numbers	1st	2nd	3rd	4th
Tonal Values of Five Scales	55	35	214	51
Graphical Five Scales				
Descriptions	Hl	Hr	Lf-r	Hf

2. Methodology

2.1. Method of Tonal Triangle Analysis (MOTTA)

Five criteria to be measured. Angle ***1**, ***2**, **ROT** (Ratio of Tone), **BOT** (Beginning of Tone), and **DOT** (Duration of Tone).



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 lists (only last syllable was measured)

T: 國軍, 水在滾, 真好睏, 排骨, 短裙, 命運, 路真滑.

M: 保溫, 作文, 接吻, 學問

2.3. Speakers

11 females and 11 males. Taiwanese students at UTA. Average age is 27, ranging from 22-38. T-M bilingual.

2.4. Procedure

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

2.5. Data analysis

Paired t-test. 0.05 p value to reject null hypothesis.

3. Results and Findings

3.1. Tonal descriptions of Taiwanese

The shape of T-tone 1 should be phonetically regarded as a slight curve rather than a traditional straight line. It's a slightly falling and then rising contour at an average of 0.776 degrees MOTTA of curve. The average ratio of falling length to rising length is 1.052.

T-Tone 1	ROT	*1	*2	BOT	DOT
mean	1.052	-0.051	0.776	41.7	238
sd.	0.051	0.183	0.021	0.7	171
highest	3.272	0.274	2.040	47.5	385
lowest	0.000	-0.417	0.000	34.1	140

T-tone 2 is a high falling tone at an average of -2.057 degrees MOTTA of falling.

T-Tone 2	ROT	*1	*2	BOT	DOT
mean	0.041	-2.057	-0.691	42.9	118
sd.	0.000	0.733	0.093	743.0	81
highest	0.231	-1.094	0.000	51.0	205
lowest	0.000	-3.890	-5.291	35.7	50

T-tone 3 is a mid falling tone at an average of -2.767 degrees MOTTA.

T-Tone 3	ROT	*1	*2	BOT	DOT
mean	0.003	-2.767	0.300	40.2	86
sd.	0.000	1.218	0.090	0.9	83
highest	0.063	-1.146	6.296	48.3	165
lowest	0.000	-4.694	0.000	33.2	20

T-tone 4 is a mid short falling tone at an average of -1.338 degrees MOTTA. And the average DOT is 69 msec. My measurements reveals that there is no significant difference between T-tone 4 and T-tone 8 among the 22 subjects.

T-Tone 4	ROT	*1	*2	BOT	DOT
mean	0.063	-1.338	-0.294	39.8	69
sd.	0.001	0.598	0.023	0.7	17
highest	0.444	-0.353	0.000	47.0	95
lowest	0.000	-2.545	-2.578	31.3	25

T-tone 5 is a low falling and then rising tone at an average of 1.773 degrees MOTTA of curve. The average ratio of falling length to rising length is 1.916.

T-Tone 5	ROT	*1	*2	BOT	DOT
mean	1.916	-0.538	1.773	37.8	227
sd.	0.220	0.663	0.042	1.0	423
highest	8.999	0.400	3.535	44.7	450
lowest	0.000	-2.555	0.000	29.1	35

T-tone 7 is a low level tone at BOT 38.0.

T-Tone 7	ROT	*1	*2	BOT	DOT
mean	0.091	0.296	-0.048	38.0	257
sd.	0.008	0.501	0.002	0.9	209
highest	2.000	2.454	0.000	46.2	390
lowest	0.000	-0.070	-1.050	30.5	110

My measurements reveal that there is no significant difference between T-tone 8 and T-tone 4 among the 22 subjects.

T-Tone 8	ROT	*1	*2	BOT	DOT
mean	0.184	-1.229	-0.124	40.1	76
sd.	0.011	0.726	0.036	0.7	81
highest	2.000	-0.109	1.337	48.9	210
lowest	0.000	-2.934	-2.864	30.4	20

3.2. Tonal descriptions of Taiwan Mandarin

M-tone 1 is a level tone at BOT 38.2. M-tone 1 is *phonemically* regarded as high level tone in Mandarin tonal system, and it's said to be equal to Taiwanese tone 1. However, my measurements reveal that

M-tone 1 should be *phonetically* close to Taiwanese tone 7 rather than T-tone1. It would be better to describe M-tone 1 as a mid level (22) tone if we compare its BOT with other Mandarin tonal categories.

M-Tone 1	ROT	*1	*2	BOT	DOT
mean	0.000	0.727	0.000	38.2	262
sd.	0.000	0.006	0.000	0.9	130
highest	0.000	1.319	0.000	44.3	360
lowest	0.000	0.207	0.000	30.8	180

M-tone 2 is traditionally regarded as a rising tone, but my measurements reveal that it should be a falling and then rising tone at an average of 1.567 degrees MOTTA of curve. And the average ratio of falling length to rising length is 1.079. It would be better to describe M-tone 2 as a mid falling-rising (212) tone based on my phonetic measurements.

M-Tone 2	ROT	*1	*2	BOT	DOT
mean	1.079	0.182	1.567	36.4	244
sd.	0.046	0.096	0.597	1.0	297
highest	4.125	6.454	17.544	43.1	440
lowest	0.000	-0.702	0.000	28.2	110

M-tone 3 is traditionally described as a falling and then rising tone. But, my measurements reveal that it should be a falling tone at an average of -1.8 degrees MOTTA of falling. It would be better to describe M-tone 3 as a mid falling (31) tone based on my phonetic measurements.

M-Tone 3	ROT	*1	*2	BOT	DOT
mean	0.357	-1.800	0.230	40.2	134
sd.	0.070	0.029	0.028	0.8	189
highest	5.377	-0.353	3.260	46.3	295
lowest	0.000	-3.352	0.000	32.0	50

M-tone 4 is traditionally regarded as a high falling tone. But, my measurements reveal that it's a rising and then falling tone (453) at an average of -2.524 degrees MOTTA of curve. And the average ratio of rising length to falling length is 0.45.

M-Tone 4	ROT	*1	*2	BOT	DOT
mean	0.450	-0.960	-2.524	42.2	153
sd.	0.003	0.015	0.032	0.9	140
highest	1.071	0.079	0.000	47.0	265
lowest	0.000	-1.957	-3.640	33.8	65

3.3. Similarities between Taiwanese and Taiwan Mandarin.

		T1	T2	T3	T4	T5	T7	T8
M1	*1	-	-	-	-	-	-	-
	*2	-	-	*2	-	-	*2	*2
	ROT	-	-	ROT	-	-	ROT	-
	BOT	-	-	-	-	BOT	BOT	-
	DOT	-	-	-	-	-	DOT	-
M2	*1	*1	-	-	-	-	*1	-
	*2	*2	-	*2	-	*2	-	-
	ROT	-	-	-	-	ROT	-	-
	BOT	-	-	-	-	-	-	-
	DOT	DOT	-	-	-	DOT	DOT	-
M3	*1	-	*1	-	-	-	-	-
	*2	-	-	*2	-	-	*2	*2
	ROT	-	ROT	ROT	ROT	-	ROT	ROT
	BOT	-	-	BOT	BOT	-	-	BOT
	DOT	-	DOT	-	-	-	-	-
M4	*1	-	-	-	-	-	-	*1
	*2	-	-	-	-	-	-	-
	ROT	-	-	-	-	-	-	-
	BOT	BOT	BOT	-	-	-	-	-
	DOT	-	-	-	-	-	-	-

	Tonal comparisons between Taiwanese and Taiwan Mandarin						
Taiwanese	T1	T2	T3	T4	T5	T7	T8
Mandarin	M2	M3(M4)	M3	M3	M2	M1	M3

The table above will be helpful for learning Taiwanese tonemes through the tonal comprehension of Taiwan Mandarin. When learning Taiwanese 1st tone, learners in Taiwan were taught to catch it through

Taiwan Mandarin tone 1. But, my study surprised me that T-tone 1 is phonetically close to M-tone 2 rather than M-tone 1. T-tone 4 and T-tone 8 are checked tones, which don't occur in Taiwan Mandarin. Therefore, the duration of M-tone 3 must be short while learning T-tone 4 and T-tone 8 through the comprehension of M-tone 3.

3.4. Summary of new tonal descriptions.

New descriptions of Taiwanese tonemes based on my findings.

Traditional Tone Numbers	1st	2nd	3rd	4th	5th	6th	7th	8th
Tonal Values of Five Scales	434	53	31	32	212	-	22	32

New descriptions of Taiwan Mandarin tonemes based on my findings.

Traditional Tone Numbers	1st	2nd	3rd	4th
Tonal Values of Five Scales	22	212	31	453

4. Conclusion

1. Key characteristics on determining tonal categories:
   - T1: high
   - T2: high falling ending
   - T3: mid-falling ending
   - T4: short
   - T5: low rising ending
   - T7: mid-level
   - T8: short
   - M1: level contour
   - M2: rising ending
   - M3: mid falling departure
   - M4: high falling ending
2. Predicition:
   - T1→ becoming high falling - rising
   - T5→ becoming low falling - rising
   - M2→ becoming low falling - rising
   - M3→ becoming mid falling
3. Falling departures tendency in both Taiwanese and Taiwan Mandarin.

5. Suggestions for further studies

- Redesign word lists to consider the influences of consonants, vowels, and preceding tones.
- Do comparisons among Taiwanese-only, Taiwan Mandarin-only, and T-M bilingual speakers.
- Do comparisons among different age generations of speakers.

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