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AN ONGOING TONAL-PATTERN CHANGE: LANZHOU DIALECT

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ABSTRACT

The tonal-pattern of Lanzhou dialect is experiencing a change demonstrated in two aspects: a) *Yin-ping* 阴平(T1a) has two variants, falling and level, and the former is being replaced by the latter; b) *Shang-sheng* 上声(T2) and *Qu-sheng* 去声(T3) are merging. We propose that the tonal change of T1a is partially a result of language contact, and the sandhi T1a from initial position of disyllabic combination also plays a role in extending the level tone to the citation T1a, the change of T1a then further triggers the merger of T2 and T3. Yet whether it is the change of sandhi T1a in the initial position or the change of the surface representation of citation T1a, or the merger of T2 and T3, all the directionality of tonal change is in line with the “clockwise tone shift circle” (Zhu et al. 2015; Yang and Xu 2019). We argue that tone changes are mainly due to internal factors. Although there are external stimuli, the path of tone change follows rules. The illustration of the ongoing tonal-pattern change in Lanzhou dialect will shed light on the understanding of the rules.

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KEYWORDS

Tonal-pattern change Evolution Merger Tone sandhi

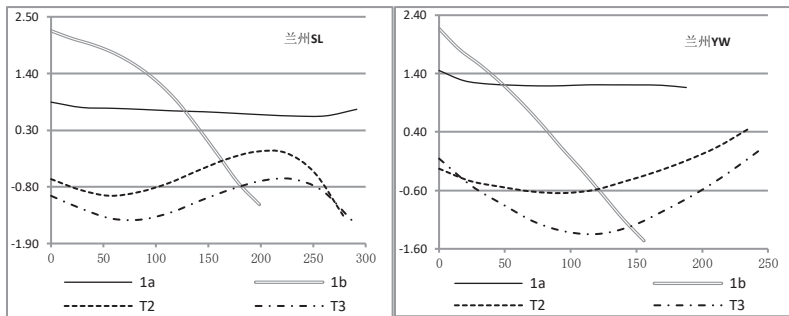
1. INTRODUCTION

Studies on tone change previously took the form of diachronic investigations, which have focused on the chronological evolution of language/dialect. It was Labov (1963: 273–309; 2006) who first put forward the sociolinguistic diagram on the segmental level and examined the social factors that are accountable. With regards to the studies concerning the in-progress tonal change, many regional dialects including Cantonese (Mok et al. 2013: 341–370), Wu dialect (Carroll 2010), Lalo language (Yang et al. 2015: 52–77), Thai language (Teeranon 2007: 1–16; Zsiga 2008: 395–408), Taiwan Mandarin (Sanders 2008: 87–107), Singapore Mandarin (Lee 2010: 345–362) and a typology of tone system changes (Pittayaporn 2007: 1421–1424; Hyman 2018: 221–240), as well as tonal evolution (Yang and Xu 2019: 417–459; Zhu 2010: 1–19; Zhu 2012: 1–16; Zhu 2014: 193–205; Zhu 2018: 113–132) have been investigated in depth.

However, the studies on Lanzhou tone system are only static descriptions. According to the previous descriptions, there are 4 citation tones in Lanzhou tonal system, which are T1a (*Yin-ping* 阴平), T1b (*Yang-ping* 阳平), T2 (*Shang-sheng* 上声), and T3 (*Qu-sheng* 去声). Table 1 lists all 14 references concerning the tonal description of Lanzhou dialect. What puzzles us is the records of T1a and T2 are inconsistent in the literature, though as Chao (1931: 312–354; 1968) and Duanmu (1994: 555–608) point out, a variation within one level in numerical representation is not to be taken and the practice of modifying the values of tone is very common. However, the variation in the literature sometimes exceeds ‘one level’. T1a has been transcribed as a falling [HM/ML] or a level [H], and T2 as a convex [MHL], a level [H], a falling [HL], and a rising [MH] respectively (Table 1), though T1b and T3 are more stable, with the former as a falling [HL] and the latter as a rising [LM]. The dialect surveys carried by Zhu and Yi (2015: 1–11) found T1a a high-level tone [H] (illustrated in Figure 1) and Yi (2014; 2019a: 59–65; 2019b) found T2 and T3 are merging.

Table 1 Tonal patterns and values of Lanzhou dialect in 14 previous references

References	Tonal Patterns	T1a	T1b	T2	T3
1 Huang and Zhao (1960)	4	53	52	442	213
2 LDZYYX (1963)	4	53	52	453	213
3 Gao (1980)	4	31	53	33	24
4 Liu (1983)	4	43	51	442	13
5 Wang (1984)	4	53	31	42	24
6 Song (1991)	3	44	41	>T1a	314
7 Wang and Zhao (1997)	4	31	53	442	13
8 Zhang (2003)	4	31	53	442	13
9 Liu (2004)	4	21	53	33	24
10 Zhang (2005)	4	44/42	53	354/442 ¹	113
11 Luo (2007)	4	544	53	332	213
12 Zhang and Mo (2009)	4	53	51	44	13
13 Deng (2009)	4	53	51	44	13
14 Zhang (2012)	4	43	51	23	12

**Figure 1** Tonal pattern of two speakers (Cited in Zhu and Yi 2015)

Note: Single line stands for T1a, double line for T1b, dotted line for T2, pecked line for T3, the following is the same.

There is not any research into the tonal-pattern change of Lanzhou dialect. In fact, Lanzhou dialect plays an important role in the study of tonal evolution. According to Zhu and Yi (2015: 1–11), “the systems of 3- (47%) and 2-tone pattern (6%) constitute a majority in Northwest Chinese dialects, which is only one step away from the disappearance or death of tone.” And all the 2-tone system dialects found so far (Luo 1999: 74–77; Mo and Zhu 2014: 43–46; Zhai and Zhang 2019: 41–53; Yi 2019) are all

located around Lanzhou city. It is quite significant to probe the factors that initiates the tonal change in Lanzhou dialect, and exploring why and how it changes will shed light on the relationship between tone evolution and language contact.

The tonal change in Lanzhou dialect involve two related processes: T1a is phonetically changing from a falling tone to a level tone; and T2 and T3 are phonemically merging. In this paper, we first present our method (§ 2). This is proceeded by a normalized tonal pattern description, citation and disyllabic, of T1a, followed by the accounts of T1a change, and the associated social factors analysis, age, gender, education in specific (§3). Next, we evaluate the merging of T2 and T3 by the statistic measurement of F0 value, self-reports, perception tests, and the account of merging (§4). Finally, we evaluate the tone changes in Lanzhou dialect and present our concluding remarks that tone changes are mainly due to internal factors. Although there are external stimuli, the path of tone change follows rules. (§5).

2. METHOD

The study was carried out in the four central districts of Lanzhou: Chengguan 城关, Xigu 西固, Qilihe 七里河 and Anning 安宁². A total of 34 local speakers participated in the present study, of which two were surveyed in 2010 (Zhu and Yi 2015: 1–11), and 32 in 2015 (Yi 2019: 59–65; 2019). Of these 34 speakers, 13 males and 21 females are aged between 18–70 years old (mean = 45.32; *SD* = 19.90). Eight speakers have finished primary and secondary education (S&P), 14 have finished high school, and 12 have graduated from college.

The material for the production study includes 148 citation words and 292 disyllabic words selected from *Fangyan diaocha zibiao* (《方言调查字表》 Target words in dialect survey). To avoid a ‘tone sandhi’ effect in Chinese dialects, the test did not adopt the ‘carrier sentence’ proposed by Ladefoged (2003).

The acoustic analysis collected and analyzed 23,424 tokens in total. Praat, a computer program to analyse, synthesize, and manipulate speech, was used for sound annotation and parameter extract. The F0 trajectory of each token was manually segmented from the vowel onset through the offset, and labeled by the second and the third author, then verified by the

first author. Raw F0 values were normalized under the Log-Z score to delete the differences caused by different stature shapes. All the statistic works were carried by the second author, then verified by the first author. Acoustic data can be retrieved from <https://doi.org/10.5281/zenodo.2647838>.

According to Yip (1989: 149–174; 2002), in a contour tone the tonal root is linked to two pitch features, and in a level tone the tonal root is linked to one pitch feature. For the convenience of demonstration and considering the tonal patterns of Northwest dialects, three features H, M, L will be adopted in the tonal description. Based on our survey, we transcribe T1a in Lanzhou dialect as [H/HM], T1b as [HL], and T2/T3 as [MH].

3. THE VARIATION OF T1A

As mentioned, the phonetic value of T1a in previous academic literature varies. We here firstly present the LZ-score normalized tonal pattern of T1a and T1b, and then discuss the different factors that might attribute to them.

3.1 Tonal Pattern of T1a and T1b

Figure 2 shows the LZ-score normalized tonal pattern of T1a and T1b of six representative speakers (three females and three males; for more information, please refer to Appendix II). Previously, most researchers tended to describe T1a as a low falling and T1b a high falling (shown in Table 1), but this is not in fact always the case. Figure 2 shows that two speakers (ZZ and CCY) do have higher T1b tonal head, but there are other performances: One speaker (WZC) has T1a and T1b almost merged, one (QYZ) has a higher tonal head of T1a than that of T1b, and two further speakers (YL and CHLL) have their T1a a high level. The figure indicates that T1a does not have only one realization: At least two variants (falling and level) coexist in the same community, which may explain the various records in the previous studies (shown in Table 1).

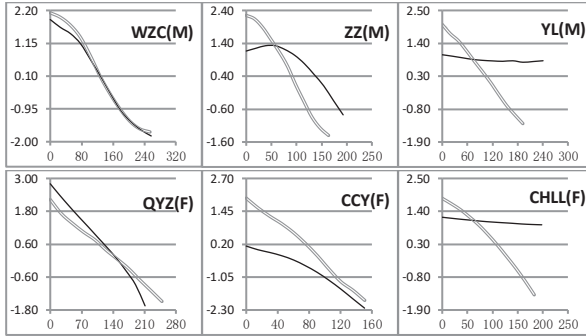


Figure 2 Tonal pattern of T1a and T1b in Lanzhou dialect

3.2 Accounts of T1a Change

In order to account for the change of T1a, the disyllabic tone materials of 22 participants have been evaluated as shown in Table 2. We will see that no matter whether the speaker’s citation T1a is level or falling, the initial syllable feature of T1a is [H].

Table 2 T1a feature of 22 participants in initial and final syllables and in monosyllable

No.	NAME	Mono	Initial syllable				Final syllable				
			1a	1a+ 1a	1a+ 1b	1a+ T2	1a+ T3	1a+ 1a	1b+ 1a	T2+ 1a	T3+ 1a
1	SJ	H	H	H	H	H	H	H	H	H	H
2	LX	H	H	H	H	H	H	H	H	H	H
3	GY	H	H	H	H	H	H	H	H	H	H
4	CSC	H	H	H	H	H	H	H	H	H	H
5	CHLL	H	H	H	H	H	H	H	H	H	H
6	CXM	H	H	H	H	H	H	H	H	H	H
7	YL	H	H	H	H	H	H	H	H	HM	H
8	CHL	H	H	H	H	H	HM	HM	HM	HM	HM
9	CXH	H	H	H	H	H	HM	HM	HM	HM	HM
10	WXH	HM	H	H	H	H	HM	HM	HM	HM	HM
11	ZMG	HM	H	H	H	H	HM	HM	HM	HM	HM
12	XXY	HM	H	H	H	H	HM	HM	HM	HM	HM
13	WZC	HM	H	H	H	H	HM	HM	HM	HM	HM
14	SMH	HM	H	H	H	H	HM	HM	HM	HM	HM
15	SFY	HM	H	H	H	H	HM	HM	HM	HM	HM
16	CYX	HM	H	H	H	H	HM	HM	HM	HM	HM
17	CCY	HM	H	H	H	H	HM	HM	HM	HM	HM
18	PLP	HM	H	H	H	H	HM	HM	HM	HM	HM

Table 2 T1a feature of 22 participants in initial and final syllables and in monosyllable (*continued*)

No.	NAME	Mono	Initial syllable				Final syllable			
		1a	1a+ 1a	1a+ 1b	1a+ T2	1a+ T3	1a+ 1a	1b+ 1a	T2+ 1a	T3+ 1a
19	XGF	HM	H	H	H	H	HM	HM	HM	HM
20	HGZ	HM	H	H	H	H	HM	HM	HM	HM
21	QYZ	HM	H	H	H	H	HM	HM	HM	HM
22	CBZ	HM	H	H	H	H	HM	HM	HM	HM

Given that most previous records (Table 1) depicted T1a as a falling tone [HM] ([53/54/41]), coupled with our survey that speakers who are persistently using the falling T1a tend to be in the senior group (specific detail in 3.3), we assume that the level T1a is an innovative one.

According to Chen (2001: 50), there is no clear hierarchy between citation tone and tone sandhi, we here just follow the usual practice: taking the former as the underlying representation, and “tone sandhi” as the surface representation (Cao 1998: 11–15; Li 2001: 106–131; Qian 2000: 1–9; Li 2004: 16–33). We propose the underlying representation of citation T1a experienced the following phonological process in disyllabic combination:

T1a: HM→H/[__T (T=T1a, T1b, T2, T3)

The underlying feature of T1a [HM] becomes [H] when it appears in the initial position of disyllabic combination. When Yip demonstrated the OCP application on the sandhi tone in Tianjin dialect, she mentioned “the first tone changes either by simplification or by insertion” (Yip 1989: 149–174). We assume the initial syllable change of T1a here is due to simplification as well.

The disyllabic tonal pattern in Lanzhou dialect is as following:

Table 3 The disyllabic combination in Lanzhou dialect

I \ F	T1a	T1b	T2	T3
T1a	H.HM/H	H.HL	H.MH	H.MH
T1b	HL.HM/H	HL.HL	HL.MH	HL.MH
T2	MH.HM/H	MH.HL	HL.MH	MH.MH
T3	ML.HM/H	ML.HL	ML.MH	MH.MH

Note: Sandhi tone combinations are labeled in grey; Combinations with final toneless syllables are omitted here.

We noticed in Table 3 that all the sandhi tones happen in initial syllables, as does T2 in ‘T2+T2’ combination and T3 in ‘T3+T1a/T1b/T3’ combination. The final syllables in disyllabic combination usually keep the same with their citation tones. However, the final syllable feature of T1a splits: [HM] for the participants with a falling citation T1a and [H] for the participants with a level citation T1a. We could observe a diffusion of level T1a in the final syllable.

According to Table 2, the change of mono- and disyllabic tones of T1a can be illustrated as a three-stage process:

Table 4 A three-stage tonal change of T1a

	Citation	Disyllabic	
		Initial	Final
Stage 1	HM	H	HM
Stage 2	H	H	HM
Stage 3	H	H	H

Therefore, T1a changes from [HM] to [H] is based on the sandhi form [H], which is internally available (the result of simplification according to Yip 1989: 149–174), and the level tone extends from initial syllable to monosyllable (stage 2), and to the final syllable (stage 3).

Yet it is also necessary to ask what other factors correlate to the extension and we will see to find it from the perspectives of gender, age and education.

3.3 Effects of Age, Gender, and Education

Figure 3 shows the distribution of falling tone and level tone on gender, age, and education (for more information, please refer to Appendix I).

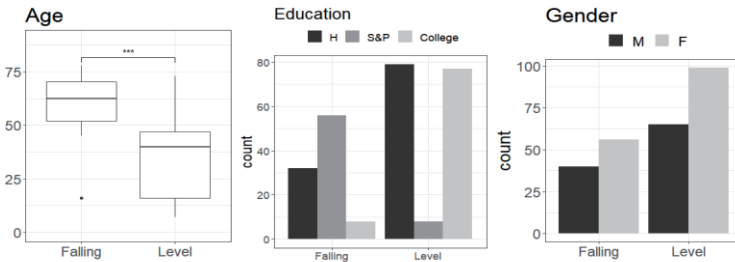


Figure 3 Distribution of falling and level contour on age, gender, and education

Figure 3 shows that the level tone of T1a is more likely to be used by speakers who are educated to high-school level and above, while the falling tone tends to be adopted by those with lower academic attainment (primary school/vocational education). Eleven out of 12 speakers with a college or above education produce a level T1a, as do 11 speakers of the 14 speakers who have completed high school. Meanwhile, seven out of 8 speakers with only a primary education produce T1a a falling tone.

Regarding age, the falling tone is more frequently used by older speakers. A total of 34 speakers aged between 18–70 years old (mean = 45.32; $SD = 19.90$) participated in the investigation. A t-test was applied to test the significant difference between groups of falling tone and level tone. The mean age of falling tone users is 59.33 years old whereas the mean age of level tone users is 37.17, which is significantly younger. The result evidences that there is a definitive age difference among the users of the two groups: Speakers who are persistently using the falling tone tend to be in the older group; young or middle-aged speakers are more likely to use the level variant.

In order to further test the correlation between age, education, gender and tone choice, a pair-wise correlation analysis has been conducted. Before it, the variables are assigned as following: male=0, female=1; <50 years old=0, >50 years old =1; primary and secondary education=0, high school and college education=1; falling tone=0, level tone=1. According to the analysis (shown in Table 5), the correlation between gender and tone choice is not significant; age and tone choice are significantly negative-correlated (-0.685), that is, people over 50 years old tend to choose falling tone and those under 50 tend to choose level tone; education level is significantly positive-correlated with tone choice, that is, people with higher education tend to choose level tone. Moreover, age is significantly negative-correlated with education (-0.705), indicating that the older the age, the lower the education level. The results of binary logistic regression analysis (Table 6) show that the significance levels of the regression coefficients of age and education are 0.005 and 0.013, respectively, both of which are significant effects on tone choice, and their effects are consistent with the results of the correlation analysis in Table 5.

Table 5 Pearson pair-wise Correlation of age, education, gender, and tone choice

	gender	age	education	T1a
gender	1	0.121	-0.294	0.052
		0.496	0.092	0.770
age	0.121	1	-0.705**	-.685**
	0.496		0.000	0.000
education	-0.294	-0.705**	1	0.606**
	0.092	0.000		0.000
T1a	0.052	-0.685**	0.606**	1
	0.770	0.000	0.000	

Note: **. Correlation is significant at the 0.01 level (2-tailed).

Table 6 Logistic regression results of the effect of age, gender, and education on tone contours

	B	S.E.	Wald	df	Sig.	Exp(B)
gender	1.666	1.164	2.047	1	.152	5.290
age	-3.183	1.141	7.780	1	.005	.041
education	1.758	.711	6.111	1	.013	5.803

As shown in above, 'gender' is not a significant factor in the correlation analysis. Fourteen out of 21 female speakers and 9 out of 13 male speakers produce T1a a level tone. We are to further explore the role in language variation with a case study involving three families. Table 7 lists the T1a variants used by three generations (G1, G2, and G3) in three families (F1, F2, and F3). Speakers' initials are listed in the table and followed by their gender and age. Individuals who adopt a falling tone are labelled in grey.

Table 7 T1a variants within three families

	F1			F2		F3
G1	CBZ (M, 68)			QYZ (F,75)		--
G2	CHL (F, 47)	CYX (M, 45)	CHLL (F, 37)	CCY (F, 52)	CXH (F, 47)	--
G3	--	--	--	--	YL (F, 21)	ZZ (M, 18)

Note: Speakers adopting falling contour are labeled in grey.

As seen in Table 7, speakers of G1 in the three families (F1, F2, and

F3) all produce T1a a falling tone, regardless of their genders. The one male speaker in F1 and one female speaker in F2 in G2 produces T1a a falling tone and other three female speakers (CHL, CHLL, CXH) produce T1a a level tone. ZZ in F3 claims that his parents speak only Standard Mandarin, whilst his grandparents speak Lanzhou dialect and they all produce T1a a falling tone.

There are four participants in F1, as follows: CBZ, a 68-year-old retired workman, who has three children: the first daughter, CHL, a 47-year-old primary school teacher; the second daughter, CHLL, a 37-year-old workwoman; and the son, CYX, a 45-year-old traffic policeman. The father CBZ and the son CYX both produce a falling T1a, whilst the two daughters, CHL and CHLL, both produce a level T1a. CHL and CYX share their family background, are of a similar age, and received the same level of education. What differs in their circumstances is that CYX pursued his four-year college education in Xi'an, a city 600 kilometers away from Lanzhou, while CHL stayed in Lanzhou to get her college education. It would be more reasonable to deduce that CYX's accent could have been affected by Xi'an dialect in his 20s, while CHL should be more likely to keep the 'old' accent. Furthermore, as a traffic policeman, CYX has been exposed to many different people from varying dialect backgrounds, and might therefore be expected to have adopted the 'new' T1a variant. However, it turns out that CHL adopts the level variant. Besides, their younger sister, CHLL also produces the level T1a.

The next observation involves YL in F2 and ZZ in F3. Both are raised by their grandparents. YL is 21 and ZZ is 18. Each has received an education above high-school level and has never left Lanzhou, but YL produces T1a a level tone and ZZ a falling tone.

From the in-family and inter-family comparison, we found gender might be another factor in sound change, as Labov (2001: 291–294) suggests that: "...in stable situations, women perceive and react to prestige or stigma more strongly than men do" and: "...women are the principal innovators in the process of change", which might offer an explanation in this case, further research is needed to confirm this, though.

Based on the previous analysis, people under 50 and people with high education level are more willing to choose level T1a. Besides, the seven speakers who produce final T1a a level [H] in disyllabic combination

are all under 50. At the same time, age is significantly correlated with education, so we infer it is Standard Mandarin education in school that triggers the change of T1a. The influence of it is to extend the level tone from initial syllable to monosyllable, and to the final syllable of disyllabic combination.

4. MERGING OF T2 AND T3

4.1 Tonal Contour of T2 and T3

In previous literature, T2 has been described as falling (Huang and Zhao 1960: 71–122; Liu 1983: 106–121), convex (LDZYYX 1963: 81–141; Zhang 2005: 77–84), level (Gao 1980: 224–231; Liu 2004) and rising (Zhang 2012: 12–18), whilst T3 has been consistently described as a low rising [LM]. Yi (2014) has drawn acoustic sound data from a previous recording (Wang and Zhao 1997), and finds that T2 has at least three tone contours as shown in Figure 4.

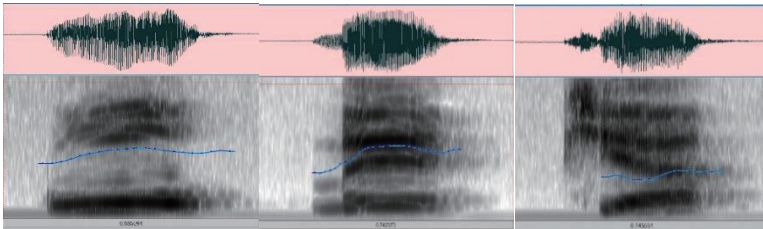


Figure 4 Three T2 words (古 [ku] ‘ancient’, 买 [mǎi] ‘to buy’, 撇 [piě] ‘to skim’) drawn from *Lanzhouhua yindang* (《兰州话音档》 Sound files of Lanzhou dialect, Wang and Zhao 1997)

As with T2, in our survey T3 is also realized in different tone contours, namely, rising, convex and dipping. The interesting thing is, each speaker is found to have their T2 and T3 paralleled or even merged. Besides, in disyllabic combination, the final syllables of them are invariably realized as a rising [MH] (Table3).

Figure 5 lists the normalized tonal pattern of T2 and T3 as produced by eight representative speakers, with four male speakers and four female speakers, where we found some of them have T2 and T3 merged, and some have them paralleled, with one thing agreeable is each of them has their F0 contour of T2 and T3 the same (for more information, please refer to Appendix II). Cao (1998: 11–15) claims that tone merging usually happens

when phonetic tone values are similar, or contours are paralleled. However, some minimal tonal contrast does occur between similar or paralleled F0 contours (Zhu and Yang 2010: 134–147). Hence, it's necessary to further check whether and in what stage the merging of T2 and T3 in Lanzhou dialect occurs.

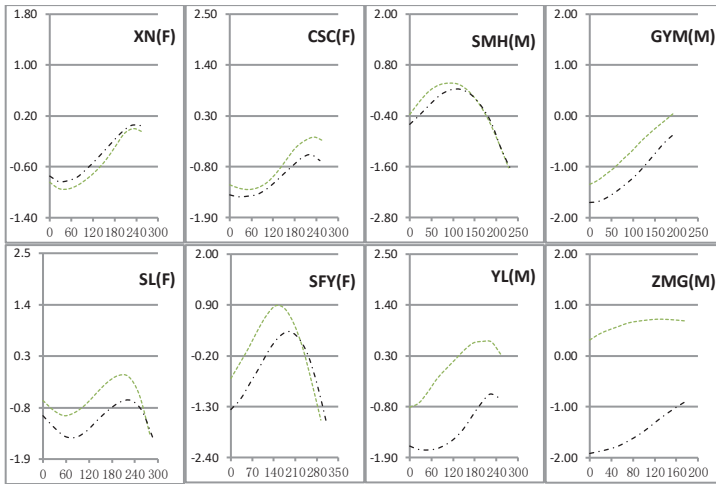


Figure 5 LZ-score tonal patterns of T2 and T3

4.2 ANOVA Test of F0 of T2 and T3

Although in Figure 5 we found that T2 and T3 paralleled in most cases, we also found that, in general, T2 has an overall higher F0 than T3. Furthermore, we would like to confirm whether there are inter-speaker differences on F0. Given this, an ANOVA test was performed. The F0 of tone pairs at corresponding positions is compared to observe the differences. Each pitch contour has been segmented evenly into 10 parts, and F0 is extracted at the 11 points. We have compared the pair of T3-T2 for 29 speakers (the eight speakers in Figure 5 are labelled in grey). The ANOVA test in Table 8 shows the individuals' performance separately, and it excludes the interference of speakers' effect on F0. The results show that for 24 out of 29 speakers, T2 is significantly higher than T3.

Table 8 ANOVA test results of pitch difference between tone pairs for each speaker

speaker	T pairs	difference	Std. Err	sig	L bound	U bound
CBZ	T3-T2	-1.268*	.185	.000	-1.632	-.904
CCY	T3-T2	-.241	.185	.195	-.604	.123
CHL	T3-T2	-.774*	.131	.000	-1.031	-.517
CSC	T3-T2	-.318	.185	.086	-.682	.046
CSW	T3-T2	-.659*	.185	.000	-1.022	-.295
CWM	T3-T2	-.614*	.185	.001	-.978	-.250
CXH	T3-T2	-.929*	.185	.000	-1.293	-.565
CXM	T3-T2	-.694*	.185	.000	-1.057	-.330
CYX	T3-T2	-.756*	.185	.000	-1.119	-.392
GTP	T3-T2	-.581*	.185	.002	-.945	-.217
GY	T3-T2	-.950*	.185	.000	-1.314	-.586
GYM	T3-T2	-.532*	.185	.004	-.895	-.168
HGZ	T3-T2	-1.126*	.185	.000	-1.490	-.762
HW	T3-T2	-.634*	.185	.001	-.998	-.270
LX	T3-T2	-.550*	.185	.003	-.914	-.186
PLP	T3-T2	-1.545*	.185	.000	-1.909	-1.181
QYZ	T3-T2	-.680*	.185	.000	-1.043	-.316
SFY	T3-T2	-.509*	.185	.006	-.873	-.146
SL	T3-T2	-.964*	.185	.000	-1.328	-.600
SMH	T3-T2	-.101	.185	.585	-.465	.263
WXH	T3-T2	-.590*	.185	.001	-.954	-.227
WZC	T3-T2	.004	.185	.982	-.360	.368
XGF	T3-T2	-1.015*	.185	.000	-1.378	-.651
XN	T3-T2	-.069	.185	.709	-.433	.295
XXY	T3-T2	-.913*	.185	.000	-1.277	-.549
YL	T3-T2	-.739*	.131	.000	-.996	-.482
ZDD	T3-T2	-1.072*	.185	.000	-1.436	-.708
ZMG	T3-T2	-1.602*	.185	.000	-1.966	-1.239
ZZ	T3-T2	-.821*	.185	.000	-1.185	-.458

Note: sig <0.05 indicates significant difference between tone pair.

4.3 Self-Reporting and Perception Test

To further confirm whether the value difference is linguistically distinct, we ask all the speakers to report if they differentiate their T2 and

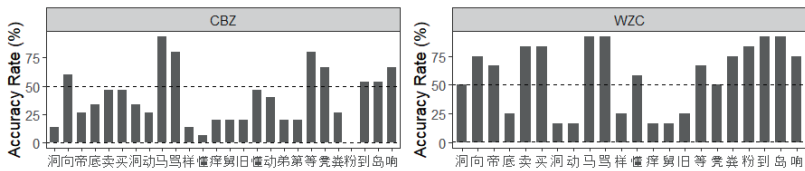
T3 in their production. It turns out that nine out of 34 speakers report they do, and the other 25 speakers say that they don't produce T2 and T3 distinctively.

An ABX discrimination perception test was designed and participants were asked to decide whether a stimuli X was identified with A or B. Five native speakers (3 males and 2 females) were invited to record 13 minimal pairs as the listening material (Table 9), with each pair of words having identical onset and rime. Fifteen native speakers were chosen as test participants (3 females and 12 males).

Table 9 Perception test pairs

Tone pairs	Word-pairs
T2-T3	/təŋ/懂-冻; /təŋ/等-凳; /fən/粉-粪; /tau/岛-到; /eiaŋ/响-向; /ti/底-帝; /təŋ/动-洞; /ma/马-骂; /jaŋ/痒-样
T3-T3	/tu/妒-渡; /teiu/舅-旧; /mai/买-卖; /ti/弟-第

In the perception test, listeners were asked to identify the word they listened to as either A or B in each minimal pair, and checked out the one they took as correct. Out of 1656 times of listening, 856 times were correctly distinguished. In other words, the overall accuracy reaches 52.5%, barely above the sheer guesswork 50%. Although it's still 2.5% above chance guess, it is high probably that T2 and T3 are merging. We then make a further observation (Figure 6), and found the accuracy of some sets of minimal pairs is higher than others, like /tau/ “岛-到”, /eiaŋ/ “响-向” and /ma/ “马-骂”, which reached the accuracy of 70%, whilst /təŋ/ “等/凳” reached 60%, and those of other pairs were all around 50%.



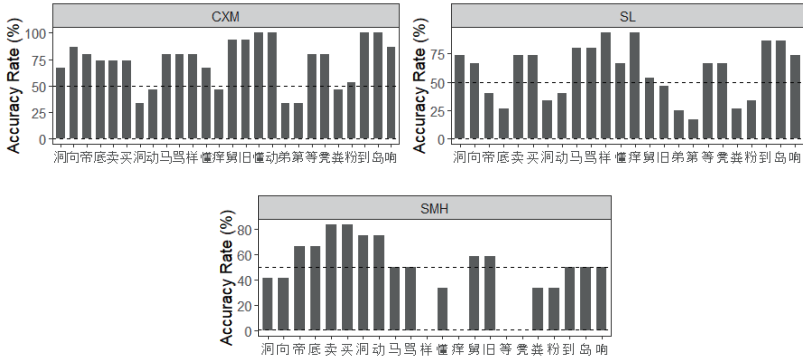


Figure 6 The accuracy rate of each word

Figure 7 shows the accuracy of the sets of minimal pairs as produced by the different native speakers. CXM (F) achieved the highest and SMH (M) ranked the lowest. The accuracy of SL reached above 50%, CZB and SMH below 50%. As for WZC, the accuracy of T2-T3a reached above 50%, while the accuracy of T2-T3b was below 50%. Of the five people, CXM has reported her T2 does not merge with T3, whilst the other four people all claimed their T2 and T3 have merged. The accuracy rate of CXM, CBZ and SMH is in most cases consistent with their reports, whilst that of SL and WZC is inconsistent with their reports. CXM perceives and produces the two tones differently. SL and WZC perceive them the same, but in more cases, their production on these tones can be differentiated by other native speakers.

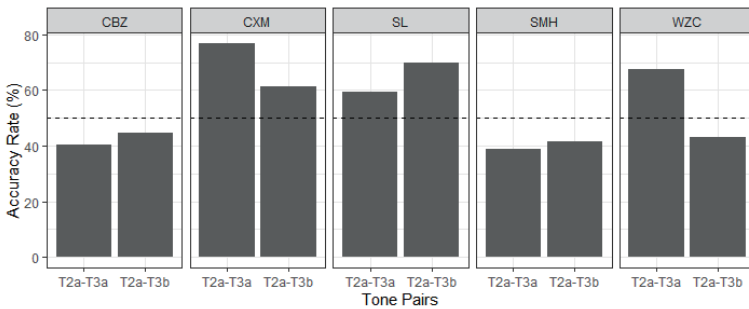


Figure 7 The accuracy of the sets of minimal pairs produced by 5 speakers

4.4 Account of the Merging

As documented in previous literature (Table 1), there are at least three tone contours of citation T2, but in disyllabic combination T2 usually realizes as a rising [MH] with only one exception when combining with a final syllable T2 (Table 3).

If we see it in a broad perspective, we will find that T2 is a very active and unstable tone category in Lanyin Mandarin dialects. According to Yi (2019), there are 5 dialect points in the west of Lanzhou with their T1a and T2 merging, 10 dialect points in the east of Lanzhou, and 15 dialect points in the west of Lanzhou with their T1b and T2 merging, as shown in the Table 10. In Northern Mandarin dialects, there are basically four tone categories, and totally three possibilities of T2 merging. Lanzhou dialect is one of them.

Table 10 Three types of T2 merging in northwest dialects (cited in Yi 2019)

T1a	T1b	T2	T3	Dialect points
L	R/F	=T1a	D/F/R	5 LZ west
L/F	R/F/D	=T1b	F/R/L	10 LZ east; 15 LZ
L/F	F	=T3	R	LZ

Note: '=' indicates 'same with'; L=level; F=falling; R=rising; D=dipping; LZ=Lanzhou.

Moreover, our inferences fit the 'clockwise tone circle' proposed by Zhu et al. (2015: 3–18) and Yang and Xu (2019: 417–459). The directionality of the expanded clockwise cycle is as follows:

low level 11|22 > low falling 32 > mid falling 42 > high falling 52 > high level 55 or rising-falling 453 > mid rising 45|35 > low rising 24|13 > falling-rising 323|214 or low level 11|22 > low falling 32

we could see the three tone contours of T2 appear in the different steps of the 'clockwise circle', we therefore deduce that T2 is experiencing a 'natural' tonal evolution, and merging with T3 is only one of the possible routes. The different tone contours are its variants at different stages.

5. SUMMARY

The tone change in Lanzhou dialect is an on-going one, because two variants of T1a coexist in one family, and the merger of T2 and T3 is

observable, besides, the different contour variants of T2 appear synchronically among speakers. Since some social factors co-related with the variation of T1a, people under 50 years old and people with higher education are more inclined to take on the level variant, we can assume it has happened within the late 50 years, a period in which Chinese Standard Mandarin started to take its prestigious position. Initiated by the influence of language contact, combined with the sandhi tone pattern in disyllabic combination, citation T1a is changing from a falling tone to a level one. We further propose that the change of T1a triggered the merging of T2 and T3. It does not mean that it is the cause-effect relation, yet the change of T1a lead to the instability in Lanzhou tonal pattern. T2 was previously described as a level (Table 1), it might be in congestion with T1a when T1a changes from a falling to a high level. There are three choices left for T2: to remain static and merge with T1a; to change into a different tone contour while keeping its tone category; or to merge with other tones. Clearly, it follows the 'clockwise tone circle' to merge with T3, instead of merging with T1b, which would be in counter-clockwise direction. Of course, T2 could keep changing in the future and it is not impossible to evolve into a new tone contour.

APPENDIX

I: General information of 34 speakers

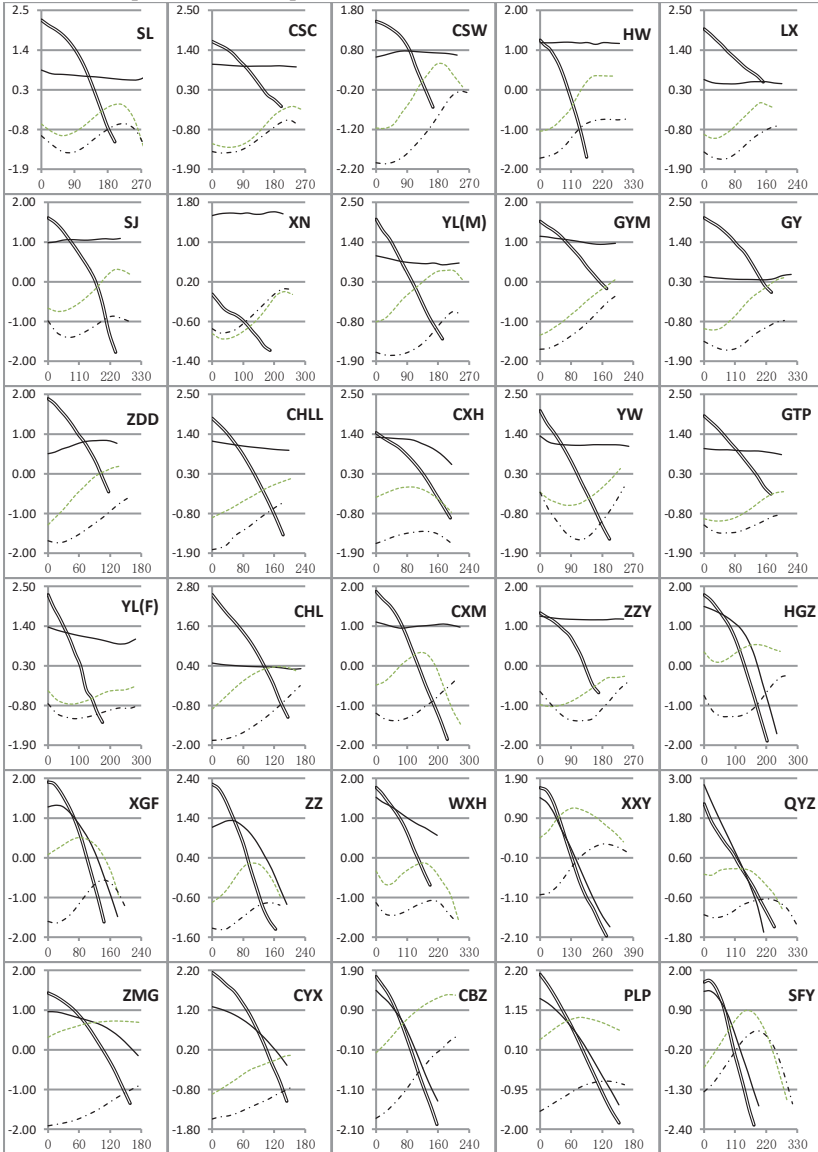
Name	Gender	Age	Education	T1a	T2 and T3
YL	F	< 50	college	level	Y
YW	F	< 50	college	level	Y
CSC	F	< 50	college	level	Y
GY	F	< 50	college	level	Y
CHLL	F	< 50	college	level	Y
CXM	F	< 50	college	level	N
XN	F	< 50	college	level	Y
SL	F	< 50	college	level	Y
CHL	F	< 50	college	level	N

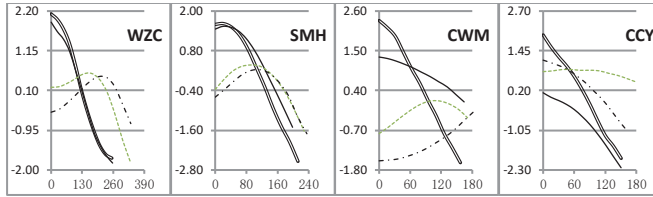
General information of 34 speakers (*continued*)

Name	Gender	Age	Education	T1a	T2 and T3
SJ	F	< 50	H school	level	Y
ZZY	F	< 50	H school	level	N
CXH	F	< 50	H school	level	Y
CWM	F	> 50	H school	level	N
HGZ	F	> 50	H school	falling	N
QYZ	F	> 50	S school	falling	Y
XGF	F	> 50	S school	falling	N
SFY	F	> 50	S school	falling	Y
CCY	F	> 50	S school	falling	N
PLP	F	> 50	P school	falling	Y
WXH	F	> 50	P school	level	Y
XXY	F	> 50	P school	falling	N
YL	M	< 50	college	level	Y
CYX	M	< 50	college	falling	Y
HW	M	< 50	college	level	Y
LX	M	< 50	H school	level	Y
ZDD	M	< 50	H school	level	Y
GTP	M	< 50	H school	level	Y
GYM	M	< 50	H school	level	Y
CTY	M	< 50	H school	level	Y
ZZ	M	< 50	H school	falling	Y
SMH	M	> 50	H school	falling	Y
WZC	M	> 50	H school	falling	Y
ZMG	M	> 50	H school	level	Y
CBZ	M	> 50	P school	falling	Y

Note: The variant contours of T1a are listed in penultimate column, the last column shows the self-reports whether their T2 merged into T3 with 'Y' for 'yes', and 'N' for 'not'. The age of 50 is watershed since the mean age of all the participants is 45.32 and the mean age of falling users is 59.33 years old, and we took a medium one.

II: The tonal-pattern of each speaker





NOTES

1. The variants of T2 in Lanzhou dialect recorded by Zhang include [35/ 354/ 44/ 442/ 42].

2. Apart from the four districts in our survey, Yuzhong county 榆中县, Gaolan county 皋兰县, Yongdeng county 永登县 and Honggu district 红古区 are all in the administrative area of Lanzhou city, but their tonal patterns are distinct from the central four districts. We will not discuss their tonal patterns in this paper.

REFERENCES

- CAO, Zhiyun 曹志耘. 1998. Dunhuang fangyan de shengdiao 敦煌方言的声调 (The tonal pattern of Dunhuang dialect). *Yuwen yanjiu* 语文研究 1: 11–15.
- CARROLL, Lucien. 2010. A diachronic chain shift in the sandhi tones of Jinhua Wu. Paper presented in Linguistics Student Association Colloquium, May 1, California.
- CHAO, Yuenren 赵元任. 1931. Fanqieyu bazhong 反切语八种 (Eight types of Fanqie languages). *Bulletin of Institute of History and Philology* 2: 312–354.
- . 1968. *A Grammar of Spoken Chinese*. Berkeley, California: University of California Press.
- CHEN, Mathew Y. 2001. *Tone Sandhi: Patterns across Chinese Dialects*. Beijing: Foreign Language Teaching and Research Press; Cambridge University Press.
- DENG, Wenjing 邓文靖. 2009. Xibei diqu sanshengdiao fangyan fenbu tedian touxi 西北地区三声调方言分布特点透析 (The traits of three-

- tone dialects distribution in Northwest China). *Lanzhou daxue xuebao* 兰州大学学报 3: 66–72.
- DUANMU, San. 1994. Against contour tones. *Linguistic Inquiry* 25(4): 555–608.
- GAO, Baotai 高葆泰. 1980. Lanzhou yinxi lueshuo 兰州音系略说 (A brief introduction of Lanzhou phonology). *Fangyan* 方言 3: 224–231.
- HUANG, Borong 黄伯荣, and Jun Zhao 赵浚. 1960. Lanzhou fangyan gaishuo 兰州方言概说 (Overview of Lanzhou dialect). *Xibei shifan daxue xuebao* 西北师范大学学报 1: 71–122.
- HYMAN, Larry. 2018. Towards a Typology of Tone System Changes. In *Tonal Change and Neutralization*, edited by H. Kubozono, 221–240. Berlin: De Gruyter Mouton.
- LABOV, William. 1963. The social motivation of a sound change. *Word* 19(3): 273–309.
- . 2001. *Principle of Linguistic Change, Social Factors*. Malden: Blackwell.
- . 2006. *The Social Stratification of English in New York City (2nd)*. New York: Cambridge University Press.
- LADEFOGED, Peter. 2003. *Phonetic Data Analysis: An Introduction to Fieldwork and Instrumental Techniques*. Malden: Blackwell.
- LDZYYX (Lanzhou Daxue Zhongwen Yuyan Yanjiu Xiaozu 兰州大学中文语言研究小组). 1963. Lanzhou fangyan 兰州方言 (Lanzhou dialect). *Lanzhou daxue xuebao* 兰州大学学报 2: 81–141.
- LEE, Leslie. 2010. The tonal system of Singapore Mandarin. In *Proceedings of the 22nd North American Conference on Chinese Linguistics and the 18th International Conference on Chinese Linguistics*, edited by Lauren Eby Clemens and Chi-Ming Louis Liu, 345–362. Cambridge, MA: Harvard University.
- LI, Qian 李倩. 2001. Zhongning fangyan liangzizu de liangzhong liandiao moshi 中宁方言两字组的两种连调模式 (The two types of tone sandhi patterns of Zhongning disyllabic words). *Yuyanxue luncong* (di ershisi ji) 语言学论丛 (第二十四辑): 106–131.
- LI, Xiaofan 李小凡. 2004. Hanyu fangyan liandu biandiao de cengji he leixing 汉语方言连读变调的层级和类型 (Levels and classes of tone sandhi in the Chinese dialects). *Fangyan* 方言 1: 16–33.
- LIU, Lili 刘俐李. 2004. *Hanyu shengdiao lun* 汉语声调论 (Chinese tones).

Nanjing: Nanjing Normal University.

- LIU, Ling 刘伶. 1983. Xin Lanzhouhua jianlun 新兰州话简论 (Comments on new Lanzhou dialect). *Lanzhou daxue xuebao* 兰州大学学报 3: 106–121.
- LUO, Peng 雒鹏. 1999. yizhong zhiyou liangge shengdiao de hanyu fangyan: Lanzhou Honggguhua de shengyun diao 一种只有两个声调的汉语方言: 兰州红古话的声韵调 (A Chinese dialect having only two tones with individual characters—the initials and finals with tones of characters of the speech of Honggu, Lanzhou). *Xibei shifan daxue xuebao* 西北师范大学学报 36: 74–77+100.
- . 2007. Gansu hanyu fangyan yanjiu xianzhuang he fenqu 甘肃汉语方言研究现状和分区 (Present research situation and dividing regions of Han dialects in Gansu province). *Gansu gaoshi xuebao* 甘肃高师学报 12: 1–4.
- MO, Chao 莫超, and Fulin Zhu 朱富林. 2014. Ershengdiao Honggguhua de liandu biandiao 二声调红古话的连续变调 (Analysis of continuous change in tones of Honggu dialect with two tones). *Gansu gaoshi xuebao* 甘肃高师学报 1: 43–46.
- MOK, Peggy P. K., Donghui Zuo, and Peggy W. Y. Wong. 2013. Production and perception of a sound change in progress: Tone merging in Hong Kong Cantonese. *Language Variation and Change* 25(3): 341–370.
- PITTAYAPORN, Pittayawat. 2007. Directionality of tone change. In *Proceedings of the 16th International Congress of Phonetic Sciences*, edited by Trouvain and W. Barry, 1421–1424. Saarbrücken: Saarland University.
- QIAN, Zengyi 钱曾怡. 2000. Cong hanyu fangyan kan hanyu shengdiao de fazhan 从汉语方言看汉语声调的发展 (Chinese tone evolution in the view of Chinese dialects). *Yuyan jiaoxue yu yanjiu* 语言教学与研究 2: 1–9.
- SANDERS, Robert. 2008. Tonetic sound change in Taiwan Mandarin: The case of Tone 2 and Tone 3 citation contours. In *Proceedings of the 20th North American Conference on Chinese Linguistics*, edited by Marjorie K.M. Chan and Hana Kang, 87–107. Columbus, Ohio: The Ohio State University.
- SONG, Faren 宋法仁. 1991. Lanzhou fangyan bijiao tan 兰州方言比较谈

- (Comparative study on Lanzhou dialect). *Lanzhou jiaoyu xueyuan xuebao* 兰州教育学院学报 2: 59–62.
- TEERANON, Phanintra. 2007. The change of Standard Thai high tone: An acoustic study and a perceptual experiment. *SKASE Journal of Theoretical Linguistics* 4(3): 1–16.
- WANG, Sen 王森, and Xiaogang Zhao 赵小刚. 1997. *Lanzhouhua yin dang* 兰州话音档 (Sound files of Lanzhou dialect). Shanghai: Shanghai Education Press.
- WANG, Yulan 王毓兰. 1984. Lanzhou fangyan yu Putonghua de yuyin chayi 兰州方言与普通话的语音差异 (Comparison and contrast between Lanzhou dialect and Chinese Mandarin). *Shehui kexue* 社会科学 3: 13–17.
- YANG, Cathryn, James N. Stanford, and Zhengyu Yang. 2015. A sociotonic study of Lalo tone split in progress. *Asia-Pacific Language Variation* 1(1): 52–77.
- YANG, Cathryn, and Yi Xu. 2019. Crosslinguistic trends in tone change: A review of tone change studies in East and Southeast Asia. *Diachronica* 36(3): 417–459.
- YI, Li 衣莉. 2014. Lanzhouhua de “shangsheng” 兰州话的“上声” (Shangsheng in Lanzhou dialect). Paper presented in the 11th Academic Conference of Chinese Phonetics. August 8–10, Urumqi.
- . 2019a. “Chundidiao” zai xibei fangyan zhong de tixian “纯低调” 在西北方言中的体现 (Embodiment of “underspecified” tone in Northwest dialects). *Yili shifan xueyuan xuebao (shehui kexueban)* 伊犁师范学院学报 (社会科学版) 37(1): 59–65.
- . 2019b. *Xibei guanhua danzidiao hebing xianxiang yanjiu* 西北官话单字调合并现象研究 (A study of the citation tone merger in Mandarins of Northwest China). Beijing: Intellectual Property Publishing House.
- YIP, Moira. 1989. Contour tones. *Phonology* 6: 149–174.
- . 2002. *Tone*. Cambridge: Cambridge University Press.
- ZHAI, Zhanguo 翟占国, and Weijia Zhang 张维佳. 2019. Xibei guanhua zhong de liangshengdiao fangyan 西北官话中的两声调方言 (A study on two-tone Mandarin dialects in Northwest China). *Minzu yuwen* 民族语文 2: 41–53.
- ZHANG, Ansheng 张安生. 2005. Yinchuanhua yangping, shangsheng

- hebingshi xintan 银川话阳平、上声合并史新探 (The new exploration on history of yangping and shangsheng merge). *Hebei daxue xuebao* 河北大学学报 1: 77–84.
- ZHANG, Guanyu 张冠宇. 2012. Lanzhouhua danziyin shengdiao geju de tongji fenxi 兰州话单字音声调格局的统计分析 (Statistical analysis on tonal pattern of Lanzhou citation tones). *Xiandai yuwen (yuyan yanjiuban)* 现代语文 (语言研究版) 3: 12–18.
- ZHANG, Wenxuan 张文轩, and Chao Mo 莫超. 2009. *Lanzhou fangyan cidian* 兰州方言词典 (Lanzhou dialect dictionary). Beijing: China Social Sciences Press.
- ZHANG, Yanlai 张燕来. 2003. Lanyin guanhua yuyin yanjiu 兰银官话语音研究 (Phonetic study on Lanyin Mandarin). PhD diss., Beijing Language and Culture University, Beijing.
- ZHU, Xiaonong 朱晓农. 2010. Quanzhuo chishenglun—jianlun quanzhuo qinghua (xiaochi) disong gaobusong 全浊弛声论——兼论全浊清化 (消弛)低送高不送 (Slack voice: The phonetic nature of the voiced consonants in ancient Chinese). *Yuyan yanjiu* 语言研究 30(3): 1–19.
- . 2012. Jiangdiao de zhonglei 降调的种类 (A classification of falling tones). *Yuyan yanjiu* 语言研究 32(2): 1–16.
- . 2014. Shengdiao leixingxue dayao 声调类型学大要——对调型的研究 (An outline of tonal typology: A study of tonal types). *Fangyan* 方言 3: 193–205.
- . 2018. Yanhua bijiaofa: Ruhe jinxing shengdiao yanhua de yanjiu? 演化比较法: 如何进行声调演化的研究? (The evolutionary comparative method: How to conduct studies of tonal evolution?). *Yuyan kexue* 语言科学 17(2): 113–132.
- ZHU, Xiaonong 朱晓农, Qing Lin 林晴, and Chaya Pa 叭差娅. 2015. Taiyu shengdiao de leixing he shunshizhen lianyi 泰语声调的类型和顺时针链移 (Typology and evolution of Thai tones and a clockwise chain shift). *Minzu yuwen* 民族语文 4: 3–18.
- ZHU, Xiaonong 朱晓农, and Jianfen Yang 杨建芬. 2010. Galiesheng zuowei didiaotezheng—Hebeisheng fangyan de shengdiao kaocha 嘎裂声作为低调特征——河北省方言的声调考察 (Creak as a distinctive feature for [+low] tone: A survey of Hebei and surrounding dialects). *Yuyan yanjiu jikan* 语言研究集刊 7: 134–147.
- ZHU, Xiaonong 朱晓农, and Li Yi 衣莉. 2015. Xibei diqu guanhua

- shengdiao de leixing 西北地区官话声调的类型 (Tonal patterns in Mandarins of Northwest China). *Yuwen yanjiu* 语文研究 3: 1–11.
- ZSIGA, Elizabeth. 2008. Modeling diachronic change in the Thai tonal space. *University of Pennsylvania Working Papers in Linguistics* 14(1): 395–408.

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兰州方言：一个正在变化中的声调格局

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摘要

兰州方言的声调变化表现在两个方面：阴平 (T1a) 有降调和平调两种变体，并且平调正在取代降调；上声 (T2) 和去声 (T3) 有合并的趋势。文章的主要观点认为 T1a 的声调变化是由语言接触引发的，普通话的影响促使双字调中已经发生变调内化的 T1a 首字将平调扩散延展到单字调 T1a 和双字调的尾字 T1a 上。T1a 的声调变化进一步引发了 T2 和 T3 的合并。在上述的三个变化中：双字调首字 T1a 的内在音系变化、单字调 T1a 的后续变化、T2 和 T3 的合并，所有这些声调变化的方向都符合“顺时针声调变化圈” (Zhu et al. 2015; Yang and Xu 2019)。我们认为声调的变化方向主要由内在的自然因素决定的，虽然有时会有外因的刺激诱发，但声调变化的路径是有规律可循的。对于正在变化的兰州声调进行研究，会有助于对上述规律的理解。

关键词

声调格局 演化 合并 连读变调