Analogical Changes in the Accent of Sino-Korean Words in Yanbian Korean

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1. Introduction

Yanbian Korean (YB, spoken in Yanbian Korean Autonomous Prefecture in north-eastern China) has a pitch accent system in which one syllable in every lexical item is the locus of a pitch peak. The YB accent patterns and system are similar to the Hamgyung dialect in North Korea and are rather different from Kyungsang Korean (Ramsey 1978, Umeda 1993, Park 2001, Che 2004, Miyashita 2007), although they tend to correspond regularly.

The purpose of this study is to show the factors working in the historical development of accent in Sino-Korean (SK) vocabulary from Middle Korean (MK, 15th-16th C), by examining them both synchronically and diachronically. The SK words examined in this paper are disyllabic words composed of two SK morphemes. In many cases SK morphemes are bound morphemes. It is possible to discern a general meaning of each SK morpheme through their reoccurrence in related words. Cf. *phon-* and *-logy* in phonology.

(1) Examples of SK words
音 ɨm 'sound' + 聲 səŋ 'voice' → ɨm.səŋ 'voice, speech sound'
音 ɨm 'sound' + 樂 ak 'playing (a music instrument); enjoy' → ɨ.mak 'music'
聲 səŋ 'voice' + 帶 tɛ 'belt' → səŋ.tɛ 'the vocal cords'
樂 ak 'playing (a music instrument); enjoy' + 器 ki 'instrument' → ak.ki 'music instrument'

YB data in this paper was collected by the author from a native speaker in her 30's in 2007-2008. The size of the corpus is 7,977 SK words and 805 native words.

Our discussion is focused on patterned exceptions to the basic historical correspondences. Major findings are: a) evidence for a stratified lexicon based on the different analogical paths in historical development between native and SK words (native HL → LH, SK LH → HL); b) a striking exception where the accent of the second morpheme determines a deviation, which can be explained as an Island of Reliability effect from segmental phonology (Albright 2002); c) a model of SK accent change with weighted constraints employing Jäger (to appear)'s Stochastic Gradient Ascent learning algorithm; d) notable deviations towards a default which take into account sonorant vs. obstruent onsets and token frequencies.

2. SK accent rules in MK

MK had a distinctive accent. In monosyllabic nouns three classes were distinguished: High (H), Low (L), and Rising (R). SK morphemes, which were brought into Korean from the Chang'an dialect in the Tang dynasty (Kōno 1968, Ito 2007), regularly corresponded with the tones of Middle Chinese.

In MK, the accent of disyllabic SK words $\mu_1\mu_2$ was as a rule the combination of individual underlying accents of μ_1 and μ_2 (Ito 1999). If the accents of both μ_1 and μ_2 are L, then the accent of

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$\mu_1\mu_2$ is LL, whereas if the accent of μ_1 is L and the accent of μ_2 is either H or R, then the accent of $\mu_1\mu_2$ is LH. On the other hand, if the accent of μ_1 is H, $\mu_1\mu_2$ appears with HX(= HH or HL): in MK, the first high pitch was distinctive and HH and HL were not lexically distinguished; the same word could appear as both HH and HL based on the number of syllables in the phonological phrase. The same is true for RX: when the accent of μ_1 is R, the accent of $\mu_1\mu_2$ is RX. (2) summarizes the SK accent formation rules in MK.

(2) Accent formation rules in SK disyllabic words (X = unspecified)

μ_1	μ_2	$\mu_1\mu_2$	Examples
L	L	LL	家 kà 'house' + 庭 tjə̀ŋ 'garden' → kà.tjə̀ŋ 'home'
L	H/R	LH	朝 tjò 'morning' + 會 hŏj 'gathering' → tjò.hój 'morning meeting'
H	ANY	HX	主 cjú 'main' + 人 ìn 'person' → cjú.in 'the head of the house'
R	ANY	RX	對 tǎj 'face each other' + 答 táp 'answer' → tǎj.tap 'answer'

Due to orthographic restrictions in MK texts,[1] the accents of SK disyllabic words ($\mu_1\mu_2$) are often not attested, whereas the accents of each SK morpheme (μ_1 and μ_2) are mostly attested, which in turn permits us to reconstruct the accent of SK words based on the accent formation rules in (2). Thus the SK word accent data in this paper is the aggregation of both attested and reconstructed accents, based on the database in Ito (2000, 2007): c. 1,930 SK words and 5,260 SK morphemes collected from more than 30 MK original texts.[2]

3. Historical development

3.1. Stratified lexicon

(3) shows the accent classes in YB disyllabic native non-compound nouns. ( ) indicates the accent of the following suffix. Examples are isolation forms and nominative forms with *-i/ka*.

(3) Accent classes in YB disyllabic native non-compound nouns

HL(L)	LH(L)	LL(H)
kú.rə̀m 'cloud' kú.rə̀m-ì	kì.rə́m 'oil' kì.rə́m-ì	kì.túŋ 'pillar' kì.tùŋ-í

In this paper, each accent class is abbreviated to HL, LH, and LL, ignoring the accent of the following suffix. Underlyingly unaccented class LL is not distinguished from final accent class LH in isolation forms, where LL appears as LH.

The accent classes of disyllabic SK words are also HL, LH and LL. However, in the frequency of each accent class, native non-compound words and SK words have different distributional patterns. As shown in (4), in SK words HL is the largest class, whereas in native words LH is the largest class.

[1] Many MK texts were the translations of Chinese classics/literatures. They usually contain the translation and the original Chinese text which was annotated with MK suffixes, occasionally as well with the readings of SK morphemes, so that MK people could read it with Korean syntax/phonology. As a convention of MK texts, even in the translation parts SK words were often represented by Chinese characters followed by their pronunciation in Hangul, whereas native words were always written only in Hangul.

[2] One problem of this reconstruction is that some SK words are not inherited from MK directly but are loanwords from Japanese: since both Korean and Japanese have Sino-words, Sino-Japanese words which were invented in Japan, and even native Japanese words which are written with Chinese characters, were adapted into Korean by replacing the original Japanese pronunciations with Sino-Korean readings. E.g.) J. setai (世帯) 'household' → K. se.tɛ, J. tetuduki (手続) 'procedure' → K. su.sok. However it is not necessarily easy to distinguish which words are genuinely inherited from MK and which words are not. Also in reality the patterns of (assumed) historical development in reconstructed SK words do not show significant differences from that of attested words. Thus it is safe to examine the historical change based on not only the attested data but also the reconstructed data.

(4) Accent class distribution in native and SK words

Accent	Native	SK
HL	182 (23 %)	5358 (67 %)
LH	549 (68 %)	2296 (29 %)
LL	74 (9 %)	323 (4 %)
Totals	805	7977

% shows the ratio of each accent class within the word class.

That is, the frequency rankings in native and SK accents are:

Native LH > HL > LL **SK** HL > LH > LL

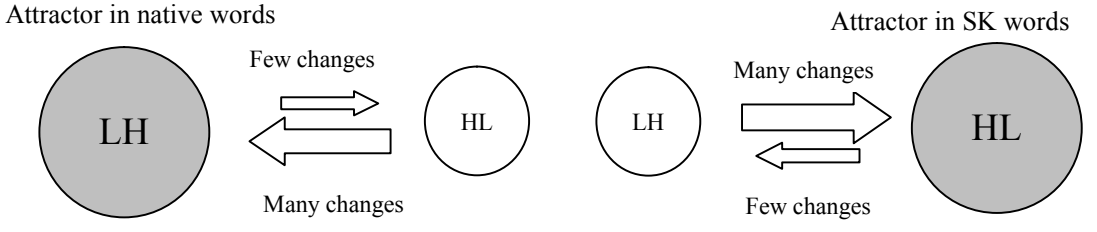
The basic correspondence between MK and YB disyllabic words is straightforward: MK LL and LH correspond with YB LL and LH respectively, whereas MK HX and RX merged with YB HL.

(5) Basic correspondence between MK and YB

MK	YB	Examples
HX	HL	發明 MK pál.mjəŋ 'invention' > YB pál.mjə̀ŋ
RX	HL	慰勞 MK ŭj.ro 'consolation' > YB wí.rò
LH	LH	消化 MK sjò.hwá 'digestion' > YB sò.hwá
LL	LL	當身 MK tàŋ.sìn 'you' > YB tàŋ.sìn

Many literatures have discussed the correlation between analogical change and frequency (Hooper 1976, Bybee 1985, 2000, 2002, 2006, Phillips 1984, 2001, and others): a higher type-frequency class tends to attract words from the lower type-frequency classes. Based on the different distributional bias between native and SK words, we expect that these two classes will show different patterns in historical development. That is, in native words where LH is larger than HL, the change from HL to LH should be more frequent than the change from LH to HL, whereas in SK words where HL is larger than LH, the change from LH to HL should be more frequent than the change from HL to LH. Cf. "The rich get richer." Figure 1 illustrates this idea.

Figure 1 Analogical change hypothesis



In fact, attraction to larger classes is confirmed in YB: a sharp distinction is drawn between native and SK disyllabic nouns in patterned exceptions to the basic correspondences. As (6) and (7) show, in native words where LH is the strongest class, LH tends to maintain the MK accent quite regularly (92 %) and rarely changed to the smaller class HL (only 4%), whereas smaller classes such as MK HX and RX often changed to LH irregularly (29 %) and the regular development rate was relatively lower (61 %). In SK words where HL is the strongest class, MK HX/RX quite regularly correspond with YB HL (80 %) and the irregular development from these classes to LH is relatively rare (18 %), whereas the smaller class LH does not show a high regular correspondence rate (51 %) and it irregularly changed to the larger class HL (= MK HX & RX) at a high rate (37 %).

(6) Historical development (Regularity rate = regular development/total of the class)

Native

MK \ YB	HL	LH	LL	Totals	Regularity
HX/RX	52	25	8	85	61 %
LH	10	215	9	234	92 %
LL	8	59	26	93	28 %
Totals	70	299	43	412	

SK

MK \ YB	HL	LH	LL	Totals	Regularity
HX/RX	3614	810	118	4542	80 %
LH	821	876	27	1724	51 %
LL	405	332	151	888	17 %
Totals	4840	2018	296	7154	

(7) Comparison of different analogical paths in historical development

	HX/RX → HL (regular)	HX/RX →LH (irregular)	LH → LH (regular)	LH → HL (irregular)
Native	52 (61 %)	25 (29 %)	215 (92 %)	10 (4 %)
SK	3614 (80 %)	810 (18 %)	876 (51 %)	821 (37 %)

Thus our finding provides evidence for a **stratified lexicon**: speakers know to which word class (native or SK) the words belong and show different analogical changes depending on the type frequency within the word class. Another important point is that markedness is not relevant here. The historical change is not motivated by the rising or falling configuration of a particular tone.

3.2. Phonological traits of native vs. SK words

Then how do the speakers know the difference between the two word classes? Other than **semantic** differences (SK words tend to be more technical/formal/unfamiliar whereas native words are more daily/informal/familiar) and **orthographical** differences (SK words can be written with Chinese characters; phonological alternations are not reflected in the orthography of SK words as a rule), **phonological** differences play a role in distinguishing the two word classes.

(8) Phonological traits of native vs. SK words

a. Syllable structure: the most frequent structure in native words is CV.CV, which is the least frequent structure in SK; the most frequent structure in SK is CVC.CVC, which is the least frequent structure in native words.

b. Phonotactic restrictions: in SK words tense onsets do not appear as a rule except for a couple of exceptional readings whereas native words do not have this restriction; SK words can have a liquid onset /r-/ which does not appear in native words (only YB younger generations); SK words do not have aspirated codas or complex codas whereas native words can.

c. Stronger OCP restrictions in native words: two aspirated consonants ($C^h...C^h$) never appear in native non-compound words whereas it is often observed in SK words; two glides (G...G) rarely appear in native words whereas it is possible in SK words. OCP-place restriction is significant in both native and SK words and so it is not a cue for the distinction of the two classes.

d. Positional markedness: the vowel distribution/frequency is different between μ_1 and μ_2 in native nouns whereas it is the same between the two positions in SK, since SK words are by definition a combination of two SK morphemes.

Given these differences, we expect that SK words with more "native-like" structure tend to behave like native words in historical development. In the next section we examine the extreme case where the correlation between lexical mis-categorization and historical development is observed.

3.3. Nativised SK words

Historical sound changes in native words tend not to apply to SK words: SK words tend to be more conservative in sound changes and to maintain the uniformity of their phonological system, since SK morphemes have multiple realizations in various related SK words and hence their identity

is mutually reinforced, which prohibits specific/sporadic sound changes in only limited SK words. Also in general, sound changes in word-medial position are not applied to SK words, probably because SK words are treated as a kind of compound, having an internal boundary. (9) shows the examples of sound changes which as a rule apply to native nouns and rarely apply to SK words.

(9) Examples of sound changes

a. The tensification of onset obstruents in word-initial position is relatively common in native words, but this is rarely observed in SK words. (Native MK **k**a.sʌi 'thorn' > YB **k***a.si vs. SK MK 家産 **k**a.san 'family property' > YB **k**a.san)

b. In native words, MK /ʌ/ merged with /a/ in word-initial position and with /ɨ/ in word-medial position. In SK words MK /ʌ/ merged with /a/ regardless of the position in a word. (Native MK mʌ.zʌm 'heart' > YB m**a**.**ɨ**m vs. SK MK 思慮 sʌ.rjə 'thoughts' > YB s**a**.rjə, MK 男子 nam.cʌ 'man' > YB nam.c**a**)

c. MK /o/ mostly changed to /u/ in word-medial position in native words whereas it remained as /o/ in SK words. (Native MK toŋ.m**o** 'friend' > YB toŋ.m**u** vs. SK MK 父母 pu.m**o** 'parents' > YB pu.m**o**)

Still in actuality, there are some SK words which underwent the same sound change as native words, probably because they were relatively frequently used or familiar words. We call this kind of SK words **natvised SK words**, and distinguish them from "genuine" SK words by defining that natvised SK words do not correspond with their underlying SK morpheme readings at least partially. The number of natvised SK words is quite small: **7,977** genuine SK words vs. **182** natvised SK words (only 2 %).

(10) Examples of natvised SK words

	Gloss	MK	Standard Korean	YB	Readings of SK morphemes
查頓	relative by marriage	sà.tón	sa.ton	sà.tún	sa, ton
孫子	grandson	sòn.cʌ́	son.ca	sòn.cɛ́	son, ca
怨讐	enemy	wə̀n.sjù	wən.su	wə̀n.s*í	wən, su
麝香	musk	sjă.hjaŋ	sa.hjaŋ	sà.hɛ́ŋ	sa, hjaŋ
子息	son	cʌ́.sik	ca.sik	c*á.sìk	ca, sik
天動	thunder	t^hjə̀n.tóŋ	c^hən.tuŋ	c^hə̀n.tùŋ	c^hən, toŋ

Given that natvised SK words are treated differently from genuine SK words in sound changes, we expect that they also show different patterns in the accent distribution and its historical development: natvised SK words may behave like native words in accent development.

In fact two results support this prediction. First, in native words LH is the largest class and in genuine SK words HL is the largest, whereas in natvised SK words, the HL/LH asymmetry breaks down and we find a more balanced distribution, although LH is slightly larger than HL.

(11) Accent distribution of native, SK, and natvised SK words

Accent	Native	SK	Natvised
HL	182 (23 %)	5358 (67 %)	75 (41 %)
LH	549 (68 %)	2296 (29 %)	91 (50 %)
LL	74 (9 %)	323 (4 %)	16 (9 %)
Totals	805	7977	182

Second, in historical development, LH was the attractor in native words and HL (MK HX/RX) was the attractor in genuine SK words, whereas in natvised SK words the regularity rate of LH is highest, attracting words from other classes as in native words, in spite of the fact that HX/RX was larger than LH as in SK words as far as MK data is concerned. The balanced distribution in natvised

SK words in YB probably resulted from this (irregular) attraction to LH.

(12) Historical development of nativised SK words

MK \ YB	HL	LH	LL	Totals	Regularity
HX/RX	55	24	7	86	64 %
LH	5	38	1	44	86 %
LL	3	19	7	29	24 %
Totals	63	81	15	159	

Thus nativised SK words, which are etymologically SK words but are phonologically treated as native words, behave like native words in their accent distribution and their historical development. These results can also provide evidence for a stratified lexicon, showing the correlation between lexical mis-categorization based on the phonological traits and the different historical developments.

4. Sound change model

4.1. Islands of Reliability

Given that **HL** attracted many words from the smaller class **LH** in SK, it is puzzling that some words irregularly changed from **HL** to **LH**. In actuality, syllable structure plays a role in this irregular change. In this paper, we distinguish a syllable with a coda *-p/l/k* as **E class**, which corresponds with Middle Chinese (MC) Entering tone, from other accent classes L, H and R. MK E class exclusively appeared in the morphemes with codas *-p/l/k* and regularly had a high pitch. (13) shows the examples of SK morphemes with each accent class. Note that E and H had an identical accent in MK and hence both EX and HX appeared with HX.

(13) Examples of SK morphemes in MK

E	法	pǿp ‘law’	食	sík ‘eat’	末 mál ‘end’
L	歌	kà ‘song’	枝	cì ‘branch’	風 p^hùŋ ‘wind’
H	次	c^hʌ́ ‘next’	紙	cí ‘paper’	網 máŋ ‘net’
R	嫁	kă ‘daughter in law’	試	sĭ ‘try’	論 rŏn ‘discuss’

The E class is relevant in determining a deviation from HL to LH: as shown in (14), when μ_1 is Non-E class and μ_2 is E class, we find more irregular change to LH than expected; still when μ_1 is E class, the ratio of irregular change to LH is around the same regardless of the accent of μ_2.

(14) Irregular change from HL to LH in YB. Non-E class means H/R in μ_1 and H/R/L in μ_2.

μ_1	μ_2	**Irregular change to LH**
Non-E class	E class	31 %
Non-E class	Non-E class	18 %
E class	E class	13 %
E class	Non-E class	11 %

This “**Entering tone effect**” (the Island of Reliability effect from segmental phonology, Albright 2002) is due to a high reliability in the correlation between E class and a high pitch in MK, which results from two factors: MC Entering tone regularly corresponded with MK high pitch; E class has a signature (coda *-p/l/k*) which identifies this class. Thus when speakers did not know the accent of a SK word which contains E class morphemes, they probably assigned a high pitch to the E class, based on this reliable correlation between E class and a high pitch. The biased irregular change to LH (31 %) in Non-E class + E class can be explained in this way. The similar ratio between E class + E class (13 %) and E class + Non-E class (11 %), on the other hand, must have resulted from not only the Entering tone effect but also the “default status of HL,” which is discussed in the next section.

4.2. Weighted constraints

In 4.2, we examine how constraint ranking can explain sound changes of SK words from MK to YB. We propose a sound change model with weighted constraints, employing Jäger (to appear)'s Stochastic Gradient Ascent learning algorithm in which faithfulness constraints start at 0 and markedness at 10. (15) shows the inputs, outputs, and constraints which are assumed in this sound change model, based on the fact that the underlying accents of both μ_1 and μ_2 are playing roles in SK accent evolution. (16) is the example of the learning data.

(15) Inputs, outputs, and constraints in sound changes from MK to YB

a. Inputs (MK underlying accents which are 16 possible combinations of E, H, R, L): EE, EH, ER, EL, HE, HH, HR, HL, RE, RH, RR, RL, LE, LH, LR, LL.
b. Output candidates: YB accent classes which are theoretically possible (HH, HL, LH, LL), along with the relative frequency of existing patterns.
c. Markedness constraints: *HH, *HL, *LH, *LL
d. Faithfulness constraints: F (E_1), F (H_1), F (R_1), F (L_1), F (E_2), F (H_2), F (R_2), F (L_2). Number indicates the first/second syllables.

(16) Example of the learning data

Input	Output	Output #	*HH	*HL	*LH	*LL	F(E_1)	F(H_1)	F(R_1)	F(L_1)	F(E_2)	F(H_2)	F(R_2)	F(L_2)
EE	HH	0	1											
	HL	297		1							1			
	LH	44			1		1							
	LL	6				1	1				1			
EH	HH	0	1											
	HL	128		1								1		
	LH	20			1		1							
	LL	0				1	1					1		

Based on the existing patterns ("Output #" in (16)), relevant markedness and faithfulness constraints were assigned different weights, as shown in (17).

(17) Obtained weights

*HH	13.81	F (L_1)	1.03
*LL	10.21	F (E_1)	0.81
*LH	8.34	F (E_2)	0.75
*HL	7.16	F (H_1)	0.60
		F (R_1)	0.32
		F (R_2)	0.32
		F (L_2)	0.18
		F (H_2)	0.06

As expected, *HH is strongest since it never appears in YB accent system. On the other hand, *LL is a more general constraint which requires every word to have a pitch peak. In YB, LL and LH have an identical pitch form LH in isolation forms, which probably accelerated the change from LL to LH, not vice versa (Base-Identity effect, Kenstowicz 1996). The default status of HL as the largest group in SK is reflected by having the lowest penalty weight among the markedness constraints.

Among faithfulness constraints, F (E_1) and F (E_2) have relatively higher weights, whereby the Island of Reliability effect is confirmed. The fact that F (L_1) is highest faithfulness constraint suggests that the most crucial information YB speakers have to memorize is F (L_1) which can result in LH or LL classes. That is, F (L_1) is necessary in order to block HL being assigned as a default, and hence its

weight is relatively higher.

As a whole, the obtained weight ranking suggests that if a speaker lacks complete information on the accent of given SK morphemes (e.g. mis-transmission in learning), then the default accent HL would be assigned, based on the markedness constraint ranking *HH > *LL > *LH > *HL, unless the SK word contains E class morphemes. Thus our model shows that the historical development of SK accent in YB was mainly motivated by the interaction of default HL accent, faithfulness constraint $F(L_1)$, and the Island of Reliability effect in E class.

5. Factors accelerating an irregular change to a default class

Finally, we point out two factors which accelerated the analogical change from LH/LL to HL in SK words. First, when the onset of μ_1 is an obstruent, MK LH/LL classes changed to YB HL irregularly more often than when the onset is zero or a sonorant (an asymmetry familiar from the tonogenesis literature). The correlations are statistically significant ($\chi^2 = 36.67$, p = 6.96E-07).

(18) Correlations between accent change in MK LH/LL and onset of μ_1

ONSET \ YB	HL	LH/LL	Totals	% of HL
Lax	596/558 (1.07)	590/628 (0.94)	1186	50 %
Aspirated	157/154 (1.02)	170/173 (0.98)	327	48 %
/s/	189/177 (1.06)	188/200 (0.94)	377	50 %
/h/	99/84 (1.17)	80/95 (0.84)	179	55 %
Ø	155/197 (0.79)	263/221 (1.19)	418	37 %
Sonorant	111/136 (0.82)	178/153 (1.16)	289	38 %
Totals	1307	1469	2776	

Left number = Observed, right number = Expected, ( ) = O/E values.

Second, a correlation between the regular development rate and token frequency is observed. Many previous literatures have pointed out that phonetic change often progresses more quickly in lexical items with high frequency, whereas analogical change affects the least frequent words first (Schuchardt 1885, Hooper 1976, Bybee 1985, 2000, 2002, 2006, Phillips 1984, 2001, and others). In this paper we calculated a kind of token frequency by counting the number of words where a SK morpheme occurs as the first element of disyllabic words. Frequency is high when μ_1 occurs in 5 or more SK words, based on the mean occurrence (4.91). E.g.) "pʰjəŋ (平)" occurs as μ_1 of **23** disyllabic words, such as "pʰjə̀ŋ.hwá (peace)," "pʰjə̀ŋ.páŋ (square)," and so the frequency of this morpheme is **23** (high frequency morpheme). As shown in (19), when μ_1 is a frequently used morpheme, they correspond with YB LH/LL more regularly: SK words whose μ_1 accent is informative enough due to its high token frequency could escape the assignment of a default accent HL. The correlations are again statistically significant (p= 2.3E-05 by Fisher's Exact Test).

(19) Correlation between accent change in MK LH/LL and token-frequency of μ_1

FREQUENCY \ YB	HL	LH/LL
High	914 (45 %)	1136 (55 %)
Low	393 (54 %)	338 (46 %)

6. Conclusion

In this paper we examined the SK accent both synchronically and diachronically and showed that the accent distribution and its historical development are different between native and SK words. This first result provides evidence for a stratified lexicon: native and SK words show different analogical paths in historical change depending on the type frequency within each word class. Second, a striking exception where μ_2 determines a deviation from HL to LH was pointed out ("Entering-tone effect,"

an Island of Reliability effect from segmental phonology (Albright 2002)). Third, we proposed a model of SK accent change with weighted constraints. The default status of HL in SK was explained by having the lowest penalty weight among markedness constraints. The Island of Reliability effect was also confirmed by the higher weights of $F(E_1)$ and $F(E_2)$. The weight of $F(L_1)$ was highest among faithfulness constraints, since $F(L_1)$ is necessary to block HL being assigned as a default. Finally, accelerated attraction from LH/LL to HL was explained by tonogenesis and token frequency.

Experimentally probing the stratified lexicon based on wug word test or novel words composed of SK morphemes, designing a model where segmental information and frequency information are taken into account, examining interdialectal differences, etc. are tasks for future research.

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