

## The Accent of Sino-Korean Words in South Kyengsang Korean

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**Abstract:** Most of the Sino-Korean readings that are attested in Middle Korean (15–16th c.) and are prevalent in contemporary Korean are assumed to have been introduced into Korean from Middle Chinese. Previous literature has reported that even in contemporary Korean dialects with distinctive tonal contrasts, the tonal patterns of Sino-Korean morphemes show regular correspondences with Middle Chinese tones to a certain extent. In this paper, we investigate the accentuation of Sino-Korean words in the South Kyengsang dialect with a comparison of native simplex nouns on the one hand and with Middle Korean accent on the other. The Sino-Korean nouns in South Kyengsang display the same range of accentual contrasts as native simplex nouns, but type frequency differs between the two lexical classes, which leads to distinct default accent classes. There are correlations between segmental type (onset and coda) and accent class in both Middle Korean and South Kyengsang Sino-Korean words, some of which are emergent patterns in the latter. We conclude that the Sino-Korean accent, while being faithful to the historically expected accent as a rule, has frequently been restructured through analogical changes based on four factors: (i) a simple type-frequency effect attracting many words to a default accent class, (ii) identical isolation forms resulting in an ambiguous accentual contrast, (iii) local generalizations based on segment-tone correlations with higher type frequency in the lexicon, and (iv) phonetically natural associations.\*

**Key words:** Sino-Korean, accent, analogy, frequency, onset and coda effects

### 1. Introduction

Sino-Korean words constitute an important lexical class in Korean; they are exclusively nouns. Most of the Sino-Korean readings that are attested in Middle Korean (15–16th c., henceforth MK) and are prevalent in contemporary Korean are assumed to have been introduced into Korean from Middle Chinese (Kōno 1968: 506–509, Ito 2007: 259–267, and references cited therein). In MK texts, the

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tonal patterns of various Sino-Korean morphemes are documented, and they regularly (not randomly) correspond with Middle Chinese tones. Previous literature reports that even in contemporary Korean dialects with distinctive tonal contrasts, such as Kyengsang (South Korea) and Hamkyeng (North Korea), the tonal patterns of Sino-Korean morphemes show regular correspondences with Middle Chinese tones to a certain extent (Ramsey 1978: 180–186, Ito 1999: 134–136, Fukui 2013: 205. See also Lee 2004: 93–96 for discussion of the correspondences of Sino-Korean accent between North Kyengsang Taykwu dialect and Middle Korean).

While showing these regular correspondences with Middle Chinese tones, the accentuation of Sino-Korean words in the contemporary dialects has not been examined in detail. Compared to the native lexicon, the tonal patterns of Sino-Korean words have either been a peripheral issue in the study of Korean accent or they have not been discussed separately from the native lexicon in a systematic way. Also, the diachronic study of Korean accentuation so far has been focused on clarifying the regular correspondences, and not much attention has been paid to irregular developments or variations.

Given this background, Ito (2008) examined the accent of Sino-Korean words in the Yanbian Korean dialect (north-eastern China), which is closely related to the Hamkyeng dialect. The accent distribution is different between native and Sino-Korean words in Yanbian, resulting in different analogical paths in historical change depending on the type frequency within each word class.

The purpose of this paper is to conduct the same line of study as Ito (2008), based on the South Kyengsang dialect (Pusan and Changwen area). By investigating the accentuation of Sino-Korean words in South Kyengsang with a comparison to native simplex nouns on the one hand and to MK accent on the other, we clarify the factors that underlie the analogical changes that have resulted in the irregular correspondences.

The Sino-Korean data discussed in this paper is composed of 403 monosyllabic words and 9,012 disyllabic words, which are taken from two Korean dictionaries (Kwuklip kwuke yenkwuwen 1999, Kadowaki et al. 1993) as well as some words added through interviews with consultants. The data of monosyllabic words were collected from five native speakers and the data of disyllabic words were collected from one of these speakers. Four speakers are in their 30's and one speaker is in her 20's. Our Sino-Korean data is compared with native simplex nouns that are discussed in Do et al. (to appear), among whose consultants two speakers are the consultants for this study as well.

This paper is organized as follows. Section 2 examines the accent distributions of both native and Sino-Korean words and shows the correlations between coda type and accent class of Sino-Korean words. Section 3 overviews the Sino-Korean accentuation in MK. Section 4 investigates the accent correspondences between MK and South Kyengsang Sino-Korean words and analyzes the causes for the synchronic/diachronic variations. Section 5 is a conclusion.



Table 2. Accentual transcription system of South Kyengsang

H(H)	páp 'rice'	H(L)	p <sup>h</sup> ál 'arm'	L(H)	pám 'chestnut'
HH	p <sup>h</sup> á.ri 'fly'	HL	pá.ta 'sea'	LH(L)	po.ri 'barley'
				LH(H)	pa.pó 'fool'

Table 3 shows the accent distribution of monosyllabic Sino-Korean words for each speaker. Some of the words were unknown to our speakers, which explains the fact that the corpus size varies among our consultants. For some words, our speakers reported more than one accent class, in which case each accent type was counted as one data point. Based on the words for which all five speakers responded (224 words), the agreement rate among speakers is 67% (= 149 agreed words/224). This fact suggests that there is quite a bit of variance among our South Kyengsang speakers, which is taken into account in the statistical analysis discussed in 4.1.

Table 3. Accent distribution of each speaker (monosyllabic Sino-Korean nouns in South Kyengsang)<sup>2</sup>

Speaker	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
CJH	139	124	131	394	35%	31%	33%
JJH	111	105	106	322	34%	33%	33%
PCY	132	120	128	380	35%	32%	34%
JYJ	133	80	102	315	42%	25%	32%
LYS	141	84	91	316	45%	27%	29%
Totals	656	513	558	1,727	38%	30%	32%

Table 4 and Figure 1 show the accent distribution of **monosyllabic** native and Sino-Korean words. Both native and Sino-Korean words are aggregated across the five speakers (i.e. all the data points taken from the five speakers are totaled). As can be seen, not only native nouns but also Sino-Korean nouns appear with three accent classes. Still in native nouns, H(H) is the largest class (53%), followed by H(L) and L(H), while in Sino-Korean words, no strong bias is observed, although H(H) is the largest class here as well.

Table 4. Accent distribution (monosyllabic native and Sino-Korean nouns in South Kyengsang)

word class \ accent	H(H)	H(L)	L(H)	Totals
	Native	1,133 (53%)	555 (26%)	450 (21%)
Sino-Korean	656 (38%)	513 (30%)	558 (32%)	1,727

<sup>2</sup> In this paper, percentages are rounded off with no decimal places.

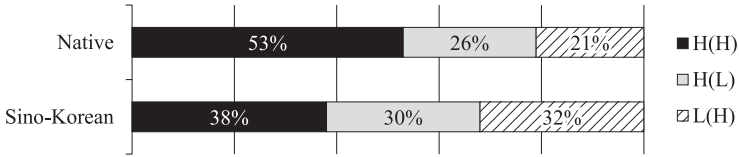


Figure 1. Ratio of each accent class in monosyllabic native and Sino-Korean nouns (South Kyengsang)

(2) Examples

- a. Native H(H): ǎn ‘inside’, í ‘louse’, pé ‘hemp’, t\*ǎl ‘daughter’, kás ‘leaf mustard’
- b. Native H(L): ǎp<sup>h</sup> ‘front’, jóp<sup>h</sup> ‘side’, cíp ‘house’, tǎc<sup>h</sup> ‘trap’, k\*óc<sup>h</sup> ‘flower’
- c. Native L(H): il ‘work’, pjǎl ‘star’, tǎn ‘money’, kǎm ‘persimmon’, sǔm ‘breath’
- d. Sino-Korean H(H): ǎk 惡 ‘evil’, íl 一 ‘one’, pǎp 法 ‘law’, cǎm 點 ‘spot’
- e. Sino-Korean H(L): jǎj 零 ‘zero’, kjún 菌 ‘germ’, pán 班 ‘group’, sín 神 ‘god’
- f. Sino-Korean L(H): ǎm 癌 ‘cancer’, ǎ 五 ‘five’, pjǎj 病 ‘sickness’, tǎm 膽 ‘gallbladder’

Table 5 and Figure 2 show the accent distributions of **disyllabic** native simplex nouns and Sino-Korean nouns. Note that the total of Sino-Korean words is not equal to the number of words (9,012 words), since our speaker reported more than one accent class for some words. Native nouns are aggregated across the five speakers. Again, not only native nouns but also Sino-Korean nouns appear in four accent classes. In disyllabic native nouns, HL is the dominant class (42%) and LH(H) is smallest (13%), whereas in Sino-Korean, both HH and LH(H) predominate. HL and LH(L), which are relatively larger classes in native nouns, are twice as small in Sino-Korean nouns.

Table 5. Accent distribution (disyllabic native and Sino-Korean nouns in South Kyengsang)

accent \ word class	HH	HL	LH(L)	LH(H)	Totals
Native	716 (18%)	1,686 (42%)	1,115 (28%)	526 (13%)	4,043
Sino-Korean	2,985 (30%)	1,789 (18%)	1,422 (14%)	3,642 (37%)	9,838

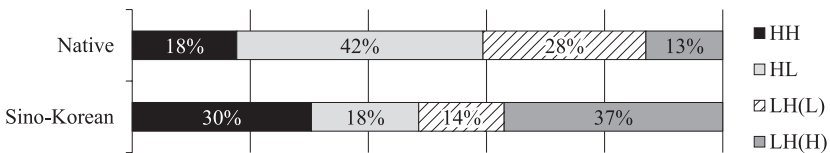


Figure 2. Ratio of each accent class in disyllabic native and Sino-Korean nouns (South Kyengsang)

## (3) Examples

- a. Native HH: á.kí ‘baby’, kú.rím ‘cloud’, tán.cí ‘jar’, ká.múm ‘drought’
- b. Native HL: á.tíl ‘son’, pá.wí ‘rock’, ká.sim ‘breast’, má.níl ‘garlic’
- c. Native LH(L): a.c<sup>h</sup>ím ‘morning’, pa.rám ‘wind’, tan.c<sup>h</sup>ú ‘button’, ka.rú ‘powder’
- d. Native LH(H): an.ké ‘fog’, həŋ.kǝp<sup>h</sup> ‘rag’, tɛ.p<sup>h</sup>é ‘plane’, kə.cís ‘lie’
- e. Sino-Korean HH: pák.sú 拍手 ‘applause’, kál.mán 渴望 ‘desire’, sú.cún 水中 ‘underwater’
- f. Sino-Korean HL: tíŋ.tɛ 燈臺 ‘lighthouse’, mú.si 無視 ‘neglect’, sú.ri 修理 ‘repair’
- g. Sino-Korean LH(L): toŋ.sán 東山 ‘hill’, kjəŋ.ú 境遇 ‘circumstances’, sin.mún 新聞 ‘newspaper’
- h. Sino-Korean LH(H): i.hé 理解 ‘understanding’, po.múl 寶物 ‘treasure’, tɛ.cǝp 待接 ‘treatment’

Thus, Sino-Korean nouns have markedly different tonal distributions compared to native simplex nouns. Is this difference explained by segmental factors? In 2.2, we explore this possibility by examining the correlation between coda type and accent class.

## 2.2. Correlation with codas

The codas that Sino-Korean morphemes can take are: -p, -l, -k, -m, -n, -ŋ, and -Ø. Table 6 shows the accent distributions in monosyllabic Sino-Korean nouns with regard to coda types. When the coda is -p/-l/-k, the accent is biased toward H(H) (85–100%), whereas when the coda is -m/-n/-ŋ/-Ø, the ratio of H(H) is relatively lower and many morphemes appear with either H(L) or L(H).

Table 6. Accent distribution based on coda (monosyllabic Sino-Korean nouns in South Kyongsang)

coda \ accent	accent			Totals	accent		
	H(H)	H(L)	L(H)		H(H)	H(L)	L(H)
p	65	0	0	65	100%	0%	0%
l	77	2	12	91	85%	2%	13%
k	246	5	1	252	98%	2%	0%
m	21	30	40	91	23%	33%	44%
n	53	112	183	348	15%	32%	53%
ŋ	60	185	134	379	16%	49%	35%
Ø	134	179	188	501	27%	36%	38%

In Table 7, the data of -p/-l/-k and -m/-n/-ŋ (nasal) are aggregated. The figures on the left are the observed number of data points, and the figures on the right are the observed/expected values (see Kawahara et al. 2006 for more detailed information on the calculation of observed/expected values). We see that -p/-l/-k

are over-represented with H(H), while nasal and -Ø are under-represented for this class.

Table 7. Aggregated accent and coda (monosyllabic Sino-Korean nouns in South Kyongsang)

coda \ accent	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
	p/l/k	388	7	13	408	<b>2.50</b>	<b>0.06</b>
nasal	134	327	357	818	<b>0.43</b>	<b>1.35</b>	<b>1.35</b>
Ø	134	179	188	501	<b>0.70</b>	<b>1.20</b>	<b>1.16</b>

Notes: Left = observed number of data points, right = observed/expected values. Statistically significant correlations ( $\alpha$ -level at .05 in Chi-square test) are in bold. These are cells whose Chi-square exceed the .05 alpha level for the table as a whole and thus contribute most to the overall Chi-square statistic [ $\chi^2 = 754.14$ ,  $df = 4$ ,  $p < .001$ ]. The same representation is used in other tables below.

(4) Examples

- a. Coda -p: c<sup>h</sup>ǒp 妾 ‘mistress’, kǒp 怯 ‘fear’, cǐp 汁 ‘juice’
- b. Coda -l: jǎl 熱 ‘heat’, sǐl 失 ‘error’, p<sup>h</sup>ǎl 八 ‘eight’
- c. Coda -k: tǎk 德 ‘virtue’, kǎk 角 ‘corner’, cǎk 敵 ‘enemy’
- d. Coda -m: cǎm 點 ‘spot’, kím 金 ‘gold’, kǎm 感 ‘feeling’
- e. Coda -n: cǎn 盞 ‘cup’, kjún 菌 ‘germ’, jǎn 緣 ‘pratyaya’
- f. Coda -ŋ: sǎŋ 賞 ‘prize’, hjǎŋ 香 ‘perfume’, cǎŋ 腸 ‘intestines’
- g. Coda -Ø: c<sup>h</sup>ǎ 齒 ‘tooth’, sí 詩 ‘poetry’, tǎ 度 ‘limit’

The same is true for disyllabic Sino-Korean nouns. Table 8 shows the accent distribution based on the first coda C<sub>1</sub> and Table 9 is the aggregated results. When C<sub>1</sub> is -p/-l/-k, Sino-Korean nouns almost always appear in the HH class (97–99%), whereas other codas (-m/-n/-ŋ/-Ø) do not show such a bias.

Table 8. Accent distribution based on C<sub>1</sub> (disyllabic Sino-Korean nouns in South Kyongsang)

coda \ accent	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
	p	259	2	2	3	266	97%	1%	1%
l	740	3	1	5	749	99%	0%	0%	1%
k	964	6	5	1	976	99%	1%	1%	0%
m	64	98	90	196	448	14%	22%	20%	44%
n	124	455	408	705	1,692	7%	27%	24%	42%
ŋ	138	474	436	732	1,780	8%	27%	24%	41%
Ø	696	751	480	2,000	3,927	18%	19%	12%	51%

Table 9. Aggregated accent and C<sub>1</sub> [ $\chi^2 = 5841.31$ , df = 6, p < .001.]

coda \ accent	accent				Totals	accent			
	HH	HL	LH(L)	LH(H)		HH	HL	LH(L)	LH(H)
p/l/k	1,963	11	8	9	1,991	<b>3.25</b>	<b>0.03</b>	<b>0.03</b>	<b>0.01</b>
nasal	326	1,027	934	1,633	3,920	<b>0.27</b>	<b>1.44</b>	<b>1.65</b>	<b>1.13</b>
∅	696	751	480	2,000	3,927	<b>0.58</b>	1.05	<b>0.85</b>	<b>1.38</b>

## (5) Examples

- a. C<sub>1</sub> -p: áp.rjók 壓力 'pressure', táp.án 答案 'answer', cip.háp 集合 'gathering'
- b. C<sub>1</sub> -l: ál.són 斡旋 'mediation', pál.héŋ 發行 'publication', c<sup>h</sup>l.wól 七月 'July'
- c. C<sub>1</sub> -k: ák.pó 樂譜 'musical score', pák.sá 博士 'doctor', tók.cú 獨奏 'solo'
- d. C<sub>1</sub> -m: cǝm.hwá 點火 'ignition', ím.ak 音樂 'music', ím.p<sup>h</sup>á 音波 'sound wave', am.c<sup>h</sup>ó 暗礁 'reef'
- e. C<sub>1</sub> -n: ín.jóŋ 引用 'quotation', án.pu 安否 'safety', an.njóŋ 安寧 'peace', an.kjóŋ 眼鏡 'glasses'
- f. C<sub>1</sub> -ŋ: c<sup>h</sup>án.cá 腸子 'internal organs', jaŋ.pok 洋服 'suit', jaŋ.kúŋ 洋弓 'archery', jaŋ.pó 讓步 'compromise'
- g. C<sub>1</sub> -∅: jó.wáŋ 女王 'queen', á.əp 漁業 'fishery', a.tóŋ 兒童 'child', ə.kám 語感 'implication'

Similarly, Tables 10 and 11 show the accent distributions based on the second coda C<sub>2</sub>. When C<sub>2</sub> is -p/-l/-k, Sino-Korean nouns do not appear with LH(L) as a rule, and they appear with HL relatively frequently. When C<sub>2</sub> is -m/-n/-ŋ/-∅, HL is less frequently observed, while LH(L) more frequently appears.

Table 10. Accent distribution based on C<sub>2</sub> (disyllabic Sino-Korean nouns in South Kyengsang)

coda \ accent	accent				Totals	accent			
	HH	HL	LH(L)	LH(H)		HH	HL	LH(L)	LH(H)
p	99	133	0	110	342	29%	39%	0%	32%
l	214	251	3	211	679	32%	37%	0%	31%
k	387	474	6	443	1,310	30%	36%	0%	34%
m	150	72	90	173	485	31%	15%	19%	36%
n	462	233	259	651	1,605	29%	15%	16%	41%
ŋ	577	215	369	654	1,815	32%	12%	20%	36%
∅	1,096	411	695	1,400	3,602	30%	11%	19%	39%



Table 11. Aggregated accent and  $C_2$  [ $\chi^2 = 1021.22$ ,  $df = 6$ ,  $p < .001$ .]

coda \ accent	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
	p/l/k	700	858	9	764	2,331	0.99	<b>2.02</b>	<b>0.03</b>
nasal	1,189	520	718	1,478	3,905	1.00	<b>0.73</b>	<b>1.27</b>	1.02
Ø	1,096	411	695	1,400	3,602	1.00	<b>0.63</b>	<b>1.33</b>	1.05

## (6) Examples

- a.  $C_2$  -p: cá.ríp 自立 'independence', ká.ip 加入 'joining', kwa.cíp 果汁 'fruit juice'
- b.  $C_2$  -l: kí.múl 器物 'vessel', kú.pjəl 區別 'distinction', mi.súl 美術 'art'
- c.  $C_2$  -k: jǎ.sík 女息 'daughter', ká.c<sup>h</sup>uk 家畜 'domestic animal', po.sǎk 寶石 'jewel'
- d.  $C_2$  -m: pón.sím 本心 'right mind', ín.p<sup>h</sup>um 人品 'personality', sə.nám 西南 'southwest', ko.p<sup>h</sup>úm 古品 'antiques'
- e.  $C_2$  -n: c<sup>h</sup>á.wón 次元 'dimension', cé.san 財產 'property', nam.mún 南門 'south gate', o.cǎn 午前 'forenoon'
- f.  $C_2$  -ŋ: c<sup>h</sup>é.cún 體重 'weight', í.təŋ 移動 'movement', jəŋ.hjǎŋ 影響 'influence', nə.jǎŋ 內容 'contents'
- g.  $C_2$  -Ø: pú.mó 父母 'parents', hó.su 湖水 'lake', p<sup>h</sup>a.tó 波濤 'wave', to.kú 道具 'instrument'

Finally, Table 12 shows the combined results of Tables 8 and 10. The Sino-Korean morphemes which have codas -p/-l/-k are indicated as  $\mu_E$ , based on the fact that these morphemes regularly correspond with the Middle Chinese Entering Tone (discussed below). The Sino-Korean morphemes which have other codas are indicated as  $\mu_O$ . Thus,  $\mu_E\mu_E$  means that both  $C_1$  and  $C_2$  are -p/-l/-k, and  $\mu_E\mu_O$  means that  $C_1$  is -p/-l/-k and  $C_2$  is other codas. The correlation between coda type and accent class is evident:  $\mu_E\mu_E$  and  $\mu_E\mu_O$  almost always appear with HH, whereas LH(L) basically appears only when neither of the codas is -p/-l/-k ( $\mu_O\mu_O$ ). On the other hand, HL is the largest class in  $\mu_O\mu_E$ .<sup>3</sup>

<sup>3</sup> In general, a resyllabification such as *cap.im* 雜音 'noises' → *ca.pim* or *hwak.in* 確認 'confirmation' → *hwa.kin* does not affect the accent patterns in South Kyengsang. For example, in  $\mu_E\mu_E/\mu_E\mu_O$  structures, the ratio of HH accent is 100% for the Sino-Korean words in which a resyllabification occurs, whereas it is 98% for the Sino-Korean words in which a resyllabification does not occur. On the other hand, nasalization such as *sip.man* 十萬 'a hundred thousand' → *sim.man* or a lateralization/liquid sequence such as *il.njən* 一年 'one year' → *il.ljən*, *sil.le* 失禮 'impoliteness' may affect the accentuation: 10 out of 197 words with a nasalization/lateralization/liquid sequence appear with an accent class other than HH, while 18 out of 1,766 words without these sequences appear with an accent class other than HH. A Pearson's Chi-square test with the Yates' continuity correction shows a significant result for this distribution ( $\chi^2 = 16.88$ ,  $df = 1$ ,  $p < .001$ ). E.g. *sók.mul* 俗物 'vulgarian', *ʔəl.na* 刹那 'moment', *ip.ně* 邑內 'in a town', *ʔəl.lāk* 脫落 'omission'.

Table 12. Coda type and accent (disyllabic Sino-Korean nouns in South Kyengsang) [ $\chi^2 = 6761.47$ ,  $df = 9$ ,  $p < .001$ .]

coda \ accent	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
	$\mu_E\mu_E$	459	4	0	2	465	<b>3.25</b>	<b>0.05</b>	<b>0.00</b>
$\mu_E\mu_O$	1,504	7	8	7	1,526	<b>3.25</b>	<b>0.03</b>	<b>0.04</b>	<b>0.01</b>
$\mu_O\mu_E$	241	854	9	762	1,866	<b>0.43</b>	<b>2.52</b>	<b>0.03</b>	<b>1.10</b>
$\mu_O\mu_O$	781	924	1,405	2,871	5,981	<b>0.43</b>	<b>0.85</b>	<b>1.63</b>	<b>1.30</b>

The same correlation is not observed in native monosyllabic nouns: native nouns with a coda -p/-l/-k do not exclusively appear with H(H) (69%, 60%, 63%, respectively), although certain correlations between coda type and accent class are observed. For example, in native monosyllabic nouns, sonorant codas tend to appear with L(H), whereas obstruent codas do not (Table 13).

Table 13. Coda type and accent (native monosyllabic nouns in South Kyengsang) [ $\chi^2 = 171.15$ ,  $df = 2$ ,  $p < .001$ .]

coda \ accent	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
	Obstruent	342	235	25	602	1.07	<b>1.50</b>
Sonorant	791	320	425	1,536	0.97	<b>0.80</b>	<b>1.31</b>

Thus, a highly predictable accentuation is observed in at least some Sino-Korean words. This originates from the regular correspondence between Sino-Korean accent in MK and Middle Chinese tones. We discuss this point in Section 3.

### 3. Sino-Korean Accents in Middle Korean

In this section, we describe the accent of Sino-Korean words in MK. First, Table 14 shows the accent patterns observed in MK simplex nouns. L, H and R indicate low, high, rise, respectively. An R tone is assumed to be composed of L+H (Kōno 1945: 232), and appears only in word-initial position as a rule. In MK, the first high pitch is distinctive and the tonal contour after the first H is predictable depending on the number of following syllables in the same phonological phrase (Kadowaki 1976, Fukui 1985: 69–70, 2013: 119–124): e.g. HH, HLH, HHLH, HLHLH; RH, RLH, RHLH, RLHLH. (The distinctive H tone as well as the H tone as a part of R (= L+H) are indicated with an underline.) These predictable tonal patterns after the first H are notated as “X” in this paper.

Table 14. Accent of MK nouns

Monosyllabic	H	L	R		
Disyllabic	HX	LH	LL	RX	
Trisyllabic	HXX	LHX	LLH	LLL	RXX

As mentioned above, the tonal patterns of Sino-Korean morphemes, which are documented in MK texts, regularly (not randomly) corresponded with the Middle Chinese tones. Middle Chinese had four tonal classes: Level, Rising, Departing, and Entering. Based on comparison with Sino-Japanese *kan'on*, one of the Sino-Japanese readings established in around the 8–9th c., the phonetic values of each Middle Chinese tone (at least those on which Sino-Korean readings were based) are assumed to be as follows: Level = low, Rising = high rise, Departing = rise, Entering = high (Rai 1950: 16, Kindaichi 1951: 699, 1980, Ito 1999: 132–134). The Middle Chinese Level tone corresponded with the Sino-Korean L tone, and the Middle Chinese Entering tone corresponded with the Sino-Korean H tone. On the other hand, the Middle Chinese Rising and Departing tones corresponded with either H or R in Sino-Korean, with a bias to R.

In Middle Chinese, the Entering tone appeared only in the morphemes with a coda -p/-t/-k/-uk.<sup>4</sup> These Middle Chinese codas were adapted as -p/-l/-k respectively (both -k and -uk > -k) in Sino-Korean. Middle Chinese morphemes with Level/Rising/Departing tones, on the other hand, had codas -m/-n/-ŋ/-uŋ/-i/-u/-Ø, which corresponded with Sino-Korean codas as follows: -m > -m, -n > -n, -ŋ/-uŋ > -ŋ, -i/-u/-Ø > -Ø.<sup>5</sup> Thus, the four Middle Chinese tonal classes corresponded with Sino-Korean codas/accents as in Table 15.

Table 15. Correspondences between Middle Chinese tone and Sino-Korean coda/ accent

Middle Chinese tone	Level	Rising	Departing	Entering
Sino-Korean coda	-m/-n/-ŋ/-Ø	-m/-n/-ŋ/-Ø	-m/-n/-ŋ/-Ø	-p/-l/-k
Sino-Korean accent	L	H/R	H/R	H

The fact that Middle Chinese Entering tone exclusively appears with an H tone in Sino-Korean means that if a Sino-Korean morpheme ends with a coda -p/-l/-k, then the accent is automatically H. On the other hand, if a Sino-Korean morpheme ends with a coda -m/-n/-ŋ/-Ø, then the accent is unpredictable and it may appear with either L, H, or R.

Disyllabic Sino-Korean words are composed of two Sino-Korean morphemes,  $\mu_1$  and  $\mu_2$ . In MK, the accent pattern of disyllabic Sino-Korean words is predictable based on the individual accents of  $\mu_1$  and  $\mu_2$  as a rule (Ito 1999: 111). Table 16 shows the accent formation rules. If the accents of both  $\mu_1$  and  $\mu_2$  are L, then the accent of  $\mu_1\mu_2$  is LL, whereas if the accent of  $\mu_1$  is L and the accent of  $\mu_2$  is either H or R, then the accent of  $\mu_1\mu_2$  is LH. When the accent of  $\mu_1$  is H,  $\mu_1\mu_2$  appears with HX, regardless of the accent of  $\mu_2$ . Similarly, when the accent of  $\mu_1$  is R, the accent of  $\mu_1\mu_2$  is RX.

<sup>4</sup> Based on Mineya (1972: 282, 1976: 117). See also Hirayama (1967: 146–148) for the phonological analysis of Middle Chinese vocalism.

<sup>5</sup> For simplicity, we assume that MK falling diphthongs (Vj) belong to the nucleus here.

Table 16. Accent formation rules in Sino-Korean disyllabic words

$\mu_1$	L	L	H	R
$\mu_2$	L	H/R	L/H/R	L/H/R
$\mu_1\mu_2$	LL	LH	HX	RX

Yet, there is one problem in assuming these accent formation rules: in actuality, the tones of not a few Sino-Korean words in MK texts are transcribed as the juxtaposition of the underlying tones of both  $\mu_1$  and  $\mu_2$ , such as LR, RL, RR, HH, HR. Although this may be a normalized/artificial transcription that tries to be faithful to the underlying accent of each morpheme, it is possible that unlike native simplex nouns, Sino-Korean disyllabic words were pronounced by just concatenating the underlying accents of  $\mu_1$  and  $\mu_2$ . We examine this problem in 4.3 below. For now, we assume that the accent formation rules in Table 16 are valid.

In MK texts, Sino-Korean words were frequently written only with Chinese characters or as the juxtaposition of each Sino-Korean morpheme following the corresponding Chinese characters: e.g. 世 :세 [sjǿj] 尊 존 [còn], 佛 ·불 [púl] 法 ·법 [pǒp]. In the latter case, the accent patterns do not reflect the accent formation rules mentioned above. Thus, the accents of Sino-Korean disyllabic words ( $\mu_1\mu_2$ ) are not necessarily attested, but the accents of the constituent morphemes ( $\mu_1$  and  $\mu_2$ ) are largely attested. Given this and the fact that the attested Sino-Korean words in MK are largely obsolete in contemporary Korean, in this paper we discuss the historical development of disyllabic Sino-Korean words by reconstructing the accents of disyllabic Sino-Korean words, based on the accent formation rules in Table 16 and the attested accent of each Sino-Korean morpheme. See 4.2 for the details of the reconstruction.

In sum, the accent of Sino-Korean morphemes in MK is correlated with the coda types (-p/-l/-k  $\rightarrow$  H vs. -m/-n/-ŋ/-Ø  $\rightarrow$  L/H/R), reflecting the phonotactics in the source language (Middle Chinese). The accent of disyllabic Sino-Korean words in MK is determined by the combination of the underlying accent of the constituent morphemes.

## 4. Correspondences between MK and South Kyengsang

### 4.1. Monosyllabic nouns

As mentioned above, MK monosyllabic nouns had three accent classes: H, L, and R. Table 17 shows the type frequency (number of lexemes) of each accent class of monosyllabic native nouns and Sino-Korean morphemes in MK based on the data from Ito (2007, 2013: 140). As can be seen, in native words, the H class is the largest (56%), whereas in Sino-Korean morphemes, the L class is the largest (40%), with a stronger bias in the former. Thus, the accent distribution was different between the two lexical classes not only in South Kyengsang but also in MK.

Table 17. Accent distribution (monosyllabic native nouns and Sino-Korean morphemes in MK)

Accent	H	L	R	Totals
Native	286 (56%)	132 (26%)	89 (18%)	507
Sino-Korean	1,327 (25%)	2,118 (40%)	1,876 (35%)	5,321

Table 18 shows the basic correspondences between MK and South Kyengsang in monosyllabic nouns. The accentual distinction between the MK H and L classes is merged to H in South Kyengsang due to a leftward accent shift (MK L(H) → South Kyengsang H(L), Ramsey 1978: 78–81; a monosyllabic suffix following an L/LL/LLL class stem appeared with an H tone as a rule in MK), and they are distinguished by the pitch patterns of the following suffix.<sup>6</sup> The MK R class corresponds with the South Kyengsang L(H) class. The rise tone of MK is faithfully retained in isolation forms of South Kyengsang L(H), but in inflected forms, the rise is decomposed to LH with the peak realized in the following syllable (Kenstowicz et al. 2007: 110).

Table 18. Basic correspondences between MK and South Kyengsang (monosyllabic nouns)

MK	H	L	R
South Kyengsang	H(H)	H(L)	L(H)

To what extent is the correspondence with MK accent regular in South Kyengsang? Also, given the different accent distributions between the two lexical classes in MK, do the corresponding patterns differ depending on each lexical class? We first see the actual correspondences between MK and South Kyengsang in native monosyllabic simplex nouns, aggregated across the five speakers in Table 19 (for the detailed discussion of the correspondences, see Do et al. to appear). The overall regularity rate is 77%, and among the three accent classes, the MK H class shows the highest regularity rate (83%), followed by L (70%) and R (65%). In the irregular correspondences, MK L → South Kyengsang H(H) and MK R → South Kyengsang H(H) are relatively frequent (24% and 23%, respectively). The correlation between analogical change and type frequency is discussed in previous literature (Bybee 1995, Albright 2009, and references cited), according to which higher type-frequency classes tend to attract words from lower type-frequency classes. The irregular correspondences observed in native nouns are assumed to be an analogical accent shift to the higher type-frequency class.

<sup>6</sup> Uwano (2012: 1436–1437) questions the hypothesis which assumes that MK represents the older accent system compared to Kyengsang. See Ito (2013: 170–173) for discussion of this problem.

Table 19. MK–South Kyengsang correspondences (monosyllabic native nouns)

MK \ Kyengsang	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
	H	720	90	55	865	83%	10%
L	81	239	22	342	24%	70%	6%
R	69	33	192	294	23%	11%	65%

Notes: Regular correspondences are shaded. The same representation is used in other correspondence tables below.

## (7) Examples of regular and irregular correspondences

- a. MK H: k\*ě ‘sesame’, t<sup>h</sup>š ‘site’, c<sup>h</sup>im ‘saliva’, nūn ‘eye’, pāl ‘foot’, s\*āl ‘rice’, pūs ‘writing brush’, p<sup>h</sup>ul ‘grass’, mōs ‘nail’, sát<sup>h</sup> ‘crotch’, pjōs ~ pjōs ‘cockscomb’, s\*āk ~ s\*āk ‘bud’, sūp<sup>h</sup> ~ sūp<sup>h</sup> ‘forest’, kül ‘oyster’, k\*il ~ k\*il ‘chisel’, hōm ~ hōm ‘groove’
- b. MK L: áp<sup>h</sup> ‘front’, súc<sup>h</sup> ‘charcoal’, mít<sup>h</sup> ‘bottom’, pák\* ‘outside’, mók ‘neck’, wí ‘upside’, kót<sup>h</sup> ‘surface’, kúk ‘soup’, c\*āk ‘pair’, mūt<sup>h</sup> ~ mūt<sup>h</sup> ‘land’, táč<sup>h</sup> ~ táč<sup>h</sup> ‘anchor’, píč ~ píč ‘debt’, cō ~ cō ‘millet’, t<sup>h</sup>é ~ t<sup>h</sup>é ‘frame’, mál ~ māl ‘horse’, t<sup>h</sup>əl ~ t<sup>h</sup>əl ‘fur’
- c. MK R: kě ‘crab’, ně ‘stream’, sūm ‘breath’, māl ‘language’, pāl ‘bee’, tōl ‘stone’, cōŋ ‘servant’, nūn ‘snow’, kōm ‘bear’, t\*ě ‘group’, p\*jām ~ p\*jām ‘the span of a hand’, mě ~ mé ‘hawk’, pāl ~ pāl ‘bamboo blind’, cās ~ cās ‘pine nuts’, sōk ~ sōk ~ sōk ‘inside’

Next, we see the correspondences between MK and South Kyengsang in Sino-Korean monosyllabic nouns (Table 20). Based on the segmental characteristics of MK H class words corresponding to the Middle Chinese Entering tone, we examine Sino-Korean words with a coda -p/-l/-k as a separate accent class (E class). Other Sino-Korean words with an MK H tone that end with a coda -m/-n/-ŋ/-∅ are simply designated as the H class. On average, the regularity rate in monosyllabic Sino-Korean words is 73%. The MK E class regularly corresponds with South Kyengsang H(H) (95%) due to the strong correlation between the segmental shape and the H tone (Island of Reliability, Albright 2002). Compared to the E class, the MK H class shows a much lower regularity rate (53%). Excluding the E class, the overall regularity rate of Sino-Korean monosyllabic nouns goes down to 65%. On the other hand, the MK R class shows a relatively high regularity (72%), which is higher than the MK L class (63%) in spite of the fact that the type frequency of the MK R class was smaller than that of the MK L class, as mentioned above. In fact, many irregular correspondences are observed in MK L → South Kyengsang L(H) (23%) and MK H → South Kyengsang L(H) (27%) correspondences. Thus, unlike native nouns, the analogical changes to a higher type-frequency class (MK L, South Kyengsang H(L)) are not clearly observed in Sino-Korean words. Rather, the irregular patterns suggest that in South Kyengsang Sino-Korean monosyllabic nouns, L(H) (= MK R) is the default accent class, attracting the words from other accent classes.

Table 20. MK-South Kyongsang correspondences (monosyllabic Sino-Korean nouns)

MK \ Kyongsang	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
	E	385	7	13	405	95%	2%
H	82	30	42	154	53%	19%	27%
L	82	367	133	582	14%	63%	23%
R	49	74	316	439	11%	17%	72%

## (8) Examples of regular correspondences

- MK E: kíp 級 ‘class’, hák 鶴 ‘crane’, cíl 質 ‘quality’, ják 藥 ‘medicine’
- MK H: cǎn 盞 ‘cup’, p<sup>h</sup>jǒ 標 ‘mark’, kí 氣 ‘spirits’, p<sup>h</sup>ǎn 板 ‘board’
- MK L: wáj 王 ‘king’, kím 金 ‘gold’, hjǒŋ 兄 ‘older brother’, sán 山 ‘mountain’
- MK R: kǎm 感 ‘feeling’, mjǒ 墓 ‘grave’, cwě 罪 ‘guilt’, sě 貰 ‘rent’

In actuality, even excluding the MK E class, correspondences differ depending on the coda type. Table 21 compares the correspondences for  $-\emptyset$  and nasal codas. For the MK H and L classes, the regularity rate is lower when the coda is a nasal, in which case many words appear with South Kyongsang L(H): for the MK H class with a nasal coda, 34 of the 46 (= 12+34) irregulars appear as L(H); for the MK L class with a nasal coda, 124 of the 173 (= 49+124) irregulars appear as L(H).

Table 21. MK-South Kyongsang correspondences based on coda type (monosyllabic Sino-Korean nouns)

MK accent	Coda	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
H	$\emptyset$	44	18	8	70	63%	26%	11%
	m, n, ŋ	38	12	34	84	45%	14%	40%
L	$\emptyset$	33	88	9	130	25%	68%	7%
	m, n, ŋ	49	279	124	452	11%	62%	27%
R	$\emptyset$	31	46	153	230	13%	20%	67%
	m, n, ŋ	18	28	163	209	9%	13%	78%

(9) Examples. ( $-\emptyset$ ) = coda  $-\emptyset$ , (-nasal) = nasal coda.

- MK H ( $-\emptyset$ ): sū ~ sú 秀 ‘excellent’, wí ~ wí 胃 ‘stomach’, c<sup>h</sup>ó ~ c<sup>h</sup>ó 楚 ‘Chu of China’
- MK H (-nasal): sǎŋ 相 ‘look’, mǎŋ ~ mǎŋ 網 ‘net’, kwǎn ~ kwǎn 管 ‘pipe’, jǎŋ 量 ‘quantity’, c<sup>h</sup>ǎŋ ~ c<sup>h</sup>ǎŋ 請 ‘request’
- MK L ( $-\emptyset$ ): wé 倭 ‘Japan’, sé 西 ‘west’, hǒ ~ hǒ 虛 ‘weak point’, kí 旗 ‘flag’
- MK L (-nasal): hjǎŋ 香 ‘perfume’, jǎŋ 零 ‘zero’, c<sup>h</sup>ǒn ~ c<sup>h</sup>ǒn 村 ‘village’, jǎŋ ~ jǎŋ 羊 ‘sheep’, jǎŋ 緣 ‘pratyaya’, pjǎŋ 邊 ‘side’

- e. MK R (-Ø): i 二 ‘two’, ĩj 義 ‘justice’, hwá ~ hwǎ 火 ‘anger’, jě ~ jě 例 ‘example’  
 f. MK R (-nasal): ün 運 ‘fortune’, jǒŋ 勇 ‘courage’, sǎn ~ sǎn 善 ‘good’, c<sup>h</sup>ǎŋ ~ c<sup>h</sup>ǎŋ 唱 ‘chant’

If we focus on the irregular changes from the MK H and L classes to the South Kyengsang L(H) or non-L(H) classes, the irregular change to L(H) is over-represented when the coda is nasal.

Table 22. Irregular changes from the MK H and L classes to the South Kyengsang accent classes (monosyllabic Sino-Korean nouns) [ $\chi^2 = 46.51$ ,  $df = 1$ ,  $p < .001$ .]

coda \ accent	accent			L(H)	
	Non-L(H)	L(H)	Totals	Non-L(H)	L(H)
Ø	51	17	68	<b>1.92</b>	<b>0.41</b>
m, n, ŋ	61	158	219	<b>0.71</b>	<b>1.18</b>

Does the association between nasal (sonorant) codas and the South Kyengsang L(H) class originate from MK? As can be seen in Table 23 below, this is not true: Sino-Korean morphemes with a nasal coda were over-represented with the L class (= South Kyengsang H(L) class), whereas they were not over-represented with the R class (= South Kyengsang L(H) class).

Table 23. Accent and coda type (MK Sino-Korean morphemes) [ $\chi^2 = 62.65$ ,  $df = 2$ ,  $p < .001$ .]

coda \ accent	accent				L(H)		
	H	L	R	Totals	H	L	R
Ø	294	1,065	1,075	2,434	<b>1.27</b>	<b>0.91</b>	1.04
m, n, ŋ	122	1,036	783	1,941	<b>0.66</b>	<b>1.11</b>	0.95

In actuality, even in South Kyengsang monosyllabic Sino-Korean words, the correlation between a nasal coda and the L(H) class (= MK R class) is not statistically significant (Table 24). However, it is at least over-represented in South Kyengsang, unlike in MK where the same association was under-represented.

Table 24. Accent and coda type (monosyllabic Sino-Korean nouns in South Kyengsang) [ $\chi^2 = 20.47$ ,  $df = 2$ ,  $p < .001$ .]

coda \ accent	accent				L(H)		
	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
Ø	134	180	188	502	<b>1.31</b>	0.93	0.91
m, n, ŋ	134	326	357	817	<b>0.81</b>	1.04	1.06

Thus, the irregular changes in South Kyengsang (nasal codas → L(H)) are assumed to be an emergent pattern. As shown above (Table 13), a correlation



between sonorant codas and L(H) is also observed in South Kyengsang native monosyllabic nouns. The same correlation existed in MK native words as well. F0 rise and sonorant codas are a phonetically natural association, since sonorants can carry F0 pitch distinctions, which are difficult if not impossible to detect in obstruents. It is assumed that the same association is analogically extended in the Sino-Korean morphemes. The fact that in the exceptional correspondences for the MK E class, the words that moved to South Kyengsang L(H) end with a coda -l is explained in the same way: e.g. *kjül* 橋 ‘mandarin’, *kül* 窟 ‘cave’.

In MK, Sino-Korean words with a coda -Ø are over-represented in the H class (i.e. the corresponding observed/expected ratio is 1.27 in Table 23). This association is carried over to South Kyengsang, explaining the over-representation of H(H) in the Sino-Korean words with a coda -Ø (1.31).

To summarize, in Sino-Korean monosyllabic words, a simple analogical change based solely on the size of the accent class is not clearly observed. This is probably because they do not have a strongly predominant accent class, unlike native words. Rather, local generalizations either induced from the patterns observed in the lexicon with higher type frequency (Entering tone codas ≈ H(H)) or motivated as a phonetically natural association (sonorant codas ≈ L(H)) play a crucial role in determining the accent. Note that these local generalizations can affect the historical development even when a type-frequency effect is observed. See Do et al. (to appear) and Do and Kenstowicz (2013) for the relevant analyses of South Kyengsang native monosyllabic nouns.

How about the onset types? As seen in Table 25, when the onset is an aspirate, the H class is over-represented in MK. As mentioned above, the Middle Chinese Rising tone (= high rise) and Departing tone (= rise) were adapted as either H or R in Sino-Korean. It is assumed that the Sino-Korean morphemes with an aspirate onset were adapted with H more than with R, because the low portion of the Middle Chinese rise tones was not perceived saliently by Korean speakers due to the long VOT of aspirates. On the other hand, fricatives (/s/, /h/) show tendencies similar to lax/sonorant onsets.

Table 25. Accent and onset type (MK Sino-Korean morphemes) [ $\chi^2 = 21.87$ ,  $df = 4$ ,  $p < .001$ .]<sup>7</sup>

onset \ accent	accent			Totals	accent		
	H	L	R		H	L	R
Aspirate	214	252	205	671	<b>1.28</b>	0.94	<b>0.87</b>
Fricative	253	404	378	1,035	0.98	0.98	1.04
Lax, sonorant	819	1,404	1,239	3,462	0.95	1.02	1.02

Given this, we expect Sino-Korean morphemes to show different regularity rates depending on onset type. In fact, as seen in Table 26, the regularity rate of the

<sup>7</sup> Onset /z/ is included in lax/sonorant. Sino-Korean morphemes with onset variation are excluded.

MK H class is higher when the onset is an aspirate vs. a lax/sonorant onset (76% vs. 42%). The MK H class with a lax/sonorant onset shows more irregular changes to South Kyengsang L(H) than an aspirate onset (39% vs. 9%). Similar deviations are observed in the MK L and R classes as well. Also interestingly, fricatives prefer the H(L) class, and they seem not to pattern with lax/sonorant onsets as in MK. The association between an aspirate, tense, fricative onset and an H tone is observed in Seoul and Kyengsang Korean in general (Cho et al. 2002, Silva 2006, Kim et al. 2002, Kenstowicz and Park 2006, Lee and Jongman 2012, and others). The accent distribution in South Kyengsang Sino-Korean nouns shown here is explained as a phonetically motivated one.

Table 26. MK-South Kyengsang correspondences based on onset type (monosyllabic Sino-Korean nouns)<sup>8</sup>

MK accent	Onset	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
H	Aspirate	25	5	3	33	76%	15%	9%
	Fricative	18	8	6	32	56%	25%	19%
	Lax, sonorant	33	15	31	79	42%	19%	39%
L	Aspirate	24	55	18	97	25%	57%	19%
	Fricative	22	95	14	131	17%	73%	11%
	Lax, sonorant	34	211	101	346	10%	61%	29%
R	Aspirate	13	8	21	42	31%	19%	50%
	Fricative	17	32	67	116	15%	28%	58%
	Lax, sonorant	19	32	228	279	7%	11%	82%

Table 27 summarizes the correlation between onset type and accent class in South Kyengsang. An aspirate onset is significantly over-represented in H(H), and a fricative onset is significantly over-represented in H(L). On the other hand, a lax/sonorant onset is significantly over-represented in L(H).

Table 27. Accent and onset type (monosyllabic Sino-Korean nouns in South Kyengsang) [ $\chi^2 = 84.56$ ,  $df = 4$ ,  $p < .001$ .]

onset \ accent	H(H)	H(L)	L(H)	Totals	H(H)	H(L)	L(H)
	Aspirate	150	81	42	273	<b>1.45</b>	1.01
Fricative	111	138	92	341	0.86	<b>1.37</b>	0.83
Lax, sonorant	385	283	422	1,090	0.93	<b>0.88</b>	<b>1.19</b>

In order to assess the joint roles of the onset and coda types in the Sino-Korean accentuations in MK discussed so far, we ran a log-linear model using the glm function in R (R Development Core Team 2011). Coda type (Entering tone

<sup>8</sup> The small number of examples with a tense onset are excluded.

codas (-p/-l/-k), nasal codas (-m/-n/-ŋ), Ø) as well as the laryngeal category of the onset consonant (aspirate, fricative, lax/sonorant) were the predictor variables, and accent class (H, L, R) was the dependent variable. The baseline was set to the R class, a lax/sonorant onset, and a nasal coda. Table 28 shows the result. For example, the third row (H class: Coda-Ø) indicates the effect of a coda -Ø for the distribution of the H class compared to the baseline R class. As can be seen, a coda -Ø, an Entering tone coda and an aspirate onset have a significant positive effect on the H class. Fricatives do not have a statistically significant association with the H class. On the other hand, a coda -Ø shows a significant negative effect on the L class.

Table 28. Results of a log-linear model (Sino-Korean morphemes in MK)

		Estimate	Std. Error	z value	Pr(> z )	
(Intercept)		6.24861	0.03968	157.469	< 2e-16	***
H class:	Coda-Ø	0.57533	0.12052	4.774	1.81e-06	***
	Coda-Entering	8.67303	1.00555	8.625	< 2e-16	***
	Onset-Aspirate	0.45786	0.10820	4.232	2.32e-05	***
	Onset-Fricative	0.00275	0.09314	0.030	0.976	
L class:	Coda-Ø	-0.27995	0.06501	-4.306	1.66e-05	***
	Coda-Entering	-0.27612	1.41503	-0.195	0.845	
	Onset-Aspirate	0.08393	0.10246	0.819	0.413	
	Onset-Fricative	-0.05609	0.08160	-0.687	0.492	

Signif. codes: '\*\*\*' 0.001, '\*\*' 0.01, '\*' 0.05, '.' 0.1.

Notes: Predictor variables = coda type, the laryngeal category of the onset consonant; dependent variable = accent class; baseline = the R class, a lax/sonorant onset, a nasal coda.

For purposes of comparison with the MK data, we also ran a mixed effects log-linear model using the lmer function from the lme4 package (Bates et al. 2013) in R for our South-Kyengsang data. A random intercept was set for item and subject. Coda type (Entering tone codas (-p/-l/-k), nasal codas (-m/-n/-ŋ), Ø) as well as the laryngeal category of the onset consonant (aspirate, fricative, lax/sonorant) were the predictor variables, and accent class (H(H), H(L), L(H)) was the dependent variable. The baseline was set to the L(H) class, a lax/sonorant onset, and a nasal coda. For detailed information on mixed effects log-linear models, see Baayen (2008: Chapter 7). Table 29 shows the result. A coda -Ø and an Entering tone coda have a significant positive effect on the H(H) class, whereas an aspirate and fricative onset have a significant positive effect on the H tones (H(H) or H(L) classes). Note that in this model, an aspirate onset has a significant positive effect on not only H(H) but also H(L), which is a result compared with the baseline L(H) class. The association with an H tone was originally observed just with an aspirate onset in MK, but in South Kyengsang, the association has been extended to fricatives as well. The association between an aspirate/fricative onset and the

South Kyengsang H(L) class is important, since it corresponds with the MK L class. This is thus a new association, reflecting the fact that the H tone is in the stem due to sound change from the MK-type accent system.

Table 29. Results of a mixed effects log-linear model (monosyllabic Sino-Korean nouns in South Kyengsang)

	Estimate	Std. Error	z value	Pr(> z )	
(Intercept)	-2.00582	0.06845	-29.301	< 2e-16	***
H(H) class: Coda-Ø	0.60078	0.15347	3.915	9.05e-05	***
Coda-Entering	4.37654	0.30025	14.576	< 2e-16	***
Onset-Aspirate	1.36021	0.18820	7.227	4.92e-13	***
Onset-Fricative	0.27795	0.15760	1.764	0.0778	.
H(L) class: Coda-Ø	0.05572	0.13029	0.428	0.6689	
Coda-Entering	-0.62858	0.49443	-1.271	0.2036	
Onset-Aspirate	1.04904	0.20520	5.112	3.18e-07	***
Onset-Fricative	0.80221	0.15512	5.172	2.32e-07	***

Signif. codes: ‘\*\*\*’ 0.001, ‘\*\*’ 0.01, ‘\*’ 0.05, ‘.’ 0.1.

Notes: Predictor variables = coda type, the laryngeal category of the onset consonant; dependent variable = accent class; random intercept = item, subject; baseline = the L(H) class, a lax/sonorant onset, a nasal coda.

Also, the fact that an aspirate onset is associated with H(H) and H(L) whereas a fricative onset is associated with only H(L) (not with H(H)) suggests that the correlation between these onsets and an H tone is based not on the phonological H tone but on the actual phonetic realizations: an H tone of the H(H) class in inflected forms is phonetically realized as a mid-tone, while an H tone of the H(L) class in inflected forms is realized as a high tone due to a boosting effect by a following low tone (Kenstowicz and Park 2006: 258–259).

In sum, the accent of Sino-Korean nouns regularly corresponds between MK and South Kyengsang, and various exceptions are explained by analogical changes due to the segmental shapes that characterize each accent class. Some correlations already existed in MK (an Entering tone coda  $\approx$  H class, an aspirate onset  $\approx$  H class), while others were not evidently observed in MK (an aspirate onset  $\approx$  L class, a fricative onset  $\approx$  L class, a nasal coda  $\approx$  R class). The latter correlations in South Kyengsang have emerged due to phonetic motivation and help to explain the deviations from the expected historical correspondences. Unlike native nouns, the type-frequency effect is not clearly observed in monosyllabic Sino-Korean words.

#### 4.2. Disyllabic nouns

In 4.2, we examine the historical development of disyllabic native and Sino-Korean nouns. Table 30 shows the accent distribution of disyllabic native simplex nouns in MK (Ito 2013: 152). As can be seen, in native nouns, LH is the predominant accent class (54%), followed by LL (27%).

Table 30. Accent distribution of disyllabic native simplex nouns (MK)

HX	LH	LL	RX	Totals
97 (13%)	417 (54%)	206 (27%)	55 (7%)	775

MK accent in disyllabic nouns corresponds with South-Kyongsang accent as in Table 31. A leftward accent shift (retraction) took place in the Kyongsang dialect from the MK-type accent system, as in monosyllabic words (Ramsey 1978: 78–81): MK LH → Kyongsang HL, MK LL(H) → Kyongsang LH(L). Kenstowicz et al. (2007: 107–108) propose that the Kyongsang accent system evolved from MK by a push chain shift: LL > LH > HL > HH. See Ito (2013: 183–185) for an alternative hypothesis on the Kyongsang accent shift.

Table 31. Basic correspondences between MK and South Kyongsang (disyllabic nouns)

MK	HX	LH	LL	RX
South Kyongsang	HH	HL	LH(L)	LH(H)

Table 32 shows the actual correspondences between MK and South Kyongsang in native disyllabic simplex nouns (Do et al. to appear). The overall regularity rate is 68%. Among the four accent classes, the MK LH class shows the highest regularity rate (71%), followed by LL (67%) and RX (66%). The regularity rate of the MK HX class is quite low (56%), but the lower regularity rate for this specific accent class seems to be found in other dialects as well (Ito 2013: 165–166). Among the irregular correspondences, MK HX → South Kyongsang HL and MK LL → South Kyongsang HL are relatively frequent (both 16%), suggesting an analogical accent shift to the higher type-frequency class, as in monosyllabic native nouns. For MK HX, exceptions are frequently found in the LH(L) class as well (18%), but this may be due to several words whose accent in the pre-Kyongsang stage could have been different from the accent attested in MK (Ito 2013: 165–166). The MK RX class irregularly corresponds with South Kyongsang LH(L) more frequently than with South Kyongsang HL (23% vs. 5%). This is probably due to their identical isolation forms: both LH(H) and LH(L) appear with LH in isolation, and hence many accent changes between these two classes are observed (Base-Identity, Kenstowicz 1996).

Table 32. MK–South Kyongsang correspondences (disyllabic native simplex nouns)

MK \ Kyongsang	Kyongsang				Totals	Kyongsang			
	HH	HL	LH(L)	LH(H)		HH	HL	LH(L)	LH(H)
HX	166	47	54	27	294	56%	16%	18%	9%
LH	89	779	156	74	1,098	8%	71%	14%	7%
LL	39	76	326	42	483	8%	16%	67%	9%
RX	11	8	37	107	163	7%	5%	23%	66%

## (10) Examples of regular and irregular correspondences

- a. MK HX: cán.c<sup>h</sup>í ‘party’, cán.sá ‘trade’, p<sup>h</sup>á.rí ‘fly’, sí.kól ‘countryside’, s<sup>\*</sup>íl.ké ‘gallbladder’, c<sup>h</sup>ó.im ‘beginning’, k<sup>\*</sup>í.ní ~ k<sup>\*</sup>í.ni ‘meal’, kó.ni ‘swan’, pó.rám ~ po.rám ‘worth’, í.rí ~ i.rí ‘wolf’, pú.á ~ pu.á ‘lungs’
- b. MK LH: í.sil ‘dew’, páŋ.ul ‘bell’, k<sup>\*</sup>ó.ri ‘tail’, há.nil ‘sky’, cá.ri ‘seat’; mǝŋ.é ~ mǝŋ.e ‘yoke’, ku.jú ‘feedbox’, k<sup>\*</sup>wá.ri ~ k<sup>\*</sup>wa.rí ‘ground cherry’, o.kím ~ o.kim ‘the crook of the knee’
- c. MK LL: ta.rák ‘loft’, ka.íl ‘autumn’, ki.túnj ‘pillar’, ca.rú ‘sack’, co.ké ‘shellfish’, p<sup>h</sup>úl.mú ‘bellows’, nú.i ‘sister’, k<sup>\*</sup>áp.cil ‘peel’, pi.njǝ ~ pi.njǝ ‘hairpin’, pu.ré ~ pu.ré ‘air bladder’
- d. MK RX: kǝ.cís ‘lie’, si.ně ‘brook’, soŋ.kós ‘gimlet’, im.cá ‘master’, so.kjǝŋ ‘blind person’, k<sup>\*</sup>ác<sup>h</sup>í ~ k<sup>\*</sup>a.c<sup>h</sup>í ~ k<sup>\*</sup>a.c<sup>h</sup>í ‘magpie’, kál.kí ~ kál.ki ‘mane’, mu.tǝŋ ~ mu.tǝŋ ‘shaman’, ke.cíp ~ ke.cíp ‘woman’, pú.c<sup>h</sup>ú ~ pu.c<sup>h</sup>ú ‘Korean leek’

Do Sino-Korean words show the same tendency? Tables 33 and 34 show the correspondences between MK and South Kyengsang Sino-Korean disyllabic nouns. The words whose MK accent had distinctive variations (e.g. HX~RX, LH~LL) are excluded in these tables. The data of Table 33 is based on only the attested MK data (627 words), whereas that of Table 34 is based on the data reconstructed by the accent formation rules mentioned in Table 16 (7,991 words). In the reconstructed data, 89% of our whole corpus is covered (= 7,991/9,012). The MK HX class is divided into two subclasses: EX for the words with the codas -p/-l/-k in  $\mu_1$  and HX for the words with other codas in  $\mu_1$ . Note that due to accentual variation by our South Kyengsang speaker, the total number of data points are different from the number of words.

Table 33. MK–South Kyengsang correspondences (disyllabic Sino-Korean nouns, attested data)

MK \ Kyengsang	Kyengsang				Totals	HH	HL	LH(L)	LH(H)
	HH	HL	LH(L)	LH(H)					
EX	79	1	0	0	80	99%	1%	0%	0%
HX	49	4	3	3	59	83%	7%	5%	5%
LH	17	91	35	48	191	9%	48%	18%	25%
LL	13	11	86	52	162	8%	7%	53%	32%
RX	4	23	31	147	205	2%	11%	15%	72%

Table 34. MK–South Kyengsang correspondences (disyllabic Sino-Korean nouns, reconstructed data)

MK \ Kyengsang	Kyengsang				Totals	HH	HL	LH(L)	LH(H)
	HH	HL	LH(L)	LH(H)					
EX	1,883	11	6	9	1,909	99%	1%	0%	0%
HX	442	67	24	57	590	75%	11%	4%	10%
LH	187	953	321	656	2,117	9%	45%	15%	31%
LL	85	118	470	361	1,034	8%	11%	45%	35%
RX	143	384	417	2,113	3,057	5%	13%	14%	69%

The distributional patterns are similar between Tables 33 and 34. Figure 3 shows the correlations between the reconstructed and attested data based on the ratios of each accent class in South Kyongsang. A linear regression analysis with attested data as a dependent variable and reconstructed data as an independent variable shows a highly significant result (estimate = 1.05850, std. error = 0.02825, t-value = 37.475,  $p < .001$ ). Given this, it is safe to examine the historical change based on the reconstructed data, which is a corpus 13 times larger than the attested data.<sup>9</sup>

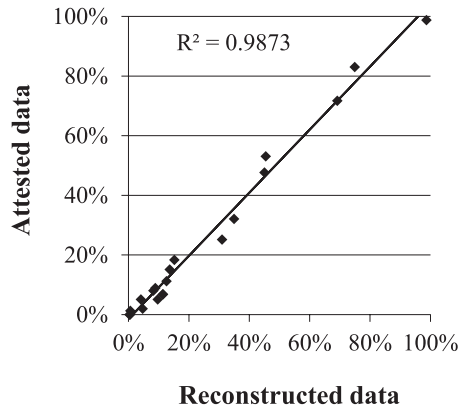


Figure 3. The correlation between the attested data and the reconstructed data

Based on Table 34, the overall regularity rate of Sino-Korean words is 67%, which is comparable to that of native nouns (68%). The MK EX class corresponds with South Kyongsang HH quite regularly (99%), again due to the strong correlation between segmental shape and accent class (MK HX, South Kyongsang HH). Excluding this class, the average regularity rate falls to 59%. Still, the basic correspondence between MK and South Kyongsang is confirmed in Sino-Korean as well, supporting the hypothesis that the Kyongsang accent shift took place after Sino-Korean vocabulary was introduced into Korean (Ito 1999: 134–136, 2013: 172–173).

Except for the EX class, the MK HX and RX classes show relatively high regularity rates (75% and 69%), compared with the LH and LL classes (both 45%). Is this because the HX and RX classes were larger classes in MK? Based on the reconstructed accent of the Sino-Korean words used by our South Kyongsang speaker, we can assume the accent distribution of disyllabic Sino-Korean words in MK as follows: EX = 1,903 (24%), HX = 558 (7%), LH = 1,907 (24%), LL = 891

<sup>9</sup> One problem with this reconstruction is that some Sino-Korean words are not inherited from MK directly but are loanwords from Japanese, such as J. *setai* 世帯 ‘household’ → K. *se.te*. However, it is not necessarily easy to distinguish which words are genuinely inherited from MK and which words are not. It is considered that this factor in fact affects some regular/irregular correspondences in the accent of Sino-Korean words in South Kyongsang (see 4.3).

(11%), RX = 2,732 (34%). Unlike native nouns, where LH was the largest class (54%), the RX and HX (= EX + HX) classes are in fact predominant in Sino-Korean nouns (34% and 31%). Thus, disyllabic native nouns and Sino-Korean nouns show contrastive distributions in the relative size of each accent class: the RX and HX classes are the larger classes in Sino-Korean, which are smaller classes in native nouns. The relatively higher regularity rates of the MK HX and RX classes may be due to their higher type frequency. Still, given that most HX/HH words have codas -p/-l/-k for  $\mu_1$  in both MK and South Kyengsang (1,903 words out of 2,461 in MK and 1,963 words out of 2,985 in South Kyengsang), we can assume that RX/LH(H) is the default accent class in Sino-Korean when the coda of  $\mu_1$  is not -p/-l/-k. This is a different trend from native simplex nouns, where the MK LH class shows the highest regularity rate.

### 4.3. Sino-Korean disyllabic nouns: Internal structure

In actuality, the accent of each component of disyllabic Sino-Korean nouns affects the accent patterns. Table 35 shows the correspondences between MK and South Kyengsang, taking into account the underlying accents of each Sino-Korean morpheme in MK.

Table 35. MK–South Kyengsang correspondences (disyllabic Sino-Korean nouns, classified based on the underlying accents of each Sino-Korean morpheme in MK)<sup>10</sup>

MK \ Kyengsang		Kyengsang				Totals	Kyengsang			
		HH	HL	LH(L)	LH(H)		HH	HL	LH(L)	LH(H)
EX	E+E	429	4	0	2	435	99%	1%	0%	0%
	E+H	162	1	0	0	163	99%	1%	0%	0%
	E+R	618	3	0	3	624	99%	0%	0%	0%
	E+L	485	2	4	3	494	98%	0%	1%	1%
HX	H+E	101	29	0	7	137	74%	21%	0%	5%
	H+H	46	5	4	10	65	71%	8%	6%	15%
	H+R	125	15	8	24	172	73%	9%	5%	14%
	H+L	122	10	8	11	151	81%	7%	5%	7%
LH	L+E	63	510	3	176	752	8%	68%	0%	23%
	L+H	26	106	46	89	267	10%	40%	17%	33%
	L+R	86	279	240	352	957	9%	29%	25%	37%
LL	L+L	85	118	470	361	1,034	8%	11%	45%	35%
RX	R+E	33	185	6	471	695	5%	27%	1%	68%
	R+H	12	23	30	180	245	5%	9%	12%	73%
	R+R	48	100	160	685	993	5%	10%	16%	69%
	R+L	40	34	177	565	816	5%	4%	22%	69%

<sup>10</sup>The numbers in Table 35 do not completely agree with those in Table 34, since Table 34 contains the words whose MK accent is reconstructed even though the underlying tone of  $\mu_2$  is unknown or variable, based on the accent formation rules in Table 16: e.g. R+? ( $\mu_2$  accent unknown) → RX class, L+R/H ( $\mu_2$  accent have variation) → LH class.



## (11) Examples of regular and irregular correspondences

- a. MK EX: ják.sók 約束 ‘promise’ (E+E), cáp.chó 雜草 ‘weeds’ (E+H), ák.móŋ 惡夢 ‘bad dream’ (E+R), púk.só 北西 ‘northwest’ (E+L); kók.sik 穀食 ‘cereals’ (E+E), káp.p<sup>h</sup>an 甲板 ‘deck’ (E+H), ul.pún 鬱憤 ‘resentment’ (E+R), c<sup>h</sup>ek.cán 冊張 ‘pages’ (E+L)
- b. MK HX: sú.áp 水壓 ‘water pressure’ (H+E), p<sup>h</sup>jó.cí 表紙 ‘cover’ (H+H), sú.mjóŋ 壽命 ‘life span’ (H+R), pón.ká 本家 ‘main family’ (H+L); kí.ip 記入 ‘entry’ (H+E), cú.pu 主婦 ‘housewife’ (H+H), co.mó 祖母 ‘grandmother’ (H+R), ko.ǝn 苦言 ‘bitter counsel’ (H+L)
- c. MK LH: jáŋ.sik 糧食 ‘food’ (L+E), wán.ca 王子 ‘prince’ (L+H), ín.he 恩惠 ‘favours’ (L+R); sǝŋ.pjǝk 城壁 ‘castle wall’ (L+E), ho.kí 豪氣 ‘heroic temper’ (L+H), nwe.ǔ 雷雨 ‘thunderstorm’ (L+R)
- d. MK LL: jaŋ.p<sup>h</sup>i 羊皮 ‘sheepskin’ (L+L), waŋ.pí 王妃 ‘queen’ (L+L), c<sup>h</sup>aŋ.mún 窓門 ‘window’ (L+L); ó.pu 漁夫 ‘fisherman’ (L+L), joŋ.mó 容貌 ‘appearance’ (L+L)
- e. MK RX: i.wǎl 二月 ‘February’ (R+E), ha.wí 下位 ‘low rank’ (R+H), ce.sá 祭祀 ‘religious service’ (R+R), tɛ.mún 大門 ‘gate’ (R+L); héŋ.sil 行實 ‘behavior’ (R+E), íj.ca 椅子 ‘chair’ (R+H), kí.jé 技藝 ‘arts’ (R+R), sa.hjǎŋ 麝香 ‘musk’ (R+L)

In all the combinations except for L+R, the regular correspondences are the most frequent, suggesting that the accent formation rule in Table 16 is basically valid.<sup>11</sup>

Still, when  $\mu_1$  is the H class, 71–81% of words regularly correspond with South Kyengsang HH, but an irregular development to South Kyengsang HL is frequently observed when  $\mu_2$  is from the E class (21%). Similarly, irregular development from MK RX to South Kyengsang HL is most frequent when  $\mu_2$  is from the E class (27%). Interestingly, the analogical change from the MK RX class to South Kyengsang LH(L) due to Base-Identity is not much observed in R+E (1%). The MK LH class shows the same asymmetry: the regularity rate (MK LH → South Kyengsang HL) is much higher in L+E (68%) than in L+H and L+R (40% and 29%), and the exceptional change to LH(L) is virtually zero in L+E.

As mentioned above, Sino-Korean morphemes with a coda -p/-l/-k (= E class) had a strong correlation with the H tone in MK, and the confidence of this cor-

<sup>11</sup>In MK native compound nouns, the R class could appear in non-word-initial position if it followed the L class. Hence the opposition between LH and LR was observed in native compound words. Given this, the apparent different patterns between L+H and L+R in South Kyengsang Sino-Korean nouns may suggest that at least these two constructions were differentiated in MK. However in native compounds, L+R corresponds with South Kyengsang HL, which is the same correspondence as L+H and LH (e.g. *mók.sum* < *mòk.sùm* ‘life’, *já.sum* < *jà.sjǔjn* ‘sixty’, He 1955: 182). It is unlikely that sound changes occurred differently depending on the lexical class. Thus the relatively high ratio of the irregular change (MK L+R → South Kyengsang LH(H), 37%) is assumed to be accidental, probably the result of an analogical change to the higher type-frequency class. See Sugiyama (2013) for relevant discussion.

relation is almost 100%. Therefore, even if speakers do not know the accent of each Sino-Korean morpheme, they could at least guess the accent of the E class with perfect reliability (Island of Reliability). Suppose that MK speakers had no knowledge of the Sino-Korean accents but only knew that the E class has the H tone, as well as the Sino-Korean accent formation rules in Table 16. Speakers would have had to assign some accent pattern to a disyllabic Sino-Korean noun based on this restricted information. Table 36 describes the emergent accent assignment in this situation.

Table 36. Emergent accent assignment in Sino-Korean disyllabic nouns (MK)

	$\mu_1$	$\mu_2$	Possible accents	Assumed major patterns
a	E class	E class	HX	HX
b	E class	?	HX	HX
c	?	E class	HX, RX, LH	RX, LH
d	?	?	HX, RX, LH, LL	RX

When  $\mu_1$  was in the E class (a and b), speakers could assign HX with a perfect reliability, whereas when neither  $\mu_1$  nor  $\mu_2$  were in the E class (d), there were theoretically four possibilities (HX, RX, LH, LL). Which accent class they chose depended on the availability of the underlying accent of each Sino-Korean morpheme: if speakers did not remember the underlying accent of a Sino-Korean morpheme reliably, then speakers should have chosen a default accent class (RX). On the other hand, when the accent of  $\mu_1$  was unknown and  $\mu_2$  was in the E class (c), at least LL was excluded from the possible candidates, since the E class had an H tone. Thus, three options (HX, RX, LH) were provided, and the choice among them again depended on the availability of the underlying accent of  $\mu_1$ . Still, speakers may not simply have assigned RX as a default in this case, since in MK, the RX class could appear as either RH or RL depending on the syllable number in a phonological phrase (Section 3). In order to be faithful to the E class in  $\mu_2$ , LH was more appropriate, since the H tone of the E class in  $\mu_2$  was always realized. Thus, the default pattern for Sino-Korean nouns whose internal structure is “? + E” was not only RX but also LH.

The historical development in South Kyengsang conforms to this hypothesis. When  $\mu_2$  is in the E class, almost no word appears with LH(L) (= MK LL) in South Kyengsang. On the other hand, irregular development to South Kyengsang HL (= MK LH) is observed frequently in this case. The higher regularity rate of MK L+E → South Kyengsang HL than MK L+H, L+R → South Kyengsang HL is explained as the accumulated result of the regular development and the emergent accent assignment. If both  $\mu_1$  and  $\mu_2$  are not from the E class, then the Sino-Korean nouns appear with either a regular development pattern or a default pattern (LH(H)), along with some noise due to the confusion between LH(H) and LH(L) based on the Base-Identity effect.<sup>12</sup> Thus, it is assumed that the accent

<sup>12</sup>LH(H) and LH(L) have another ambiguity, in that they have the identical form (LHHL)

of many Sino-Korean nouns has been analogically restructured. Note that due to the leftward accent shift, the association between the E class and an H tone is no longer straightforward in South Kyengsang:  $\mu_1 = \text{E class} \rightarrow \text{HH}$  vs.  $\mu_2 = \text{E class} \rightarrow \text{HL}$ . However, speakers probably know these arbitrary associations and apply them to unknown Sino-Korean words, even if the associations are not phonetically natural.

What is the cause of this widespread restructuring in Sino-Korean accent? One factor is that the Sino-Korean lexicon contains many unusual words or technical terms which are not frequently used. The correlation between sound change and **token** frequency is discussed in previous literature (Hooper 1976, Bybee 1985: 119, 2000, 2001: 11–12, 2003, Phillips 1984, 2001, and others). The general idea is that phonetic change often progresses more quickly in lexical items with high frequency, whereas grammatical change or analogical change affects the least frequent words first. Another factor is the massive borrowing of (Sino-)Japanese words into Korean. Many Japanese words written with Kanji (Chinese characters) were adapted into Korean by replacing the original Japanese pronunciations with Sino-Korean readings. Theoretically, these loanwords do not have underlying accents and hence they have to be assigned some “emergent accent”.

Accent reanalysis due to an analogical change seems to be observed in Sino-Japanese as well (see Okumura 1961, 1963, Kindaichi 1980, Ogawa 2006, Ueno 2006, 2011: Chapter 5 for discussion of the accent of Sino-Japanese words and their historical development). Probably reflecting this, Sino-Japanese accentuation in the Tokyo dialect is correlated with syllable weight structure strongly (Kubozono 2006: 1161): in Heavy-Light trimoraic words, 79% of Sino-Japanese words appear with the accented class, whereas in Light-Heavy trimoraic words, 82% of Sino-Japanese words belong to the unaccented class.

As in Sino-Korean words, not all Sino-Japanese words are adapted from Chinese either, since many Sino-Japanese words were newly created in order to translate Western words/notions. Thus Sino-morphemes, which have existed in both Korean and Japanese for several centuries but have been subject to reorganization in the construction of new lexical items, in fact share the same feature: the information of the underlying tone of each Sino-morpheme is gradually lost and a new accent is assigned based on specific associations with certain segmental shapes.

#### 4.4. Sino-Korean disyllabic nouns: Coda and onset types

Is there any effect of segmental shape on the regularity rate in disyllabic Sino-Korean words other than the Entering tone codas (-p/-l/-k)? We first examine the correlation between coda type (except for the Entering tone codas) and accent class. Table 37 shows the correlation of coda type and accent class in disyllabic Sino-Korean nouns in South Kyengsang. “Nasal-Nasal” indicates that the codas of both  $\mu_1$  and  $\mu_2$  are nasal. Similarly, “Nasal-Ø” indicates that the coda of  $\mu_1$  is nasal,

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when they are verbalized by *hata* ‘do, be’.

while the coda of  $\mu_2$  is  $-\emptyset$ . As can be seen, when  $\mu_1$  ends with a nasal coda, LH(L) (and HL for Nasal- $\emptyset$ ) is significantly over-represented, while HH and LH(H) are under-represented. Contrastively, when  $\mu_1$  ends with  $\emptyset$ , HH and LH(H) are significantly over-represented, while LH(L) (and HL for  $\emptyset$ - $\emptyset$ ) is under-represented.

Table 37. Accent and coda type (disyllabic Sino-Korean nouns in South Kyongsang) [ $\chi^2 = 320.54, df = 9, p < .001.$ ]

coda \ accent	accent				Totals	coda			
	HH	HL	LH(L)	LH(H)		HH	HL	LH(L)	LH(H)
Nasal-Nasal	121	253	511	664	1,549	<b>0.60</b>	1.06	<b>1.40</b>	<b>0.89</b>
Nasal- $\emptyset$	133	268	418	655	1,474	<b>0.69</b>	<b>1.18</b>	<b>1.21</b>	<b>0.93</b>
$\emptyset$ -Nasal	285	261	201	809	1,556	<b>1.40</b>	1.09	<b>0.55</b>	<b>1.08</b>
$\emptyset$ - $\emptyset$	242	142	275	743	1,402	<b>1.32</b>	<b>0.66</b>	<b>0.83</b>	<b>1.10</b>

(12) Examples. ( ) = MK accent class.

- a. Nasal-Nasal: pón.rón 本論 ‘main subject’ (HX), pín.kon 貧困 ‘poverty’ (LH), in.kán 人間 ‘human’ (LL), pjəŋ.kjún 病菌 ‘germ’ (RX)
- b. Nasal- $\emptyset$ : pón.bú 本部 ‘headquarters’ (HX), jón.ki 煙氣 ‘smoke’ (LH), kwan.rjó 官僚 ‘bureaucrat’ (LL), mun.cé 問題 ‘question’ (RX)
- c.  $\emptyset$ -Nasal: c<sup>h</sup>ó.wón 草原 ‘plain’ (HX), kjó.hwan 交換 ‘exchange’ (LH), hwa.pún 花盆 ‘flowerpot’ (LL), ja.mán 野望 ‘ambition’ (RX)
- d.  $\emptyset$ - $\emptyset$ : cí.wí 地位 ‘position’ (HX), hjú.ci 休紙 ‘toilet paper’ (LH), ka.cé 家財 ‘household’ (LL), so.njǎ 少女 ‘young girl’ (RX)

Table 38 summarizes the observed patterns. As can be seen from the corresponding MK tonal patterns, the observed patterns suggest that when the coda of  $\mu_1$  is nasal, Sino-Korean words in South Kyongsang tend to appear with the accent class that corresponds with the MK L-initial class, while when the coda of  $\mu_1$  is  $-\emptyset$ , Sino-Korean words in South Kyongsang tend to appear with the accent classes that correspond with MK H- and R- initial classes.

Table 38. Summary of the correlation between the  $\mu_1$  coda and accent class in South Kyongsang

$\mu_1$ coda	Over-represented	Under-represented
Nasal	LH(L), HL = MK LL, LH	HH, LH(H) = MK HX, RX
$\emptyset$	HH, LH(H) = MK HX, RX	LH(L), HL = MK LL, LH

Recall the parallel correlations observed in Sino-Korean morphemes in MK (Table 23): Sino-Korean morphemes with a coda  $-\emptyset$  are over-represented in the H class, whereas Sino-Korean morphemes with a nasal coda are over-represented in the L class. The correlation between a coda  $\emptyset$  and the R class is not statistically significant, but it is at least over-represented in MK. Thus we expect that in South Kyongsang, accentual shifts based on these correlations will be observed.

In fact, this is what we find in the correspondences between MK and South Kyengsang, at least partially. Table 39 below shows these correlations. When the  $\mu_1$  coda is nasal, the regular/irregular correspondences with the South Kyengsang LH(L) class are more frequently observed than when the  $\mu_1$  coda is  $-\emptyset$ : [MK] HX, LH, LL, RX  $\rightarrow$  [South Kyengsang] LH(L). Also, when the  $\mu_1$  coda is  $-\emptyset$ , the regular/irregular correspondences with the South Kyengsang HH/LH(H) classes are more frequently observed than when the  $\mu_1$  coda is a nasal: [MK] HX, LH, LL  $\rightarrow$  [South Kyengsang] HH; [MK] LH, LL, RX  $\rightarrow$  [South Kyengsang] LH(H).

Table 39. MK-South Kyengsang correspondences based on coda type (disyllabic Sino-Korean nouns)

MK accent	$\mu_1$ coda	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
HX	$\emptyset$	377	59	16	40	492	77%	12%	3%	8%
	m, n, ŋ	65	8	8	17	98	66%	8%	8%	17%
LH	$\emptyset$	102	315	83	282	782	13%	40%	11%	36%
	m, n, ŋ	85	638	238	374	1,335	6%	48%	18%	28%
LL	$\emptyset$	51	52	87	125	315	16%	17%	28%	40%
	m, n, ŋ	34	66	383	236	719	5%	9%	53%	33%
RX	$\emptyset$	75	210	216	1,322	1,823	4%	12%	12%	73%
	m, n, ŋ	68	174	201	791	1,234	6%	14%	16%	64%

As mentioned above, in monosyllabic Sino-Korean words, the Sino-Korean nouns with a nasal (sonorant) coda tend to move to the L(H) class (= MK R class), whereas the Sino-Korean nouns with a coda  $-\emptyset$  do not. In disyllabic Sino-Korean words, a similar dispersion is not observed but many words move to the LH(H) class (= MK RX class) even if the  $\mu_1$  coda is  $-\emptyset$ . This difference between monosyllabic and disyllabic Sino-Korean words is probably due to two factors. First, unlike monosyllabic Sino-Korean words without an evident default accent class, the type-frequency effect is observed in disyllabic Sino-Korean words, where the default LH(H) attracts many words from other accent classes. Second, although both L(H) and LH(H) are regular reflexes of the MK R/RX classes, the former faithfully retains the F0 rise in isolation forms, whereas the latter does not show a rise tone but L.H. Thus, analogical changes based on the phonetically natural association between a nasal (sonorant) coda and a rise tone were promoted for monosyllabic Sino-Korean words, while such a change (= if  $\mu_1$  coda is nasal, then move to LH(H)) was not promoted in disyllabic Sino-Korean words, since there is no phonetic motivation for that change.

How about the onset types? As mentioned above, Sino-Korean words with an aspirated onset are over-represented in the MK H class. The effect of this correlation is observed in the correspondences of disyllabic Sino-Korean words as well: the irregular correspondences ([MK] LH, LL, RX  $\rightarrow$  [South Kyengsang] HH) are more frequently observed when the onset is an aspirate than when the onset is a lax/sonorant, as seen in Table 40. The relatively higher regularity rate in the MK

LH class → South Kyengsang HL with an initial fricative onset than with a lax/sonorant onset (53% vs. 42%) is probably due to the phonetic effect of the aspirate/fricative onsets (F0 elevation) as well, which is a tendency parallel to monosyllabic Sino-Korean words.

Table 40. MK-South Kyengsang correspondences based on onset type (disyllabic Sino-Korean nouns)<sup>13</sup>

MK accent	Onset	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
HX	Aspirate	80	10	2	16	108	74%	9%	2%	15%
	Fricative	71	13	6	5	95	75%	14%	6%	5%
	Lax, sonorant	291	43	16	36	386	75%	11%	4%	9%
LH	Aspirate	34	111	33	73	251	14%	44%	13%	29%
	Fricative	32	239	72	105	448	7%	53%	16%	23%
	Lax, sonorant	121	602	216	478	1,417	9%	42%	15%	34%
LL	Aspirate	25	17	54	36	132	19%	13%	41%	27%
	Fricative	17	29	102	67	215	8%	13%	47%	31%
	Lax, sonorant	42	72	311	257	682	6%	11%	46%	38%
RX	Aspirate	37	34	23	187	281	13%	12%	8%	67%
	Fricative	15	104	99	490	708	2%	15%	14%	69%
	Lax, sonorant	91	246	295	1,436	2,068	4%	12%	14%	69%

Table 41 summarizes the correlation between onset type and accent class in South Kyengsang disyllabic Sino-Korean words. Aspirate onsets are significantly over-represented in HH, and fricative onsets are significantly over-represented in HL. On the other hand, lax/sonorant onsets are significantly overrepresented in LH(H).

Table 41. Accent and onset type (disyllabic Sino-Korean nouns in South Kyengsang) [ $\chi^2 = 113.86$ ,  $df = 6$ ,  $p < .001$ .]

accent \ onset	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
Aspirate	497	210	134	353	1,194	<b>1.37</b>	0.97	<b>0.78</b>	<b>0.80</b>
Fricative	545	446	309	732	2,032	<b>0.88</b>	<b>1.21</b>	1.05	0.97
Lax, sonorant	1,942	1,131	976	2,556	6,605	0.97	<b>0.94</b>	1.02	<b>1.04</b>

We ran a log-linear model using the glm function in R. Coda type of the penultimate syllable (Entering tone codas (-p/-l/-k), nasal codas (-m/-n/-ŋ), Ø), coda type of the final syllable (Entering tone codas vs. other), and the laryngeal category of the word-initial consonant (aspirate, fricative, lax/sonorant) were the predictor variables, and accent class (HH, HL, LH(H), LH(L)) was the dependent variable. The baseline was set to LH(H), a lax/sonorant onset, a coda Ø for the penult, and a non-Entering tone coda for the final. The result (Table 42) shows an Entering

<sup>13</sup> The small number of examples with a tense onset are excluded.

tone coda in the penult has a highly significant positive effect on HH, whereas a nasal coda in the penult has a significant negative effect on HH and a positive effect on HL and LH(L).<sup>14</sup> Also, an Entering tone coda in the final has a significant positive effect on HL and a negative effect on LH(L). Finally, an aspirate onset has a significant positive effect on HH and HL, and a fricative onset has a significant positive effect on HL. Note that in this model, in parallel to the monosyllabic Sino-Korean words in South Kyengsang, an aspirate onset has a significant positive effect on HL as well, which reflects the relative over-representation compared with the baseline (default) LH(H) class. The fact that an aspirate/fricative effect is observed in South Kyengsang HL but not in LH(L) is important, since both originate from the MK L-initial class. This confirms that the association between an aspirate/fricative onset and South Kyengsang HL is an emergent one, which is phonetically motivated.

Table 42. Result of a log-linear model (disyllabic Sino-Korean nouns)

		Estimate	Std. Error	z value	Pr(> z )	
(Intercept)		-2.094180	0.026259	-79.752	< 2e-16	***
HH class:	Coda (penult)-Entering	6.440557	0.336874	19.119	< 2e-16	***
	Coda (penult)-Nasal	-0.558184	0.075010	-7.441	9.96e-14	***
	Coda (final)-Entering	0.143332	0.059354	2.415	0.01574	*
	Onset-Aspirate	0.616847	0.075836	8.134	4.15e-16	***
	Onset-Fricative	-0.020270	0.064087	-0.316	0.75179	
HL class:	Coda (penult)-Entering	1.181500	0.451410	2.617	0.00886	**
	Coda (penult)-Nasal	0.516691	0.058487	8.834	< 2e-16	***
	Coda (final)-Entering	1.241947	0.062441	19.890	< 2e-16	***
	Onset-Aspirate	0.295981	0.094182	3.143	0.00167	**
	Onset-Fricative	0.319880	0.069883	4.577	4.71e-06	***
LH(L) class:	Coda (penult)-Entering	1.309335	0.488235	2.682	0.00732	**
	Coda (penult)-Nasal	0.865814	0.065346	13.250	< 2e-16	***
	Coda (final)-Entering	-3.728171	0.336004	-11.096	< 2e-16	***
	Onset-Aspirate	-0.005892	0.108217	-0.054	0.95658	
	Onset-Fricative	0.100297	0.077576	1.293	0.19605	

Signif. codes: '\*\*\*' 0.001, '\*\*' 0.01, '\*' 0.05, '.' 0.1.

Notes: Predictor variables = coda type of the penultimate syllable, coda type of the final syllable, the laryngeal category of the word-initial consonant; dependent variable = accent class; baseline = the LH(H) class, a lax/sonorant onset, a coda  $\emptyset$  for the penult, a non-Entering tone coda for the final.

<sup>14</sup> The fact that an Entering tone coda in the penult has a significant positive effect on HL and LH(L) is probably due to their relative over-representation compared with the baseline LH(H) class. However, given the small number of these examples (HL = 11, LH(L) = 8, LH(H) = 9), this is not considered to be a meaningful result. Also, an Entering tone coda in the final has a significant positive effect on HH. This may be because many words that have an Entering tone coda in the final also have an Entering tone coda in the penult as well (67%, 459 out of 700 words), which resulted in the high frequency of HH.



Thus, just as in monosyllabic Sino-Korean words, the accent of disyllabic Sino-Korean words in South Kyengsang have strong correlations with the segmental shapes, and the regular/irregular development was controlled by these factors. Among these correlations, most associations are carried over from MK and are not necessarily phonetically natural:  $\mu_1$  (E class)  $\approx$  HH,  $\mu_2$  (E class)  $\approx$  HL,  $\mu_1$  (nasal coda)  $\approx$  LH(L) and HL,  $\mu_1$  (coda - $\emptyset$ )  $\approx$  HH and LH(H), aspirate onset  $\approx$  HH. There are also emergent associations: aspirate onset  $\approx$  HL, fricative onset  $\approx$  HL. Unlike in monosyllabic Sino-Korean words, a type-frequency effect is observed, leading to analogical changes to the default LH(H) class.

## 5. Conclusion

This paper examined in detail the distribution and historical development of Sino-Korean accent in the South Kyengsang dialect of Korean. Our major findings are summarized as follows:

- (a) As in native simplex nouns, Sino-Korean monosyllabic nouns in South Kyengsang appear with three accent classes (H(H), H(L), L(H)), and Sino-Korean disyllabic nouns appear with four accent classes (HH, HL, LH(L), LH(H)). Still, the type frequency is quite different between the two lexical classes: in native simplex monosyllabic nouns, H(H) is the predominant class, whereas in Sino-Korean nouns, no strong bias is observed and three accent classes appear more or less evenly; in native simplex disyllabic nouns, HL is the predominant class, whereas in Sino-Korean nouns, LH(H) is the default accent class.
- (b) There is a strong correlation between coda type and accent class in both MK and South Kyengsang Sino-Korean words. When the coda of a Sino-Korean morpheme is -p/-l/-k, the accent is regularly H in MK and H(H) in South Kyengsang. In disyllabic Sino-Korean nouns, if the initial morpheme ends with -p/-l/-k, then the accent pattern is almost always HH in South Kyengsang. On the other hand, if the second morpheme ends with -p/-l/-k, then the LH(L) class never appears in South Kyengsang due to the same correlation on the one hand and the historical accent retraction that took place in the Kyengsang dialect on the other.
- (c) In South Kyengsang monosyllabic Sino-Korean nouns, an open-syllable stem is correlated with the H(H) class, whereas many words with a sonorant coda irregularly moved to the L(H) class. The latter association is not evidently observed in MK, and it has been analogically extended from native monosyllabic nouns, as a phonetically natural association. In South Kyengsang disyllabic Sino-Korean nouns, the correlation between coda type (nasal/ $\emptyset$ ) and accent class as well as the historical development reflects the general patterns observed in MK. The difference between monosyllabic and disyllabic Sino-Korean words is due to the absence/presence of a default accent class and the different surface realizations of the same underlying tone: a rise in monosyllables vs. L.H decomposition in disyllables.



- (d) In MK, Sino-Korean morphemes with an initial aspirate onset tended to appear with the H class (= South Kyongsang H(H) class). In South Kyongsang, the same association is still observed, but it has been extended to fricatives and the H(L)/HL classes: both aspirates and fricatives are positively associated with the H(L) and HL classes, which were L-initial classes in MK, and reflect the leftward accent shift from the MK-type accent system.
- (e) In sum, the Sino-Korean accent, while being faithful to the historically expected accent as a rule, has frequently been restructured through analogical changes based on four factors: (i) simple type frequency resulting in a default accent class that attracts many words from other classes, (ii) the Base-Identity effect that leads to a tonal perturbation due to an ambiguous accentual contrast, (iii) local generalizations based on segment-tone correlations with higher type frequency in the lexicon, and (iv) phonetically natural associations. The first factor may not play a role if there is originally no biased distribution in the lexical category. Thus, the Sino-Korean accent in contemporary South Kyongsang is a result of historical development in which these various factors with different weights interact with one another.

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## 【要 旨】

### 韓国語慶尚南道方言の漢字語アクセント

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中期朝鮮語資料に記録され、現代韓国朝鮮語においても使用されている漢字音の多くは、中国語中古音よりもたらされたものと考えられている。また、現代韓国朝鮮語のうち弁別的なアクセント対立を有する諸方言においては、漢字形態素に現れる音調パターンが、今なお中国語中古音の声調とある程度規則的に対応していることが知られている。本稿では、韓国語慶尚南道方言の漢字語アクセントの音韻論的性質について、固有語アクセント及び中期朝鮮語アクセントと比較しつつ、検討を行う。慶尚南道方言の漢字語名詞は、固有語単純名詞と同じアクセント対立を示すが、各アクセントクラスの異なり頻度に違いが見られ、それが両者の異なるデフォルトアクセントクラスを引き起こしている。また、中期朝鮮語と慶尚南道方言の漢字語においては、分節音のタイプ（頭子音・末子音）とアクセントクラスとの間に相関性があり、そのうちいくつかは慶尚南道方言において独自に生じたものである。全体として、慶尚南道方言の漢字語は原則的に、歴史的に見て期待されるアクセントクラスで現れるが、(1) デフォルトアクセントに多くの語を引き寄せる、単純な異なり頻度の影響、(2) 単独形（後続の助詞等を伴わない形）におけるアクセント対立の中和による、アクセント情報の曖昧化、(3) 漢字語において高い異なり頻度で観察される、分節音－音調の相関パターンに基づく局所的な一般化、(4) 音声学的に自然な分節音と音調との結合、の四つの要因により、しばしば類推的に再構築されている。