Mandarin Loanwords in Yanbian Korean I: Laryngeal Features*

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ABSTRACT. The paper documents and then discusses the motivation for the loanword adaptation of the Mandarin binary aspirated vs. unaspirated contrast with respect to the Yanbian ternary aspirated-tense-lax contrast. The way in which the Yanbian tense vs. lax/aspirated contrast in fricatives behaves with respect to loans from Mandarin, English and Japanese is also discussed.

Keywords: Voice quality, H1-H2, Enhancement Theory, phonetic correlates

1. Introduction

The laryngeal features of voicing and aspiration have figured prominently in discussions of the distinction between phonetics and phonology ever since Keating's seminal paper (1984) showing that languages differed systematically in the articulatory and acoustic correlates of these features thus necessitating a phonetic grammar distinct from the phonology. Other noteworthy studies focusing on these features include Keyser and Steven's (1989, 2006) Enhancement Theory and Kingston and Diehl's (1994) Phonetic Knowledge. The basic observation is that while such categories as *p*, *b*, p^h are phonologically stable, their phonetic correlates vary considerably both cross-linguistically as well as contextually within a single language. Many researchers assume that one phonetic correlate is singled out as principal while the others play a supportive role to help signal the category when the principal is challenged by context. Which particular phonetic correlates play an enhancing role and why remains a major research question. Another noteworthy problem the laryngeal contrasts present is that their enhancing properties are often realized in neighboring segments rather than in the consonants themselves, making them susceptible to diachronic recategorizations in which they take on a phonological life of their own. Within the loanword literature itself the role of such redundant features has been a topic of considerable debate. LaCharité and Paradis (1997, 2005) found them to play a minimal role in their loanword corpora. But more recent research has found such "phonetic approximations" to be decisive in a number of cases (e.g. Peperkamp et al 2008). Our goal in this paper is to document another example showing that enhancing features are relevant for loanword adaptation and hence are the basis upon which the phonological categories of one language can be identified with those of another.

Our study focuses on a corpus of c. 240 recent loans from Mandarin (Ma) Chinese into the Yanbian (YB) dialect of Korean (Northeastern China). The data have been checked with a bilingual Ma/YB consultant (35 year old female). We begin by tabulating the YB and Ma obstruent systems.

(1) Inventory of obstruents

YB	lax	p	t	c [ts]	k	examples:	tal	'moon'
	aspirated	p^h	t^h	c^h	k^h		t^hal	'mask'
	tense	p*	t*	c*	k*		t*al	'daughter'
	lax/aspirated			s			sal	'frame'
	tense			s*			s*al	'rice'

Ma	unaspirated	p	t	ts	tʂ	tɕ	k
	aspirated	p^h	t^h	ts^h	$tʂ^h$	$tɕ^h$	k^h
	fricative	f		s	ʂ	ɕ	

The phonological features underlying the three-way contrast among the Korean stops (all voiceless in postpausal phrase-initial position) have been the subject of considerable discussion from Kim (1965) and Halle and Stevens (1971) through Cho et al. (2002) and Kim and Duanmu (2004). We assume the specifications in (2) from Halle and Stevens (1971).

(2) Korean obstruent specifications

	C^h	C	C*
[spread glottis]	+	−	−
[constricted glottis]	−	−	+

Examples of the loanword correspondences found in syllable-onset position both word initially and word medially are illustrated in (3). The parenthesized figures indicate the number of examples in the corpus for each correspondence. The Ma data are transcribed in Pinyin (*b, d, g* indicate voiceless unaspirated stops) with the numbers that customarily indicate the four tones (1 = [55] High, 2 = [35] Rise, 3 = [21(4)] Low, 4 = [51] Fall). The correspondences are first that Ma aspirated stops are adapted as YB aspirated, second that Ma unaspirated stops are adapted as YB tense word initially but as primarily lax word medially, and third that Ma sibilants are adapted as YB tense *s** both word initially and medially.[1]

(3) Obstruent correspondences

Ma	YB-initial	YB-medial	Examples (word-initial)
p	p* (27), p (1)	p (19)	bing4-du2 病毒 'virus' → p*íŋ.tu
p^h	p^h (5), p (1)	p^h (13)	pei4-yin1 配音 'voice artist' → p^{h}ei.ín
t	t* (23), t (2)	t (9), t* (8)	dian4-chi2 电池 'battery' → t*ɛ́n.c^{h}ɨ
t^h	t^h (17)	t^h (12)	tong2-ju1 同居 'live together' → t^{h}uŋ.cwí
k	k* (9), k (1)	k (13), k* (6)	guo4-min3 过敏 'allergy' → k*wə́.min
k^h	k^h (9)	k^h (17)	kong1-tiao2 空调 'air-conditioner' → k^{h}úŋ.t^{h}jo
ts	c* (2)	c (9), c* (2)	zao3-can1 早餐 'breakfast' → c*oo.c^{h}án
ts^h	c^h (7), c (2)	c^h (4)	cun2-zhe2 存折 'bankbook' → c^{h}ún.cə
tɕ	c (5), c* (4)	c (36), c* (2)	jin1-ling3 金领 'gold collar' → c*ín.liŋ
tɕ^h	c^h (9)	c^h (9)	qing2-fu4 情妇 'lover' → c^{h}iŋ.fú
tʂ	c* (6)	c (7), c* (2)	zha4-pian4 诈骗 'fraud' → c*a.p^{h}ɛ́n
tʂ^h	c^h (11)	c^h (11)	chu2-fang2 厨房 'kitchen' → c^{h}ú.faŋ
s	s* (10)	s* (3)	suan4-zhang4 算帐 'counting' → s*wan.cáŋ
ɕ	s* (20)	s* (25), s (8)	xue3-gao1 雪糕 'ice cream' → s*we.kó
ʂ	s* (12), s (1)	s* (9), s (1)	shang4-banr1 上班儿 'attendance at work' → s*aŋ.pál

These data provoke the questions detailed in (4).

(4) Our questions

- Why are Ma unaspirated stops adapted as the phonologically more complex tense stops word initially? (E.g. *dian4-nao3* 电脑 'computer' → ***t****ɛ́n.no*)
- Why is there a difference in position, given the context-free mapping of aspirated stops and sibilants? (E.g. *bing4-du2* 病毒 'virus' → ***p****íŋ.tu, kong1-tiao2* 空调 'air-conditioner' → ***k***^{h}*úŋ.**t***^{h}*jo, xian4-xie*3 献血 'blood donation' → ***s****ɛ́n.**s***we*)
- Why are the Ma sibilants adapted as tense *s** instead of as lax *s*?
- Can we explain deviations from the basic correspondences? Certain word-medial Ma unaspirated stops are adapted with tense variants: e.g. *chong1-dian4* 充电 'battery charge' → *c*^{h}*uŋ.**t****ɛ́n* ~ *c*^{h}*uŋ.**t**ɛ́n*; Ma palatal *ɕ* is sometimes adapted with a lax variant: e.g. *bing1-xiang1* 冰箱 'refrigerator' → *p*íŋ.**s****jaŋ* ~ *p*íŋ.**s**jaŋ*

- English word-initial *sV* is adapted unpredictably as *s*V* or *sV* in YB (cf. Seoul where *s** is the current preference), whereas Japanese *s* is adapted as YB/Seoul *s*: e.g. *size* → ***s*a.í.ci*** ~ ***sa.í.ci***, *sa.si.mi* → ***sa.si.mí***. Why is the phonologically identical segment adapted differently into the same grammar?

Our answers to these questions are based on the hypothesis that the phonetic correlates of the laryngeal contrasts in both Ma and YB play a crucial role. Moreover, Korean dialects differ in the choice and magnitude of their phonetic correlates. Finally, donor languages may also differ in the phonetic correlates of the phonologically identical segment. The adaptations pay particular attention to the phonetic correlates in order to choose the closest matching sound in the recipient language. The next section details these points.

2. Phonetic Correlates of the Laryngeal Contrasts

Korean's ternary tense-lax-aspirated contrast has been the subject of numerous investigations over the past forty years. The principal acoustic correlates have been found to lie in VOT, F0, and voice quality (H1-H2). In order to see how YB compares with respect to these correlates, a corpus of words that combined labial, dental, and velar stops with tense, lax, and aspirated laryngeal states as well as the fricatives *s* and *s** followed by the vowel *a* in both initial and medial position was recorded in a frame sentence. A total of 222 CV stimuli extracted and analyzed in Praat (Boersma and Weenink 2004). Three measures were taken: VOT, F0 at V-onset and V-mid points, and H1-H2 at V-onset. Table (5) compares our findings for YB with several other studies of various dialects.

(5) VOT (ms)

YB	Labial	Coronal	Velar	Ave	L & A	C-Seoul	C-Cheju	K & P	S & J	S-Y
Aspirated	55	55	71	60	104	120	105	81	80-120	**75**
Lax	8	9	20	**12**	30	**70**	45	50	30-50	**70**
Tense	8	9	19	**11**	12	**20**	20	22	10-20	10

(L & A = Lisker & Abramson 1964, C-Seoul = Seoul dialect data from Cho et al. 2002, C-Cheju = Cheju dialect data from Cho et al. 2002, K & P = Kyungsang dialect data from Kenstowicz & Park 2006, S & J = Silva & Jin 2006, S-Y = younger generation of Seoul dialect from Silva 2006)

It is clear that VOT fails to distinguish the lax from the tense series in YB. In this respect YB differs from most other Korean dialects reported in the literature—in particular the Seoul standard. However, even here Silva (2006) finds that for the younger generation of Seoul speakers the lax category has merged with the aspirated in VOT. For these speakers, Silva finds F0 in the following vowel to be the factor that distinguishes the lax from the aspirated series. A similar F0 difference is noted by Cho et al. (2002) and was also observed in Jun's (1993) study of accentual phrasing. For YB, we find a small F0 difference between tense and lax in high-tone syllables but none in low-tone ones (6).

(6) F0 differences

Seoul (Cho et al. 2002, male voices)	C^h	C	C*
F0 (Hz)	140	124	138

YB High / Low tone (female voice)	C^h	C	C*
F0 (Vowel onset)	314 / 251	273 / 225	287 / 224
F0 (Vowel mid)	311 / 246	261 / 227	281 / 225

If neither VOT nor F0 reliably distinguishes tense from lax in YB, how is the contrast signaled? As seen in (7), voice quality in the following vowel is the major factor in YB.

(7) Voice quality: breathy vs. creaky (H1-H2)[2]

Seoul (older speakers: Cho et al. 2002)	C^h	C	C*
H1-H2 (V onset, dB)	2	5	-3

Seoul (younger speaker: Kim et al. 2002)	C^h	C	C*
H1-H2 (V onset, dB)	3.9	4.2	-4.8

YB word-initial position: mean / st.dev.	C^h	C	C*
H1-H2 (V onset, dB)	6.3 / 3.1	-2.8 / 1.9	-7.1 / 1.8

Single-factor ANOVAs:

	df	F	p
tense vs. lax:	1, 82	105.34	<< 0.0000
aspirated vs. lax	1, 82	256.27	<< 0.0000
aspirated vs. tense	1, 82	565.08	<< 0.0000

These data indicate that for the older generation of Seoul speakers, lax stops are the most breathy while for the younger generation neither voice quality (nor VOT) distinguishes the lax from the aspirated series; only F0 does. For YB, the H1-H2 range is larger and reliably distinguishes each of the three series.

Our conclusion is that the tense-lax contrast is signaled primarily by F0 in Seoul (especially for younger speakers) but by voice quality in YB. This difference finds a ready explanation in Keyser and Steven's Enhancement Theory. Since YB retains the Middle Korean High vs. Low tonal contrast, F0 is unavailable as a resource for enhancing the laryngeal contrast in the consonants. The Seoul dialect has lost the lexical tonal contrasts and utilizes F0 as a % LH accentual phrase melody (Jun 1993, 1996). Evidently, the melody has taken on a % HH variant after the tense and aspirated consonants, suggesting that the enhanced F0 has been phonologized into the intonational, phrasal phonology. Thus, in both dialects VOT has been supplemented by an enhancing feature in the following vowel in order to signal the three-way contrast postpausally, trading a ternary distinction in one phonetic dimension (VOT) for two (binary) distinctions (VOT and F0 or voice quality).

What are the perceptual correlates of the laryngeal contrasts? The answer to this question is particularly important for understanding the loanword correspondences. Kim et al. (2002) investigated the Seoul laryngeal contrasts with a splicing experiment in which the CV onset-rhyme sections of canonical stimuli were systematically interchanged at the zero-crossing point and subjects were asked to identify the consonant. Their principal finding is that F0 in the vowel is the decisive cue to the lax vs. tense/aspirated contrast in the preceding consonant. The first author conducted a similar experiment with our YB consultant utilizing Praat (see Ito 2008). A set of nonce words (t^h_ana, tana, t*ana, lat_^{h}_a, lata, lat*a_) was recorded in a frame sentence (_ikesɨn_ ___ _lako iks*ɨmnita_). The CV sections of the target words were spliced at the zero crossing point and systematically recombined to yield a set of nine stimuli. They were presented to the consultant in two formats: single (no replay possible) and multiple (replay possible). The results are summarized below; a^h, _a, a*_ indicate the vowels after aspirated, lax, and tense onsets respectively.

(8) Cross-splicing experiment in YB: word initial

Target	Single presentation	Multiple presentation
ta	lax	lax
ta*	tense	tense
ta^h	lax, lax≈aspirated	lax, lax with slight aspiration
t*a*	tense	tense
t*a	lax	lax
t^*a^h	lax	lax
t^ha^h	aspirated	aspirated
t^ha	aspirated	aspirated
t^ha^*	aspirated	aspirated

It is clear that the presence of VOT that marks a YB aspirated stop suffices to identify the stimulus as aspirated regardless of the vowel. But if the stimulus lacks significant VOT and hence is ambiguous between tense and lax, then the voice quality in the following vowel (*ta** and *t*a*) decides the outcome as tense or lax. Finally, when a relatively breathy vowel characteristic of aspiration a^h is combined with an onset (*t** or *t*) that lacks the telltale VOT, the cues are conflicting (fail to integrate). It is interesting that in this situation the lax judgment predominates. It suggests that lax is a phonological default assigned when perceptual system fails to reach a conclusive decision.[3]

In (9) we see the results for medial position. Once again positive VOT in the onset decides in favor of aspirated regardless of the quality in the vowel. Also, the relatively breathy voice of a^h leads to an aspirated judgment when combined with t*. But this time when a lax/tense onset is combined with a tense/lax vowel (*ta** or *t*a*), it is the consonant that decides the outcome. This result suggests that the internal cues of (passive) voicing and short closure duration that mark the lax stops in inter-sonorant position (see (11) below) suffice to distinguish tense from lax and thus the vocalic cues are ignored.

(9) Cross-splicing experiment in YB: word medial

Target	Single presentation	Multiple presentation
ta	lax	lax
ta*	lax	lax
ta^h	weakly aspirated lax	weakly aspirated
t*a*	tense	tense
t*a	tense	tense
t^*a^h	aspirated	aspirated
t^ha^h	aspirated	aspirated
t^ha	aspirated	aspirated
t^ha^*	aspirated	aspirated

In sum, the splicing experiment suggests that for YB VOT of the aspirated stops is the dominant cue both word initially as well as word medially. In the absence of positive VOT, voice quality (measured by H1-H2) is the dominant cue word initially but not word medially. In the latter position the stop-internal correlates of closure duration and (passive) voicing suffice. The latter are not available postpausally and this is where the vocalic correlate of voice quality steps in to maintain the contrast.

3. Loanwords Again

In this section we return to the loanword correspondences to see to what extent they are elucidated by the phonetic correlates of the laryngeal features presented in section 2. For this part of the study we recorded and analyzed a corpus of 135 Ma nonce words whose Ca target sections were evenly distributed over labial, dental, velar stops combined with the aspirated and unaspirated laryngeal categories and the four tones. Also included were the three Ma sibilants combined with the four tones. We begin with word-initial position. First, recall that here Ma aspirated stops are systematically adapted as YB aspirated. The data in (10) suggest that the YB aspirated series is a good match for the Ma in terms of VOT (the decisive perceptual cue). In addition, the following vowel is relatively breathy in both languages. (The F0 values are averaged over all four Ma tones and YB High and Low).

(10) Phonetic correlates in initial position (for H1-H2, mean / st.dev.)

Aspirated	Ma	YB
VOT (ms)	63	60
F0 (Hz)	277	268
H1-H2 (dB)	3 / 3.2	6.3 / 3.1

Unaspirated	Ma	YB-lax	YB-tense
VOT (ms)	11	12	11
F0 (Hz)	268	249 / 7	255 / 7
H1-H2 (dB)	-5.6 / 3.6	-2.8 / 1.9	-7.1 / 1.9

Second, recall that Ma unaspirated stops are adapted with the phonologically more complex (marked) tense series in YB. The data in (10) help to explain why. Neither VOT nor F0 distinguish YB tense from lax in providing a significantly closer match to the Ma stop. But, as the data indicate, the Ma unaspirated series is relatively creaky and so on average is better matched by YB tense. Recall that voice quality in the following vowel was the decisive factor in the perceptual experiment for judging the CV onsets with minimal VOT.

Turning to word-medial position, we recall that while Ma aspirated stops are regularly adapted as YB aspirated, Ma unaspirated stops are adapted as YB lax rather than tense. Once again, the phonetic correlates help us to understand this difference. First, the data in (11) show that the YB aspirated series matches the Ma one well in total intervocalic voiceless duration as well as in voice quality.

(11) Phonetic correlates in medial position (for H1-H2, mean / st.dev.)

Aspirated	Ma	YB
VOT (ms)	57	33
closure duration (ms)	67	86
total voiceless duration (ms)	124	119
H1-H2 (dB)	3.8 / 3.4	2.1 / 3.2

Unaspirated	Ma	YB-lax	YB-tense
VOT (ms)	12	7	11
closure duration (ms)	79	48	105
voicing	voiceless	voiced	voiceless
H1-H2 (dB)	-4.4 / 2.9	-4.9 / 2.1	-6 / 2.1

With respect to the Ma unaspirated series, we see that VOT is uninformative. Furthermore, on the dimension of closure duration the Ma series falls between the relatively short YB lax series and the relatively long tense series. As far as voice quality is concerned, when the data are viewed in a scatter plot (not presented here due to space limitations), the Ma unaspirated series overlaps both YB lax and tense. So while the average of Ma -4.4 dB is closer to YB lax, this does not yield a decisive classification. Furthermore, the perceptual experiment indicated that YB speakers pay attention to internal cues in judging between tense and lax medially. Since the Ma unaspirated stops are consistently voiceless in medial position, the YB tense series (also voiceless) would seem to be the best match. At present, we do not have a good explanation for why they are not chosen. One possibility is that the word-medial judgment as tense vs. lax depends on both duration and voicing. These factors integrate in the expected way in YB. Perhaps the Ma value (79 ms) is too distant from YB (105 ms) to count as a sufficient match. The outcome is then turned over to the phonology, which assigns the lax category as a default. [4]

We noted in (4) certain exceptions to the medial Ma unaspirated = YB lax correspondence where a tense consonant is found instead. They occur almost exclusively when the Mandarin loan has tone 4. What could be the basis of this tonal correlation? The answer is suggested by the table in (12) showing the voice quality for the four Ma tones. The data indicate that creaky voice (a high negative value for H1-H2) is used to enhance high tone in Mandarin (a crosslinguistically common association). Evidently the exceptionally negative voice quality of such high-tone words is enough to push some of the medial Ma unaspirated stops into the YB tense region.

(12) Voice quality and tones in Ma

Tone	Initial	Medial
1	-6.2	-4.0
2	-2.8	-2.6
3	-2.7	-3.3
4	-10.0	**-8.2**

Let us summarize our findings. Both word initially and medially aspirated stops are marked by positive VOT in YB, which is the dominant perceptual cue. Ma aspirated stops also have positive VOT in both positions and so their correspondence in the loans makes sense on phonetic grounds. As far as the adaptation of Ma unaspirated stops is concerned, the perception experiment indicated that the consonant-internal cues of voicing and closure duration were decisive word medially. Ma medial unaspirated stops largely fail to match these cues in a consistent manner and so a lax adaptation is assigned as the phonological default. In initial position voicing and closure duration are not available as cues and so enhancing features in the following vowel are deployed: F0 in Seoul and voice quality in YB. Since Ma unaspirated stops are relatively creaky, they are adapted as tense in YB.

4. The Adaptation of Ma Sibilants

The Ma sibilants *s, ɕ*, and *ʂ* are adapted with YB tense *s** both initially and medially. The data in (13) show that this is the best phonetic match since these consonants are all associated with relatively creaky voice in Ma. They also match well in duration if the aspiration of lax *s* is not taken into account.

(13) Phonetic correlates in sibilants

Initial	Frication	Aspiration	H1-H2
s (YB)	70	27	7.3
s* (YB)	101	7	-7.2
s (Ma)	101	6	-5.7
ɕ (Ma)	109	7	-2.1
ʂ (Ma)	112	6	-5

Medial	Frication	Aspiration	H1-H2
s (YB)	57	11	1.2
s* (YB)	101	7	-8.4
s (Ma)	90	7	-4.6
ɕ (Ma)	103	7	-3.7
ʂ (Ma)	99	5	-4.3

Voice quality also helps to understand certain exceptions to these correspondences. In particular, 8 out of 33 words in our corpus with the Ma palatal sibilant *ɕ* word medially are adapted with the YB lax/aspirated *s* while no Ma *s* are and only 1 of 10 Ma *ʂ* are. For our consultant *ɕ* is associated with the least negative H1-H2; some tokens fall comfortably within the breathy range of YB *s*. If her speech is representative of the population that provided the input to the loans then the special behavior of palatal sibilant finds a ready explanation.

5. The Adaptation of English and Japanese *s*

Kim and Curtis (2002) pointed to the adaptation of English prevocalic and final *s* as Standard Korean tense *s** in words like *size* and *gas* in contrast to the adaptation with lax/aspirated *s* for English preconsonantal *s* in words like *smog* and *disk*. They attributed this dual outcome to a durational difference in which the shorter preconsonantal *s* is matched with the shorter Korean *s* while the longer tense *s** provides a better match for the relatively longer English prevocalic and final *s*. In view of this finding, Ito et al. (2006) called attention to the complementary Korean adaptations from Japanese where geminate *ss* is matched with *s** and singleton *s* with *s*: cf. *assari* 'simply' → [a.s*a.ri] vs. *sakura* 'cherry tree' → [sa.ku.ra]. The upshot is that the phonologically identical string /sa/ is adapted differently depending on whether it originates from English or from Japanese. Ito et al. attribute the difference to systemic contrast: the relatively short preconsonantal *s* of English is adapted with the shorter Korean fricative while the longer geminate *ss* of Japanese is adapted with the longer Korean tense *s**. The prevocalic *s* is adapted differently because it is paired with a shorter consonant in English adaptations but with a longer one in Japanese adaptations. This explanation implies that a loanword correspondence is not calculated in isolation but takes into account the range of contrasts in the donor language. It presupposes some knowledge of the overall system that could only come from extensive language contact/bilingualism.

In subsequent research into this problem, Kang (2008) offers an alternative explanation. Basing her discussion on an analysis of 500 tokens of *s* drawn from a corpus of spoken American English, Kang finds that the duration measures are too variable to provide a reliable basis to explain the systematic Korean adaptation of preconsonantal vs. prevocalic and final *s*. She reports that English prevocalic *s* is associated with a near modal voice quality (H1-H2) in the following vowel that is consistently closer to Korean tense *s** than to the relatively breathy lax/aspirated *s* and suggests that voice quality in the following vowel leads Korean adapters to select the tense *s** for English loans. Kang also reports a more variable adaptation for English *s* in a loanword dictionary from the 1930's. Specifically, while preconsonantal *s* is uniformly adapted as lax/aspirated *s*, prevocalic *s* is split almost evenly between tense and lax/aspirated—in marked contrast to the uniform *s** adaptation in contemporary speech.

In (14) below we report the correspondences between English and Japanese *s* and YB *s** vs. *s* found in our corpus. They are compared with Standard Korean.

(14) Correspondences between English, Japanese *s* and YB *s** vs. *s*

		YB adaptation	Standard Korean
English	sV (word initial)	s (44), s* (27)	s*
	sV (word medial)	s (27), s* (1)	s*
	s (word final)	s (67), s* (4)	s*
	sC	s (57)	s
Japanese	sV (word initial)	s (18), s* (2)	s
	sV (word medial)	s (20), s* (1)	s
	ss	s (1)	s*

The most notable difference concerns English word-initial prevocalic position where there is considerable variation between *s* and *s** in the face of the uniform preference for *s* in other YB contexts as well as for *s** in contemporary Seoul. Our suggestion is that if Kang's data on H1-H2 for English *s* are representative of the input for YB loans then the roughly modal voice quality in the following English vowel falls almost evenly between the relatively breathy YB *s* (H1-H2 = 7.3) and the relatively creaky YB *s** (H1-H2 = -7.2). Hence, unlike with the Ma stops, no conclusive choice can be made between *s* and *s** leading to the variation seen in (14). Earlier we noted that when no perceptual equivalence is established then the grammar steps in to assign a default. The fact that no default is assigned here might indicate that tense *s** and lax/aspirated *s* are both marked segments and hence that no default exists in this case. The Cho et al. (2002) study reports H1-H2 values for *s* and *s** of c. 4 and -3.5 dB for four Seoul males of c. 60 years of age. Kang's modal voice average for English prevocalic *s* falls roughly in between these two values as well and so would also give rise to an uncertainty comparable to what we have found for YB. It is thus possible that these speakers as well as our YB consultant represent a cue regimen that mirrors what was operative in 1930's speech. For the younger contemporary Seoul generation the H1-H2 values of both *s* and *s** have shifted up, making English modal voice prevocalic *s* closer to *s**. The relative breathiness of both *sa* and *s*a* may be connected with the merger of the lax with the aspirated stop categories found in Silva's subjects with respect to VOT.

The uniform adaptation of Japanese *s* as Seoul/YB lax/aspirated *s* suggests that Japanese *s* is relatively breathy compared to what Kang (2008) reports for English. A pilot study with three Japanese speakers pronouncing *sa* sequences in words like *sake* 'rice wine', *sara* 'plate', *saru* 'monkey' supports this speculation (H1-H2 Mean = 8.5 dB, st.dev. = 2.5dB).

5. Summary and Conclusions

In this paper we studied the way in which the Mandarin voiceless aspirated vs. unaspirated contrast is reflected in the Yanbian Korean aspirated-lax-tense contrast in a corpus of c. 240 recent loanwords. The chief finding is that while aspirated stops are regularly adapted as aspirated, unaspirated stops appear as tense or lax as a function of word-initial vs. medial context. We proposed that the phonetic correlates of the Korean contrast, in particular the relative breathiness of the following vowel, are crucial to understanding this asymmetry. The Yanbian situation was compared to several other dialects, in particular Seoul. Based on Kang (2008) we suggested that voice quality may also explain the contrasting adaptations of English and Japanese *s* in both Seoul and YB. Tasks for future research include expanding the pool of experimental subjects as well as trying to understand when an adaptation accepts an imperfect phonetic match vs. substitutes a phonological default.

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Notes

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[1] Chi (2008) finds essentially the same correspondences, except that sibilants are adapted as lax/aspirated word medially like stops are (although she admits many exceptions to this).

[2] According to Cho et al. (2002:202) open quotient (the period of time during the glottal cycle in which the vocal folds are open and more energy can pass through) is larger for breathy voice in comparison to modal voice and as a result the spectrum is dominated by energy near the fundamental and so H1 is higher than H2; in creaky (pressed) voice the folds are closed for a longer period of time in the cycle and hence the opposite effect occurs.

[3] See Ito et al. (2006) for another example of default assignment where coronal place is inserted in Japanese loans when the place specification of a coda nasal is not perceived.

[4] The lax series is clearly the default in Korean phonology. For example, the three-way laryngeal contrast is neutralized in the (unreleased) coda. When this stop is resyllabified to

onset across a strong juncture, a lax specification is uniformly assigned: cf. *kət^h* 'surface': [kət] (isolation), [kət^h-i] ([kətʃ^h-i] in Standard Korean, nominative); *kət^h* 'surface' + *usɨm* 'laugh' →[kə.tu.sɨm] 'forced laugh'.

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