

Korean Umlaut Revisited*

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This paper examines what conditions Korean Umlaut. Since Umlaut involves the place assimilation of a back vowel to a following high front vocoid across a consonant or cluster, we might raise a question of whether the process is conditioned by the place of articulation of an intervening consonant or cluster, as usually assumed in the literature. Or we might ask ourselves whether there is something else other than phonological accounts for the occurrence of Korean Umlaut.

In this paper, a survey of Korean Umlaut was made for the questions raised in the above. The results of the survey show that the place of articulation of an intervening consonant or cluster is not consistent with conditioning Umlaut, and that it is by non-phonological variables -- lexical, dialectal and individual differences -- that Korean Umlaut may or may not be triggered. Based on the results of the survey, it is proposed that Korean Umlaut is phonologically represented as the spread of the secondary vocalic feature [coronal] to a preceding vowel across an intervening consonant or cluster, regardless of its place of articulation, and that it is a sound change called lexical diffusion.

1. Introduction

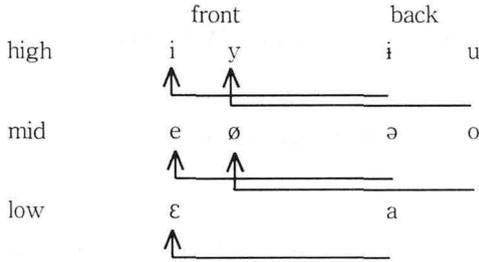
Korean Umlaut is a vowel mutation in which the non-front vowels -- /u, o, i / as well as /a, ə/ among the ten monophthongs of Modern Korean (e.g., Lee 1972, Huh 1985) -- are fronted when followed by a high front vocoid, across an intervening consonant or cluster, as shown in (1).^{1,2}

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¹ In general, umlauted forms are often used in informal speech, but they are likely to be avoided in formal speech, because they are regarded as non-standard Korean, not as Standard Korean spoken by educated middle class Seoulites.

² One might say that Umlaut also occurs when there is no intervening consonant at

(1) Korean Umlaut



e.g.

/aki/	[a.gi]	~	[ε.gi]	'baby' ^{3,4}
/ʈsamkita/	[ʈsam.gi.da]	~	[ʈsɛm.gi.da]	'to be flooded'
/sokita/	[so.gi.da]	~	[sø.gi.da]	'to deceive'
/ʈsukita/	[ʈsu.gi.da]	~	[ʈsy.gi.da]	'to kill'

Korean Umlaut has been much discussed in the literature, especially in terms of the place of articulation of an intervening consonant or cluster. It is a general consensus that non-coronal consonants are transparent to Umlaut when they are between the trigger and the target vowel (e.g., Kim 1973, Ramsey

all, which was suggested by Lee (1935) and Chung (1938). But see Choi (1989) for historical accounts against the suggestion. In this paper, following Choi (1989), I assume that Umlaut occurs just when there is an intervening consonant or cluster.

³The dot in phonetic transcription indicates a syllable boundary. In intervocalic position a voiceless plain stop is usually voiced in Korean.

⁴For reference, the Korean consonant inventory assumed in this paper is based on Kim (1997, 1999b):

	labial	coronal		velar	glottal
		alveolar	palatal		
plain stops	p	t		k	
aspirated stops	p ^h	t ^h		k ^h	
tense stops	p'	t'		k'	
plain affricate		ʈs			
aspirated affricate		ʈs ^h			
tense affricate		ʈs'			
plain fricatives		s			h
tense fricative		s'			
nasals	m	n		ŋ	
lateral		l			
glides	w		j	(w)	

1978). But, as for the place of articulation of an intervening coronal consonant or cluster in Umlaut, there have been a lot of discrepancies in the literature, some of which are as follows: a) all coronal consonants block the rule of Umlaut (e.g., Kim 1973); b) all coronal consonants except for the lateral /l/ block Umlaut (e.g., Ahn 1989); c) no coronal consonants block Umlaut (e.g., Chung 1938, Kim 1963); d) only coronal affricates block Umlaut (e.g., Hume 1990).

First, Kim (1973) among others proposes that Korean Umlaut does not apply when an intervening consonant is coronal, and that it occurs only when an intervening consonant is either labial or dorsal, as shown in (2).⁵

(2)

a.	[ka.si]		*[kɛ.si]		'thorn'
	[ə.di]		*[e.di]		'where'
	[ə.mə.ni]		*[ə.me.ni]		'mother'
	[so.ri]		*[sø.ri]		'sound'
	[ka.ʃsi]		*[kɛ.ʃzi]		'branch'
	[ku.ʃzi]		*[ky.ʃzi]		'insistently'
	[sø.bu.ʃsʰi]		*[sø.by.ʃsʰi]		'metal'
b.	[no.pʰi.da]	~	[nø.pʰi.da]		'to elevate'
	[a.bi]	~	[ɛ.bi]		'father'
	[nu.bi.da]	~	[ny.bi.da]		'to embroider'
	[ə.mi]	~	[e.mi]		'mother'
	[ʃsi.pʰaŋ.i]	~	[ʃsi.pʰɛŋ.i]		'walking stick'
	[mɛ.gi.da]	~	[me.gi.da]		'to feed'
	[a.gi]	~	[ɛ.gi]		'infant'
	[so.gi.da]	~	[sø.gi.da]		'to deceive'
	[ʃsu.gi.da]	~	[ʃsy.gi.da]		'to kill'

Based on the South Hamkyeng dialect of North Korea, Ramsey (1978) notes that the dialect has a productive umlaut system, and that the rule of Umlaut does not apply across a "coronal" consonant.

Second, from dialects spoken in middle parts of South Korea such as dialects to the north of Chwungcheng province, Ahn (1989) proposes that among coronal consonants Umlaut only applies across an intervening lateral /l/ preceded by an unrounded vowel in a verb, as shown in (3a); that Umlaut never occurs even in a verb when the intervening liquid is the

⁵ Kim (1973) does not mention which dialect is concerned and who his informants were in (2).

geminate lateral /ll/, as shown in (3b); and that it never applies in non-derived nouns, even across a single /l/, as shown in (3c).⁶

- (3)
- | | | | | |
|-----|-------------------------|---|--------------------------|----------------------|
| a. | [s'i.ri.da] | ~ | [s'i.ri.da] | 'to be sore' |
| | [ta.ri.da] | ~ | [tɛ.ri.da] | 'to iron' |
| | [ja.ri.da] | ~ | [jɛ.ri.da] | 'to be tender' |
| | [ka.rjɔp.t'a] | ~ | [kɛ.rjɔp.t'a] | 'to be itchy' |
| | [ə.ri.da] | ~ | [e.ri.da] | 'to be young' |
| | [pə.ri.da] | ~ | [pe.ri.da] | 'to throw away' |
| vs. | [u.ri.da] | | *[y.ri.da] | 'soak out' |
| | [pu.ri.da] | | *[py.ri.da] | 'to work (a person)' |
| | [tsu.ri.da] | | *[tsy.ri.da] | 'to be hungry for' |
| b. | [kəl.li.da] | | *[kel.li.da] | 'to be hooked' |
| | [mal.li.da] | | *[mɛl.li.da] | 'to stop' |
| | [kul.li.da] | | *[kyl.li.da] | 'to roll' |
| c. | [ta.ri] | | *[tɛ.ri] | 'bridge' |
| | [mu.ri] | | *[my.ri] | 'throng' |
| | [mə.ri] | | *[me.ri] | 'head' |
| | [ts ^h a.rje] | | *[ts ^h ɛ.rje] | 'order' |

The other proposal for an intervening consonant or cluster in Umlaut is concerned with the North Phyengan dialect of North Korea where no coronal consonants block Umlaut, as shown in (4) (e.g., Chung 1938, Kim 1963, Toh 1981, Choi 1982, Choi 1984, Kim 1985).

- (4)
- | | | | |
|-------------------------------|---|-------------------------------|---------------------|
| [ma.di] | ~ | [mɛ.di] | 'knot' |
| [ts ^h a.ɗzi.ha.da] | ~ | [ts ^h ɛ.ɗzi.ha.da] | 'to occupy' |
| [tsə.ts ^h i.da] | ~ | [tsɛ.ts ^h i.da] | 'to turn over' |
| [sən.njə] | ~ | [sen.njə] | 'nymph' |
| [kan.ɗzi.rəm] | ~ | [kɛn.ɗzi.rəm] | 'tickling' |
| [man.ɗzi.da] | ~ | [mɛn.ɗzi.da] | 'to touch' |
| [sa.ts ^h i.ha.da] | ~ | [sɛ.ts ^h i.ha.da] | 'to be extravagant' |
| [ə.ts ^h i] | ~ | [ɛ.ts ^h i] | 'worth' |

⁶ Ahn does not provide information on how he collected his data, who were his informants, and to which dialects they belonged. Note that the intervocalic lateral /l/ in (3) is changed into [r] in Korean.

Finally, the proposal that only coronal affricates block the rule of Umlaut while the other coronal consonants are transparent to it, comes from Hume (1990) whose data are based on her work with two native speakers of the Kyengsang dialect of South Korea.⁷ As shown in (5), her data show Umlaut across non-coronal consonants and all coronal consonants, except affricates.

(5)

a. Umlaut occurs:

i) across a non-coronal consonant:

/koki/	[ke.gi]	'meat'
/mæk + hi + ta/	[me.k ^h i.da]	'to be eaten'
/t̃suk + i + ta/	[t̃sy.gi.da]	'to kill'
/api/	[ɛ.bi]	'father'
/t̃s ^h ap ^h pi/	[t̃s ^h ɛŋ.p ^h i]	'shame'
/sum + ki + ta/	[sym.gi.da]	'to hide'

ii) across an anterior coronal:

/kili + ta/	[ki.ri.da]	'to draw, paint'
/salp ^h + i + ta/	[sɛl.p ^h i.da]	'to inspect closely'
/t̃oti + ta/	[te.di.da]	'moving slowly'
/puti/	[pi.di]	'by all means'
/t̃santi/	[t̃sɛn.di]	'lawn'

b. Umlaut is blocked across an affricate:

/kat̃s ^h i/	[ka.t̃s ^h i]	*[kɛ.t̃s ^h i]	'value'
/tat̃si + ta/	[ta.d̃zi.da]	*[tɛ.d̃zi.da]	'to mince'
/tot̃si + ta/	[to.d̃zi.da]	*[te.d̃zi.da]	'worsening of an illness'
/hut̃si + ta/	[hu.d̃zi.da]	*[hy.d̃zi.da]	'to be old-fashioned'
/p ^h ət̃si + ta/	[p ^h ə.d̃zi.da]	*[p ^h e.d̃zi.da]	'to spread out'

⁷ According to Hume (p.c.), she worked with one native speaker in his late thirties from Pusan, South Kyengsang province, and consulted another native speaker. In the data in (5), the word /kat̃s^hi/ is not a native Korean word but a Sino-Korean word where Umlaut is not usually expected, though there are some few exceptions, as we will discuss below.

The disagreements about which intervening consonant blocks Umlaut in the above lead us to reconsider the process with a question of whether non-coronals are always transparent to Umlaut, while all coronals always block it or they do so except /l/ or only affricates block it, as usually assumed in the literature. To answer the question on Korean Umlaut, a survey was conducted. As we will see later, it is shown in the survey that the place of articulation of an intervening consonant or cluster is not consistent with conditioning Umlaut. Rather it is shown that Korean Umlaut is conditioned by non-phonological variables such as lexical, dialectal and individual differences. Based on the results of the survey, it is proposed that Korean Umlaut is phonologically represented as the spread of the secondary vocalic feature [coronal] to a preceding vowel across an intervening consonant or cluster, regardless of its place of articulation, and that it is a sound change called *lexical diffusion*.

This paper is organized as follows: section 2 introduces the data and results of the survey; section 3 is a proposal of Korean Umlaut; and section 4 is a brief conclusion of this paper.

2. A Survey of Umlaut

2.1. Data

The total number of the subjects who participated in the survey is thirty four, and they were students, government officials, artists and people associated with church work, such as a pastor. The dialects to which the subjects belonged ranged from the Seoul dialect to two southern dialects (Kyengsang and Cella), and two middle dialects (Chwungcheng and Kyengki) in South Korea. Eight of the subjects belonged to the Seoul dialect; ten of them to the Kyengsang dialect; seven of them to the Cella dialect; four of them to the Chwungcheng dialect; and five of them to the Kyengki dialect.⁸ Test words were prepared from previous studies such as Kim (1973), Hume (1990) and others, and also from my own consultation of a Korean dictionary in which appropriate words were chosen where back vowels are followed by a high

⁸ The dialectal classifications of speakers are based on where the subjects were born and grew up in their teens and twenties. See Appendix 1 for further information on our subjects.

front vocoid across one or more intervening consonants. The test words were all native Korean, except for several Sino-Korean words which were included to see whether Umlaut applies if Sino-Korean words are perceived as native due to their frequency. In the test words, there were some words where a back vowel is followed by the high front rounded vowel /y/ or the palatal glide /j/, as in /ipsaky/ 'leaf' and /əljəpta/ 'to be difficult', to see whether these contexts trigger vowel fronting, since these vocoids are specified as [coronal, -anterior] like the vowel /i/.⁹ In test words were also included native Korean and Sino-Korean words followed by the subject marker /i/, and some Sino-Korean words whose final morpheme has the high front vocoid /i/ or /j/.¹⁰ The total number of the test words is one hundred thirty two.

In a questionnaire, the test words were written with their unmlauted alternants in Korean and mixed them up so that the subjects would focus only on whether they have vowel fronting in test words, not noticing the main purpose of the survey. Given questionnaires in my presence, subjects were asked to write down their responses in the following ways: a) if they use the unmlauted alternations in their own speech, they were asked to write 'o'; b) if they never use the unmlauted alternations in their own speech, they were asked to write 'x'.

2.2. Results

In (6) are the results when the intervening consonant is non-coronal with dialects presented in the following order: southern dialects (Kyengsang and Cella dialects), the Seoul dialect, middle dialects (Kyengki and Chwungcheng dialects). Umlauted alternants with fronted vowels are marked in bold face in the first column in (6). A female subject is referred to as F and a male subject as M, and results are sorted out in terms of the total numbers of "o" responses for each test word in the last column and for each subject in the last row.

⁹ See Appendix 2 for the test words with their unmlauted alternants, classified by the place of articulation of an intervening consonant or cluster. All examples therein conform to the morphological conditions mentioned above, except that adverbs are included.

¹⁰ See Appendix 2 (j).

(6) when the intervening consonant is non-coronal (17 items)

a. Kyengsang dialect (10 subjects)

	F1	F2	F3	F4	F5	M1	M2	M3	M4	M5	Total "o" responses
[ɛ.gi]	o	x	o	o	o	o	o	o	o	o	9
[sə.ul.kə'ak.t͡s'ɛŋ.i]	o	o	o	x	o	o	o	o	o	o	9
[se.k'i.da]	x	x	x	x	x	x	x	x	x	x	0
[sɛ.gi.da]	x	x	x	x	x	x	x	o	o	x	2
[k'ɛ.k'i.da]	o	x	x	x	x	x	x	x	o	x	2
[t͡sy.gi.da]	o	o	x	x	x	o	o	o	x	o	6
[e.gi.da]	x	x	x	x	x	x	x	x	x	x	0
[p'e.gi.da]	o	x	x	x	x	x	x	x	x	o	2
[ka.d͡zɛ.mi]	o	o	x	x	x	o	o	o	o	o	7
[sø.gi.da]	x	x	x	x	x	o	x	o	x	x	2
[son.d͡zɛ.bi]	o	o	x	x	x	o	x	o	o	o	6
[t ^h o.bɛ.gi]	o	o	x	o	x	o	o	o	o	o	8
[kø.gi]	x	x	x	x	x	x	x	o	x	x	1
[ɛ.bi]	x	o	x	o	x	o	x	o	o	x	5
[kɛ.bjɔp.t'a]	x	x	x	x	x	x	x	o	x	x	1
[ip.s'ɛ.ky]	x	o	x	x	x	o	x	o	x	x	3
[sa.mɛ.ky]	x	x	x	x	x	x	x	o	x	x	1
Total "o" responses	8	7	2	3	2	9	5	13	8	7	64

b. Cella dialect (7 subjects)

	F1	F2	F3	F4	F5	M1	M2	Total "o" responses
[ɛ.gi]	o	o	o	x	x	o	o	5
[sə.ul.k'ak.t͡s'ɛŋ.i]	oo	o	x	o	x	o	5	2
[se.k'i.da]	x	x	o	x	x	x	o	2
[sɛ.gi.da]	x	x	o	x	x	x	o	0
[k'ɛ.k'i.da]	x	x	x	x	x	x	x	0
[t͡sy.gi.da]	x	x	x	x	x	x	x	0
[e.gi.da]	x	x	x	x	x	x	x	0
[p'e.gi.da]	x	o	o	x	x	o	o	4
[ka.d͡zɛ.mi]	x	x	o	x	o	o	o	4
[sø.gi.da]	x	x	o	x	x	x	x	1
[son.d͡zɛ.bi]	x	x	o	x	x	o	o	3
[tho.bɛ.gi]	x	o	o	x	x	o	o	4
[kø.gi]	x	x	o	x	x	x	x	1
[ɛ.bi]	x	o	o	x	x	o	o	4
[kɛ.bjɔp.t'a]	x	x	o	x	x	x	o	2
[ip.s'ɛ.ky]	x	x	o	x	x	x	o	2
[sa.mɛ.ky]	x	x	o	x	x	x	o	2
Total "o" responses	2	5	14	0	2	6	12	41

c. Seoul dialect (8 subjects)

	F1	F2	F3	M1	M2	M3	M4	M5	Total "o" responses
[ɛ.gi]	0	0	0	x	0	0	0	0	7
[sə.ul.k'ak.t̃s'ɛŋ.ji]	0	0	0	0	0	x	x	x	5
[se.k'i.da]	x	x	x	x	x	x	0	x	1
[sɛ.gi.da]	x	0	x	x	x	x	0	x	2
[k'.ɛ.k'i.da]	x	x	x	x	x	x	x	x	0
[t̃sy.gi.da]	x	0	x	x	x	x	x	x	1
[e.gi.da]	x	x	x	x	x	x	x	x	0
[p'e.gi.da]	x	x	x	x	x	x	x	x	0
[ka.d̃zɛ.mi]	0	0	x	0	0	0	0	x	5
[sø.gi.da]	x	x	x	x	x	x	x	x	0
[son.d̃zɛ.bi]	0	x	x	x	x	0	x	x	2
[t ^h o.bɛ.gi]	x	x	0	x	0	0	x	x	3
[kø.gi]	x	x	x	x	x	x	x	x	0
[ɛ.bi]	0	0	0	0	0	x	x	x	5
[kɛ.bjəp.t'a]	x	x	x	x	x	x	x	x	0
[ip.s'ɛ.ky]	x	x	x	x	x	x	x	x	0
[sa.mɛ.ky]	x	x	x	x	x	x	x	x	0
									31
Total "o" responses	5	6	4	2	5	4	4	1	31

d. Kyengki dialect (5 subjects)

	F1	F2	F3	M1	M2	Total "o" responses
[ɛ.gi]	x	0	x	0	0	3
[sə.ul.k'ak.t̃s'ɛŋ.ji]	x	0	x	0	0	3
[se.k'i.da]	x	x	x	0	x	1
[sɛ.gi.da]	x	0	x	0	x	2
[k'.ɛ.k'i.da]	x	x	x	x	x	0
[t̃sy.gi.da]	x	x	x	0	x	1
[e.gi.da]	x	x	x	x	x	0
[p'e.gi.da]	x	x	x	x	x	0
[ka.d̃zɛ.mi]	x	0	x	0	x	2
[sø.gi.da]	x	x	x	x	x	0
[son.d̃zɛ.bi]	x	x	x	0	x	1
[t ^h o.bɛ.gi]	0	x	x	0	x	2
[kø.gi]	x	x	x	x	x	0
[ɛ.bi]	0	x	x	0	0	3
[kɛ.bjəp.t'a]	x	x	x	x	x	0
[ip.s'ɛ.ky]	0	x	x	0	x	2
[sa.mɛ.ky]	x	x	x	x	x	0
						20
Total "o" responses	3	4	0	10	3	20

e. Chwungcheng dialect (4 subjects)

	M1	M2	M3	M4	Total "o" responses
[ɛ.gi]	o	o	x	o	3
[sə.ul.k'ak.ʔs'ɛŋ.i]	o	o	x	o	3
[se.k'i.da]	x	x	x	x	0
[sɛ.gi.da]	x	x	x	x	0
[k'ɛ.k'i.da]	x	x	x	x	0
[ʔsy.gi.da]	x	x	x	x	0
[e.gi.da]	x	x	x	x	0
[p'e.gi.da]	x	x	x	x	0
[ka.dʒɛ.mi]	o	x	x	x	1
[sø.gi.da]	x	x	x	x	0
[son.dʒɛ.bi]	x	x	x	x	0
[t ^h o.bɛ.gi]	o	x	x	x	1
[kø.gi]	x	x	x	x	0
[ɛ.bi]	x	x	x	x	0
[kɛ.bjəp.t'a]	x	x	x	x	0
[ip.s'ɛ.ky]	x	x	x	x	0
[sa.mɛ.ky]	x	x	x	x	0
					8
Total "o" responses	4	2	0	2	8

The results in (6) show three types of non-phonological variables: lexical, dialectal, and individual differences. First, we can note a high degree of lexical conditioning. When the intervening consonant is non-coronal, the subjects did not always have vowel fronting, regardless of which dialect they spoke. The results also show that they had vowel fronting in certain words but not others, even across the same consonant. For instance, we can note that though vowel fronting applies quite productively across the stop /k/ in the word /aki/ 'baby', the subjects did not report vowel fronting as productively across the same consonant in other testwords in (6). None of them reported having vowel fronting across the velar stop /k/ in the word /əkita/ 'to violate' in their own speech. In the two test words /p'əkita/ 'to be haughty' and /sok +i+ta/ 'to cheat'+caus., no subjects of the Seoul, Kyengki, and Chwungcheng dialects reported vowel fronting across the velar stop /k/, whereas a few subjects in the Kyengsang and Cella dialects reported vowel fronting in these words. Another case would be vowel fronting across the velar tense stop /k/. No subjects in any dialect, except F1 and M4 in the Kyengsang dialect, reported vowel fronting across the stop /k/ in /k'ak'ita/ 'to trim'+caus. But in the test word /sək'ita/ 'to mix'+passive, no subjects in the Kyengsang dialect reported vowel fronting across the same velar stop /k/, while a few subjects

in the Cella, Seoul and Kyengki dialects reported vowel fronting here.

Second, the results in (6) also show dialect differences. Table 1 below shows the percentage of the “o” responses when an intervening consonant is non-coronal. The percentage of the “o” responses across dialects is 26%, among which the subjects in the Kyengsang dialect reported vowel fronting the most frequently (38%) which is followed by those in the Cella dialect (35%), whereas those in the Chwungcheng dialect reported vowel fronting the least frequently (12%) in their own speech.

Table 1. The percentage of the “o” responses when the intervening consonant is non-coronal.

Kyengsang	38
Cella	35
Seoul	23
Kyengki	24
Chwungcheng	12
	26

From Table 1 we can also note that in the context, Umlaut occurs more in the two southern dialects of Kyengsang and Cella than in the other three dialects.

Third, when we take a closer look at the results in (6) in a single dialect, we also find substantial individual differences in vowel fronting. That is, even in a single dialect several subjects reported more vowel fronting than others. For example, in the Kyengsang dialect (6a), M3 had more tendency to report unlauded forms in his own speech (77%) than any other subject, whereas F3 and F5 had the least tendency (12%). In the Cella dialect (6b) F3 reported unlauded forms the most productively (82%) among the subjects across dialects, and is followed by M2 who reported unlauded forms in his own speech (71%). But the rest of the subjects reported less unlauded forms in their own speech. In the Seoul dialect (6c), F2 reported unlauded forms most productively (35%) among surveyed Seoulites, but the frequency of her unlauded forms is much lower than that of M3 in the Kyengsang dialect and those of F3 and M2 in the Cella dialect. The subjects in the Kyengki dialect (6d) also exhibit a similar tendency of vowel fronting in relation to the other dialects: some subjects reported more vowel fronting than the others. The subject M1 reported unlauded forms the most (59%), while the other subjects reported only three or four unlauded forms, or none in the case of F3. In the Chwungcheng dialect (6e), the subjects rarely used unlauded alternants

except the two test words /aki/ 'baby' and /səulk'aktəsəŋ i/ 'shrewd Seoultite', while M3 never used unlauded alternants, even in the two test words where the other subjects speaking the same dialect and those speaking the other dialects in (6) reported unlauded alternants.

Furthermore, the present study also shows that there is no strict condition of cross-dialect validity concerning the place of articulation of an intervening consonant or cluster. For instance, vowel fronting can apply not *only across non-coronal consonants*, as in (6), but also *across coronals* including an affricate. In particular, it is noteworthy that vowel fronting often applies across an affricate as well as a consonant cluster including a coronal affricate. As shown in Table 2, a summary table of percentages comparing contexts in each dialect, the rate of vowel fronting of our subjects' own speech when the intervening consonant is a coronal affricate

Table 2 Dialect pattern (%) across contexts ("o" responses)

	Kyengsang	Cella	Seoul	Kyengki	Chwungcheng	Average
a.	38	35	23	24	12	26
b.	11	20	7	10	2	10
c.	10	11	1	7	2	6
d.	49	34	13	22	3	24
e.	34	36	14	37	16	27
f.	23	26	9	17	4	16
g.	18	22	3	22	6	14
h.	4	7	2	6	4	5
i.	3	17	2	3	0	5
j.	2	14	0	0	0	3
overall:	19	22	7	15	5	14

a: when the intervening consonant is non-coronal

b: when the intervening consonant is a coronal affricate

c: when the intervening consonant is a coronal stop, nasal or fricative

d: when the intervening consonant is /l/

e: when the intervening consonant cluster is non-coronal

f: when the intervening consonant cluster includes a coronal affricate

g: when the intervening consonant cluster consists of a non-coronal consonant and a coronal consonant other than a coronal affricate

h: when the intervening consonant cluster is entirely only a coronal and contains no affricate

i: when a native Korean or Sino-Korean word is followed by the subject marker /i/

j: Sino-Korean words whose second morpheme contains /i/

(10% in (b)) is higher than when the intervening consonant is a coronal stop, nasal or fricative (6% in (c)); the rate of vowel fronting when the intervening consonant cluster includes a coronal affricate (16% in (f)) is higher than when the intervening consonant cluster is a non-coronal and a coronal (14% in (g)) or when the intervening consonant cluster is coronal (5% in (h)).

Interestingly, Table 2 shows several strong tendencies in which contexts do and do not favor Umlaut, though the process occurs across the contexts. The percentage of “o” responses across contexts is 14%, among which the percentage of the contexts (a), (d), and (e) is all above 20%. In particular, when we consider vowel fronting of the cluster /n̄t̄s/ separately in the context wherein the intervening consonant cluster includes a coronal affricate (f), the percentage of “o” responses across dialects is 33%.¹¹ But, the percentage of the other contexts is much lower. This shows that the subjects favored the contexts (a), (d), (e) and the consonant cluster /n̄t̄s/ for vowel fronting. That is, single or double non-coronals (a, e), single /l/ (d) and the consonant cluster /n̄t̄s/ in (f) are the most transparent contexts in vowel fronting. In contrast, single coronals including a coronal affricate (b, c), coronal clusters (h, f) except /n̄t̄s/, non-coronal plus /t̄s/ cluster (f) and geminates /kk/ (e) and /ll/ (h) are relatively more opaque contexts. It is also noteworthy that across contexts, coronal affricates do not behave much differently from coronal stops and fricatives, except that /n̄t̄s/ is much more transparent than /nt/ or /ns/.

A closer examination of vowel fronting in a single dialect also confirms the result of Table 2 that there is no strict condition on the place of articulation of an intervening consonant or cluster. Instead of strict condition, our survey shows that the lexical conditioning of vowel fronting is extensively individual-specific, regardless of to which dialect an individual belongs. Table 3 illustrates individual-specific patterns by examining individual responses from e.g. the Kyengsang dialect, plotted across

¹¹ The following table shows the percentage of “o” responses in each dialect when the intervening consonant cluster is /n̄t̄s/.

Kyengsang	36
Cella	43
Seoul	20
Kyengki	32
Chwungcheng	<u>0</u>
	33

contexts.¹² M3 reported vowel fronting more frequently in his own speech than any other subject in the Kyengsang dialect, whereas F5 in the same dialect barely reported vowel fronting, regardless of whether the intervening consonant is non-coronal (a) or coronal including an affricate (b, c, d). F2 and M5 reported no vowel fronting in their own speech when the intervening consonant is a coronal stop, nasal or fricative (c) and when the intervening consonant cluster is only a coronal and contains no affricate (h). But they reported vowel fronting in their own speech when the intervening consonant is a coronal affricate (b) and when the intervening consonant cluster includes a coronal affricate (f). On the other hand, F3 and M2 reported no vowel fronting in their own speech when the intervening consonant is a coronal affricate (b), but they reported vowel fronting when the intervening consonant cluster includes a coronal affricate (f). F1, M1, M3 and M4 reported vowel fronting in their own speech, no matter whether the intervening consonant and consonant cluster is non-coronal (a, e), coronal including an affricate (b, c, d, f, h), or non-coronal plus coronal (g).

Table 3 Individual-specific patterns in the Kyengsang dialect across contexts ("o" responses)

	F1	F2	F3	F4	F5	M1	M2	M3	M4	M5	Total %	Rank	
a.	8	7	2	3	2	9	5	13	8	7	64	38	2
b.	5	4	0	3	0	4	0	9	1	3	29	11	6
c.	3	0	0	1	0	1	1	5	1	0	12	10	7
d.	8	5	2	5	0	6	4	7	6	6	49	49	1
e.	8	4	1	3	1	9	5	7	8	2	47	34	3
f.	5	3	1	0	1	5	1	5	2	4	27	23	4
g.	2	1	0	1	0	2	1	4	3	2	16	18	5
h.	2	0	0	0	0	3	0	1	1	0	7	4	8
I.	0	0	0	0	0	0	0	1	1	0	2	3	9
j.	0	0	0	0	0	0	0	1	0	0	1	2	10
Total	41	24	6	15	4	39	17	53	31	24			
%	32	19	5	12	3	30	13	40	26	19			
Rank	2	5	9	8	10	3	7	1	4	5			

In support of the results shown in the above, we can refer to the vowel fronting across the single liquid /l/ and the geminate /ll/ in our survey.

¹² As references to the contexts of Umlaut, the alphabetical letters in the first row in Table 3 correspond to those in Table 2.

According to Ahn (1989), Umlaut does not apply when an intervening consonant is the geminate liquid /ll/ in a verb, whereas it applies when the intervening lateral /l/ is preceded by an unrounded vowel, not by a rounded vowel in a verb, as shown in (3). But the present survey shows that it can apply in both contexts, following the same tendencies -- lexical, dialectal and individual differences -- as in the other contexts.

First of all, when the intervening consonant is the single liquid /l/ preceded by an unrounded vowel in a verb, some subjects from the middle dialects -- the Seoul dialect, the Kyengki dialect and the Chwungcheng dialect -- reported vowel fronting in their own speech, partially confirming Ahn's account.¹³ But seven of the seventeen subjects from these three dialects reported no vowel fronting in the same context.

Umlaut also applies even when an intervening consonant is the geminate liquid /ll/ in a verb with the same tendencies, which is not consistent with Ahn (1989).¹⁴ For instance, when the intervening consonant is the geminate /ll/ in a verb, two subjects (M1 and F1) in the Kyengki dialect reported vowel fronting in their idiolects in the test words /ʔsal+li+ta/ 'to be cut' and /tallita/ 'to run', respectively, and one subject (M4) in the Chwungcheng dialects reported vowel fronting in his idiolect in the test word /t'əl+li+ta/ 'to shake'+caus. In the other test words no subjects in the two dialects reported vowel fronting in their idiolects. In the Cella dialect, F3 reported vowel fronting in /p^hal+li+ta/ 'to sell'+pass., whereas M2 did so in the three test words /ʔsal+li+ta/ 'to be cut', /tallita/ 'to run' and /t'əl+li+ta/ 'to shake'+caus. In the Kyengsang dialect, only F1 reported vowel fronting in /sa+li+ta/ 'to make alive'. In contrast, in the case of the Seoul dialect no subjects reported vowel fronting across the geminate /ll/ in their own speech except when M5 had vowel fronting in the adverb /p'alli/ 'quickly'.

Table 4 shows the comparison of the umlauted cases across the intervening geminate liquid /ll/ in (a) and those across the single liquid /l/ in (b), in terms of percentage of "o" responses. As shown below, the subjects across dialects reported having vowel fronting even when the intervening consonant is /ll/ (a), although umlauted cases were reported much more when the intervening consonant is /l/ (b).

¹³ See Appendix 3 for the results when the intervening consonant is the single liquid /l/.

¹⁴ See Appendix 2 (h) for the test words with the geminate liquid /ll/ in the present survey.

Table 4 The comparison of the percentage of "o" responses when the intervening consonants are /l/ (a) and /l/ (b)

a.	/l/	b.	/l/
Kyengsang	1	Kyengsang	49
Cella	5	Cella	34
Seoul	1	Seoul	13
Kyengki	3	Kyengki	22
Chwungcheng	2	Chwungcheng	3
	2		24

In addition, as lexical differences in the two contexts /l/ and /l/, we can note that our subjects reported vowel fronting frequently in some words but rarely in others across dialects. For instance, several subjects in the Kyengsang, Cella, Seoul and Kyengki dialects reported vowel fronting in e.g. the word /talita/ 'to iron', but none in the Chwungcheng dialect reported vowel fronting in the word. It is in the word /s'ilita/ 'to have a heartburn' that only M2 reported vowel fronting in his own speech in the Chwungcheng dialect. Regarding individual differences, F3 in the Cella dialect, for instance, reported vowel fronting in all the test words in her own speech, but F1, F4 and M1 in the same dialect reported no vowel fronting in the test words in their own speech, while F2, F5 and M2 reported vowel fronting in some test words.

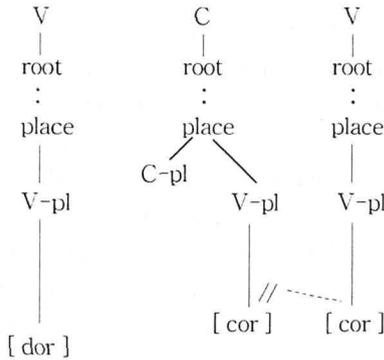
To sum up, the present survey has shown the following in overall. First of all, we have noted from the above survey that vowel fronting does not apply uniformly in words whose intervening consonants or consonant clusters are of the same place of articulation, regardless of whether the consonants are non-coronal or coronal, and that it does not apply uniformly either across dialects or among individual speakers. Rather we have noted that Umlaut is conditioned by non-phonological variables such as lexical, dialectal and individual differences.

Second, we have also noted that there is no strict condition of cross-dialect validity concerning the place of articulation of an intervening consonant or cluster. Our survey has shown that not only non-coronal but also coronal consonants including affricates and /l/ can be either transparent or opaque to vowel fronting across survey dialects.

Third, the results show that the Kyengsang data (5) reported by Hume (1990) is not representative of the patterns reported by the Kyengsang speakers. In order to provide a phonological account of why only affricates

among coronal consonants function as blockers of Umlaut in the Kyengsang dialect, as in (5), Hume (1990) proposes that a Korean affricate is alveolo-palatal with the secondary vocalic feature [coronal], thus blocking the spread of the vocalic feature from a following front vocoid, as shown in (7).¹⁵

(7)



(Hume 1990)

The spread of the secondary vocalic feature [coronal] across affricates violates a universal constraint against crossing the association line (e.g., Goldsmith 1976), because of the presence of the same feature in affricates. When intervening consonants are obstruents other than affricates, they are transparent in vowel fronting, due to the absence of the secondary vocalic feature [coronal] in those consonants in Hume’s account.

However, as already shown in Table 2, Umlaut can occur even across an affricate (the context (b)) and a consonant cluster including an affricate (the context (f)) across dialects including Kyengsang dialect. Instead of consistently blocking Umlaut, as proposed by Hume (1990), our survey has shown that not only in the Kyengsang dialect but also in the other dialects, affricates behave like the other coronal and non-coronal consonants in that they can be transparent or sometimes opaque to vowel fronting like the latter.

Finally, some results of the survey do offer support for several earlier descriptions in the literature. We have noted from the present survey that

¹⁵ In Hume (1990), Korean affricates are assumed to be palatal, but in Hume (1992) they are reinterpreted as alveolo-palatal, due to the assumption that palatals have no secondary vocalic feature [coronal].

We assume that Umlaut observes the Locality Condition in the sense of Odden (1994). What we mean here by the Locality Condition is that the trigger and target of Umlaut are required to be 'local' within the V-pl plane, as shown in (8). Since an intervening consonant or cluster, regardless of its place of articulation, does not bear secondary articulations in our analysis, the target and trigger of Umlaut immediately dominated by the V-pl node are local to each other within the plane of the V-pl node.¹⁶ But the C-pl node, to which its primary articulator feature of an intervening consonant or cluster is linked, is on a different plane from that of the V-pl node. Thus no consonant can block Umlaut, regardless of its place of articulation. Our assumption that the target and trigger vowel can characterize non-adjacent root nodes is justified by the fact that Umlaut applies across an intervening consonant or cluster.

We also propose that Korean Umlaut is a case of the type of sound change called lexical diffusion: context-by-context or item-by-item sound change.¹⁷ According to Kiparsky (1995: 643), an important clue to the identity of lexical diffusion is "its driftlike spread through the lexicon, by which it extends a phonological process context by context, and within each new context item by item."

In support of Korean Umlaut as a case of lexical diffusion, we can provide four pieces of evidence for the gradual word-by-word, context-by-context extension of the scope of Umlaut from the survey: the core environment of Umlaut -- monomorphemic native Korean nouns and verbs -- is loosened such that the context for Umlaut is extended to a) some native Korean adverbs¹⁸; b) some Sino-Korean words; c) some native Korean or some other Sino-Korean words suffixed by the subject marker /i/; and d) the trigger of Umlaut is loosened such that it is extended to the high front rounded vowel /y/. We discuss these four pieces of evidence in turn below.

First, vowel fronting often applies in some native Korean adverbs. As in monomorphemic native Korean nouns and verbs, the present survey shows the similar lexical conditioning of Umlaut and individual/dialectal differences as well when test words are adverbs, as in (9).

¹⁶ For phonological and phonetic evidence that Korean affricates do not bear secondary articulations, see Kim (1997, 1999a, b).

¹⁷ See Wang (1979), Labov (1994), Kiparsky (1988, 1995), Lee (1999) and the references cited there for general discussion of lexical diffusion in the literature.

¹⁸ In this respect Choi (1989) also considers Umlaut as a case of diffusion.

(9)

	umlauted alternants	
/ə̃tsikanhi/	[e.ɗzi.gan.hi]	'fairly'
/k'uf̃sil̃k'uf̃sil̃/	[k'y.ɗzil.k'y.ɗzil]	'nastily'
/tasi/	[tɛ.si]	'again'
/puti/	[py.di]	'please'
/ə̃ts'ina/	[e.ʃs'i.na]	'how, very'
/kaʃsilənhi/	[kɛ.ɗzi.rən.hi]	'trimly, neatly'
/k'aʃsilakk'aʃsilak/	[k'ɛ.ɗzi.rak.k'ɛ.ɗzi.rak]	'listlessly'
/p'ə̃nt̃silp'ə̃nt̃sil/	[p'en.ɗzil.p'en.ɗzil]	'sleekly'
/p'ə̃nt̃silili/	[p'en.ɗzi.ri.ri]	'greasily, glossly'
/salʃs'aki/	[sal.ʃs'ɛ.gi]	'softly'
/kansinhi/	[kɛn.sin.hi]	'barely, hardly'
/p'alli/	[p'ɛl.li]	'quickly'

As in monomorphemic native Korean nouns and verbs, the subjects had vowel fronting in certain adverbs more than in other adverbs. For instance, the subjects across dialects reported vowel fronting across a coronal affricate or a cluster including a coronal affricate in the adverbs /ə̃tsikanhi/ 'fairly', /p'ə̃nt̃silp'ə̃nt̃sil/ 'sleekly' and /p'ə̃nt̃silili/ 'greasily, glossly' in their own speech more than in the other test words in (9). But in the adverb /ə̃ts'ina/ 'so, quite' our subjects reported no vowel fronting, though the intervening consonant /ʃs/ is an affricate, as in the three adverbs /ə̃tsikanhi/ 'fairly', /p'ə̃nt̃silp'ə̃nt̃sil/ 'sleekly' and /p'ə̃nt̃silili/ 'greasily, glossly'. The subjects across dialects reported no vowel fronting in the adverbs /tasi/ 'again' and /puti/ 'please', but a few subjects across dialects reported vowel fronting across the consonant /s/ in the adverb /kansinhi/ 'barely, hardly'. The survey also shows that across dialects the subjects except M5 in the Seoul dialect had no vowel fronting in /p'alli/ 'quickly'. Four of ten subjects in the Kyongsang dialect reported vowel fronting in /salʃs'aki/ 'softly', but no subjects in the Seoul and Chwungcheng dialects reported vowel fronting in the adverb.

In addition to such lexical conditioning and individual differences, dialectal differences were also reported when test words are adverbs, as in (9). Table 5 below shows the percentage of "o" responses in each dialect. The percentage of "o" responses across dialects is 21%, among which the subjects in the Cella dialect reported vowel fronting the most frequently (37%) and those in the Chwungcheng dialect reported vowel fronting the

least frequently (2%) in their speech.

Table 5 The percentage of “o” responses in native Korean adverbs

Kyengsang	24
Cella	37
Seoul	18
Kyengki	23
Chwungcheng	2
	21

Such lexical, individual and dialectal differences in the adverbs in (9) are similar to those observed in monomorphemic native Korean nouns and verbs, and this leads us to say that Umlaut extends its scope also into adverbs.

Second, Umlaut usually does not apply in Sino-Korean words, as shown in (10).

(10)

/sa + pi/	[sa.bi]	*[sɛ.bi]	‘private expense’
/sa + ki/	[sa.gi]	*[sɛ.gi]	‘fraud’
/kə + ts ^h i/	[kə.ts ^h i]	*[ke.ts ^h i]	‘deferment’
/no + pi/	[no.bi]	*[nø.bi]	‘servant’
/p ^h o + ki/	[p ^h o.gi]	*[p ^h ø.gi]	‘surrender’
/so + ts ^h i/	[so.ts ^h i]	*[sø.ts ^h i]	‘result’
/ku + pi/	[ku.bi]	*[ky.bi]	‘equipment’

But in the present survey of some Sino-Korean words, two of seven subjects in the Cella dialect reported vowel fronting in their own speech in the three Sino-Korean words /sək + ju/ ‘petroleum’, /am + ki/ ‘memory’ and /hak + kjo/ ‘school’.¹⁹ Except one subject in the Kyengsang dialect who reported vowel fronting in the word /hak + kjo/ ‘school’, no other subjects reported vowel fronting in their speech. Thus the percentage of their usage of unlauted alternants across dialects is 3%, as shown in Table 2 (j).

Third, additional data in support of the lexical diffusion of Umlaut comes from native Korean and Sino-Korean words followed by the subject marker /i/ in the survey.²⁰ Seven of the thirty four subjects reported having vowel fronting in [[mam]_s i] ‘mind’ + subj. in their own speech: two in the

¹⁹ See Appendix 2 (j) for the Sino-Korean test words in the survey.

²⁰ See Appendix 2 (i) for the test words.

Kyengsang dialect; three in the Cella dialect; one in the Seoul dialect and the Kyengki dialect, respectively. In the Cella dialect, two subjects reported having unlauded alternants in the three test words -- [[kam]ɳ i] 'persimmon'+ subj., [[tək]ɳ i] 'virtue'+subj., and [[wəlkip]ɳ i] 'monthly payment'+subj.

Finally, the fact that the high front rounded vowel /y/ can trigger Umlaut can also be regarded as additional data in support of the lexical diffusion of Umlaut. As in the previous cases in section 2, the vowel fronting triggered by the vowel /y/ shows three types of non-phonological variables: lexical, dialectal and individual differences. In the three test words -- /tutət̃sy/ 'mole', /ipsaky/ 'leaf', and /samaky/ 'mantis' -- the subjects reported vowel fronting, and among the three test words, they reported vowel fronting more in the testword /ipsaky/ 'leaf' than in the other two test words. In addition to such a lexical conditioning, the survey shows individual differences. Three subjects in the Kyengsang dialect, two subjects in the Cella dialect, and two subjects in the Kyengki dialect reported vowel fronting in the test word /ipsaky/ 'leaf' in their own speech, whereas in the word /tutət̃sy/ 'mole' only two subjects in the Kyengsang dialect and in the Cella dialect, reported vowel fronting. No subjects in the Seoul and Chwungcheng dialects reported vowel fronting in the test words.

As for dialectal differences, Table 6 below shows the percentage of "o" responses in each dialect. The percentage of "o" responses across dialects is 7%, among which our subjects in the Kyengsang dialect reported vowel fronting the most frequently (17%) and those in the Seoul and Chwungcheng dialects reported no vowel fronting.

Table 6 The percentage of "o" responses when the target vowel is followed by the high front rounded vowel /y/

Kyengsang	17
Cella	5
Seoul	0
Kyengki	13
Chwungcheng	0
	7

So far we have provided four pieces of evidence for the lexical diffusion of Umlaut context by context: the core environment of Umlaut is loosened such that the context for Umlaut is extended to a) some native Korean adverbs; b) some Sino-Korean words; c) some native Korean or some other

Sino-Korean words suffixed by the subject marker /i/; and d) the trigger of Umlaut is loosened such that it is extended to the high front rounded vowel /y/.

4. Conclusion

In this paper we have shown from the survey that Korean Umlaut is conditioned by the three types of non-phonological variabilities: lexical, dialectal and individual differences, and also that it can occur no matter whether an intervening consonant or cluster is non-coronals or coronals including affricates. Given the results of the survey, we have proposed that Korean Umlaut is phonologically represented as the spread of the secondary vocalic feature [coronal] to a preceding vowel across an intervening consonant or cluster, regardless of its place of articulation. We have also proposed that Korean Umlaut is a kind of sound change called lexical diffusion, according to which sound change spreads through the lexicon context by context and item by item within each new context.

Consequently, based on the present survey, we can conclude that Korean affricates pattern together with the other “alveolar” coronal in Korean Umlaut, indicating they are not alveolo-palatals, and that the process of Umlaut in Korean propagates itself gradually context by context and word by word through the lexicon, though differentiated by lexical, dialectal and individual differences.

Appendix 1

a. The subjects in the Kyengsang dialect

	age	birth place	occupation
F1:	30's	Pusan	student
F2:	20's	Pusan	student
F3:	30's	Taykwu	student
F4:	30's	Phohang	student
F5:	30's	Masan	student
M1:	30's	Kyengnam	government official
M2:	30's	Pusan	student
M3:	50's	Taykwu	artist
M4:	40's	Kyengnam	pastor
M5:	30's	Pusan	student

b. The subjects in the Cella dialect

F2:	40's	Kimce	artist
F3:	40's	Nacwu	housewife
F4:	20's	Cenpuk	student
F5:	20's	Kwangcwu	student
M1:	40's	Cenpuk	government official
M2:	40's	Mokpho	businessman

c. The subjects in the Seoul dialect

F1:	30's	Seoul	student
F2:	30's	Seoul	government official
F3:	30's	Seoul	government official
M1:	40's	Seoul	government official
M2:	40's	Seoul	government official
M3:	30's	Seoul	government official
M4:	40's	Seoul	businessman
M5:	30's	Seoul	student

d. The subjects in the Kyengki dialect

F1:	30's	Swuwen	student
F2:	30's	Inchen	student
F3:	10's	Ichen	student
M1:	40's	Inchen	government official
M2:	10's	Ichen	student

e. The subjects in the Chwungcheng dialect

M1:	40's	Yesan	government official
M2:	40's	Chwungnam	government official
M3:	30's	Chwungnam	artist
M4:	30's	Taycen	student

Appendix 2

a. the intervening consonant is non-coronal:

		umlauted alternants	
/aki/	[a.gi]	[ɛ.gi]	'baby'
/səul.k'akʔsəŋi/	[sə.ul.k'ak.ʔsəŋ.i]	[sə.ul.k'ak.ʔsɛŋ.i]	'shrewd Seoulite'
/sək'+i+ta/	[sə.k'i.da]	[sɛ.k'i.da]	'to mix'+pass.
/sak+i+ta/	[sa.gi.da]	[sɛ.gi.da]	'to calm oneself'
/k'ak'+i+ta/	[k'a.k'i.da]	[k'ɛ.k'i.da]	'to trim'+pass.
/ʔsuk+i+ta/	[ʔsu.gi.da]	[ʔsy.gi.da]	'to kill'+caus.
/əkita/	[ə.gi.da]	[e.gi.da]	'to violate'
/p'əkita/	[p'ə.gi.da]	[p'e.gi.da]	'to be haughty'
/kaʔsami/	[ka.ɗza.mi]	[ka.ɗzɛ.mi]	'flatfish'
/sok+i+ta/	[so.gi.da]	[sø.gi.da]	'to cheat'+caus.
/sonʔsap+i/	[son.ɗza.bi]	[son.ɗzɛ.bi]	'handle, knob'
/t ^h opak+i/	[t ^h o.ba.gi]	[t ^h o.bɛ.gi]	'native'
/koki/	[ko.gi]	[kø.gi]	'meat'
/api/	[a.bi]	[ɛ.bi]	'father'
/kapjəpta/	[ka.bjəp.t'a]	[kɛ.bjəp.t'a]	'to be light'
/ipsaky/	[ip.s'a.gy]	[ip.s'ɛ.gy]	'leaf'
/samaky/	[sa.ma.gy]	[sa.mɛ.gy]	'mantis'

b. the intervening consonant is a coronal affricate:

	umlauted alternants		
/t̥s ^h ətsita/	[t̥s ^h ə.dzi.da]	[t̥s ^h e.dzi.da]	'to hang down'
/t̥s ^h ətsihata/	[t̥s ^h a.dzi.ha.da]	[t̥s ^h ɛ.dzi.ha.da]	'to occupy'
/ətsikanhi/	[ə.dzi.kan.hi]	[e.dzi.kan.hi]	'fairly'
/mut̥sikin̥hata/	[mu.d̥zi.gin.ha.da]	[my.d̥zi.gin.ha.da]	'to feel heavy'
/k'otsipta/	[k'o.d̥zip.t'a]	[k'ø.d̥zip.t'a]	'to pinch'
/k'ut̥sil̥k'ut̥sil/	[k'u.d̥zil.k'u.d̥zil]	[k'y.d̥zil.k'y.d̥zil]	'nastily'
/k'ut̥sil̥ehata/	[k'u.d̥zi.re.ha.da]	[k'y.d̥zi.re.ha.da]	'to be filthy'
/ətsilta/	[ə.d̥zil.da]	[e.d̥zil.da]	'to be benevolent'
/tat̥sita/	[ta.d̥zi.da]	[tɛ.d̥zi.da]	'to harden'
/kətsi/	[kə.d̥zi]	[ke.d̥zi]	'beggar'
/pətsi/	[pə.d̥zi]	[pɛ.d̥zi]	'pant'
/mat̥simak/	[ma.d̥zi.mak]	[mɛ.d̥zi.mak]	'the last'
/mat̥s ^h i/	[ma.t̥s ^h i]	[mɛ.t̥s ^h i]	'like'
/mat̥s ^h + hi + ta/	[ma.t̥s ^h i.da]	[mɛ.t̥s ^h i.da]	'to guess right'
/k'at̥s ^h il̥hata/	[k'a.t̥s ^h il̥.ha.da]	[k'ɛ.t̥s ^h il̥.ha.da]	'to be haggard'
/kəts ^h il̥ta/	[kə.t̥s ^h il̥.da]	[ke.t̥s ^h il̥.da]	'to be rough'
/k'əts ^h il̥hata/	[k'ə.t̥s ^h il̥.ha.da]	[k'e.t̥s ^h il̥.ha.da]	'to look emaciated'
/əts'ina/	[ə.t̥s'i.na]	[e.t̥s'i.na]	'how, very'
/əts'ilhata/	[ə.t̥s'il̥.ha.da]	[e.t̥s'il̥.ha.da]	'to be dizzy'
/katsil̥ənhata/	[ka.d̥zi.rən.ha.da]	[kɛ.d̥zi.rən.ha.da]	'to be in order'
/katsil̥ənhi/	[ka.d̥zi.rən.hi]	[kɛ.d̥zi.rən.hi]	'trimly, neatly'
/hut̥sita/	[hu.d̥zi.da]	[hy.d̥zi.da]	'to be inferior'
/p ^h ətsita/	[p ^h ə.d̥zi.da]	[p ^h e.d̥zi.da]	'to spread'
/tut̥ətsy/	[tu.də.d̥zy]	[tu.de.d̥zy]	'mole'
/tot̥sita/	[to.d̥zi.da]	[tø.d̥zi.da]	'to spread'
/kətsi/	[kə.d̥zi]	[kɛ.d̥zi]	'eggplant, branch'
/t̥səts̥ + hi + ta/	[t̥sə(t).t̥s ^h i.da]	[t̥sɛ(t).t̥s ^h i.da]	'to turn over'
/k'at̥silakk'at̥silak/	[k'a.d̥zi.rak.k'a.d̥zi.rak]	[k'ɛ.d̥zi.rak.k'ɛ.d̥zi.rak]	'listlessly'

c. the intervening consonant is a coronal stop, fricative or nasal:

	umlauted alternants		
/mati/	[ma.di]	[mɛ.di]	'knot'
/tasi/	[ta.si]	[tɛ.si]	'again'
/masita/	[ma.si.da]	[mɛ.si.da]	'to drink'
/tətita/	[tə.di.da]	[tɛ.di.da]	'to be late'
/mutita/	[mu.di.da]	[my.di.da]	'to be dull'
/pət ^h ita/	[pə.t ^h i.da]	[pɛ.t ^h i.da]	'to throw away'
/kasi/	[ka.si]	[kɛ.si]	'thorn'
/kasina/	[ka.si.na]	[kɛ.si.na]	'lass'
/aʔsəsi/	[a.ɗzə.s'i]	[a.ɗze.s'i]	'uncle'
/kənilta/	[kə.nil.da]	[ke.nil.da]	'to stroll'
/puti/	[pu.di]	[py.di]	'please'
/tanita/	[ta.ni.da]	[tɛ.ni.da]	'to attend'

d. the intervening consonant is /l/:

	umlauted alternants		
/pəlita/	[pə.ri.da]	[pe.ri.da]	'to throw away'
/ʔs ^h alita/	[ʔs ^h a.ri.da]	[ʔs ^h ɛ.ri.da]	'to prepare'
/talita/	[ta.ri.da]	[tɛ.ri.da]	'to iron'
/kalita/	[ka.ri.da]	[kɛ.ri.da]	'to hide, choose'
/s'ilita/	[s'i.ri.da]	[s'i.ri.da]	'to burn'
/kilita/	[ki.ri.da]	[ki.ri.da]	'to draw'
/ʔsəlita/	[ʔsə.ri.da]	[ʔse.ri.da]	'to be sore'
/kaljəpta/	[ka.rjəp.t'a]	[kɛ.rjəp.t'a]	'to be ticklish'
/əlita/	[ə.ri.da]	[e.ri.da]	'to be young'
/əljəpta/	[ə.rjəp.t'a]	[e.rjəp.t'a]	'to be difficult'

e. the intervening consonant cluster is non-coronal:

	umlauted alternants		
/mæk + hi + ta/	[mæ(k).k ^h i.da]	[mɛ(k).k ^h i.da] ²¹	'to eat' + pass.
/kam + ki + ta/	[kam.gi.da]	[kɛm.gi.da]	'to shut' + pass.
/f̄sam + ki + ta/	[f̄sam.gi.da]	[f̄sɛm.gi.da]	'to soak' + pass.
/sak + hi + ta/	[sa(k).k ^h i.da]	[sɛ(k).k ^h i.da]	'to digest'
/makhi + ta/	[ma(k).k ^h i.ta]	[mɛ(k).k ^h i.da]	'to obstruct' + pass.
/pak + hi + ta/	[pa(k).k ^h i.da]	[pɛ(k).k ^h i.da]	'to nail' + pass.
/səm + ki + ta/	[səm.gi.da]	[sem.gi.da]	'to serve'
/əŋk ^h ita/	[əŋ.k ^h i.da]	[eŋ.k ^h i.da]	'to get tangled'
/f̄sap + hi + ta/	[f̄sa(p).p ^h i.da]	[f̄sɛ(p).p ^h i.da]	'to catch' + caus.
/samk ^h ida/	[sam.k ^h i.da]	[sɛm.k ^h i.da]	'to swallow'
/f̄sæk + hi + ta/	[f̄sə(k).k ^h i.da]	[f̄sɛ(k).k ^h i.da]	'to write' + pass.
/f̄s ^h əp ^h i/	[f̄s ^h əp ^h i]	[f̄s ^h ɛp ^h i]	'shame'
/sum + ki + ta/	[sum.gi.da]	[sym.gi.da]	'to conceal'
/jək ^h kjəpta/	[jək.k ^h jəp.t'a]	[jek.k ^h jəp.t'a] ²²	'to feel sick'

f. the intervening consonant cluster includes a coronal affricate:

	umlauted alternants		
/kanf̄siləpta/	[kan.ɗzi.rəp.t'a]	[kɛn.ɗzi.rəp.t'a]	'to be ticklish'
/manf̄sita/	[man.ɗzi.da]	[mɛn.ɗzi.da]	'to touch'
/p'ənf̄silp'ənf̄sil/	[p'ən.ɗzil.p'ən.ɗzil]	[p'ɛn.ɗzil.p'ɛn.ɗzil]	'sleekly'
/pənf̄silili/	[pən.ɗzi.ri.ri]	[pɛn.ɗzi.ri.ri]	'greasily, glossly'
/salf̄s ^h ita/	[səl.f̄s ^h i.da]	[sɛl.f̄s ^h i.da]	'to work halfway'
/kalf̄s ^h ita/	[kəl.f̄s ^h i.da]	[kɛl.f̄s ^h i.da]	'to extend, stretch'
/salf̄s ^h aki/	[sal.f̄s ^h a.gi]	[sɛl.f̄s ^h ɛ.gi]	'softly'
/ənf̄s ^h ita/	[ən.f̄s ^h i.da]	[ɛn.f̄s ^h i.da]	'to have indigestion'
/əp̄hf̄s ^h ita/	[əp̄.f̄s ^h i.da]	[ɛp̄.f̄s ^h i.da]	'to turn upside down'
/k'amf̄s'ikhata/	[k'am.ɿk'ik.ha.ta]	[k'ɛm.ɿk'ik.ha.ta]	'to be precocious'
/k'akf̄si/	[k'ak.ɿ'i]	[k'ɛk.ɿ'i]	'pod'
/f̄səf̄s ^h + hi + ta/	[f̄sə(t).f̄s ^h i.da]	[f̄sɛ(t).f̄s ^h i.da]	'to lean back' + caus.

²¹ When a verb-stem final consonant is followed by the suffix /hi/, there are two accounts of the surface phonological representation of the stem-final consonant. One is that the stem-final consonant is coalesced with the suffix-initial consonant /h/ by a single process, as in [k^h] in [mæk^hi.da] (e.g. Cho 1990). The other is that it remains in its neutralized form with the coalesced segment together in spelling pronunciation, as in [k] in [mæk.k^hi.da], while it is deleted in fast speech, giving e.g. [mæk^hi.da] (e.g. Kim-Renaud 1974, Iverson and Kim-Renaud 1994). Though it is not relevant to our present discussion whether or not the stem-final consonant remains on the surface, we follow the latter approach in our transcription here giving the stem-final consonant in parenthesis.

²² In Korean a consonant after an obstruent becomes tense by virtue of the

- g. the intervening consonant cluster consists of a non-coronal consonant and a coronal consonant other than an affricate:

	umlauted alternants		
/əpsinjəkita/	[əp.sin.jə.gi.da]	[ep.sin.jə.gi.da]	'to despise'
/tat + hi + ta/	[ta(t).t͡sʰi.da]	[tɛ(t).t͡sʰi.da] ²³	'to close' + caus.
/an + ki + ta/	[an.gi.da]	[ɛn.gi.da]	'to embrace' + caus.
/pəs + ki + ta/	[pə(t).k'i.da]	[pɛ(t).k'i.da] ²⁴	'to take off' + caus.
/kamanhi/	[ka.man.hi]	[ka.mɛn.hi]	'silently'
/salpʰita/	[sal.pʰi.da]	[sɛl.pʰi.da]	'to inspect'
/əpsi/	[əp.si]	[ep.si]	'without'
/k'alkita/	[k'al.gi.da]	[k'ɛl.gi.da]	'to scribble'
/hankil/	[han.gil]	[hɛn.gil]	'big street'

- h. the intervening consonant cluster is entirely coronal and contains no affricate:

	umlauted alternants		
/t͡santi/	[t͡san.di]	[t͡sɛn.di]	'grass'
/kjəntita/	[kjən.di.da]	[kjen.di.da]	'to endure'
/mantilta/	[man.dil.da]	[mɛn.dil.da]	'to make'
/kansinhi/	[kan.sin.hi]	[kɛn.sin.hi]	'barely, hardly'
/al + li + ta/	[al.li.da]	[ɛl.li.da]	'to know' + caus.
/sal + li + ta/	[sal.li.da]	[sɛl.li.da]	'to make alive'
/pʰal + li + ta/	[pʰal.li.da]	[pʰɛl.li.da]	'to sell' + pass.
/t͡sal + li + ta/	[t͡sal.li.da]	[t͡sɛl.li.da]	'to cut' + pass.
/k'al + li + ta/	[k'al.li.da]	[k'ɛl.li.da]	'to spread' + pass.
/kəl + li + ta/	[kəl.li.da]	[kɛl.li.da]	'to hang' + caus.
/tallita/	[tal.li.da]	[tɛl.li.da]	'to run'
/k'il + li + ta/	[k'il.li.da]	[k'ɛl.li.da]	'to pull' + caus.
/t'əl + li + ta/	[t'əl.li.da]	[t'ɛl.li.da]	'to shake' + caus.
/p'alli/	[p'al.li]	[p'ɛl.li]	'quickly'
/mallita/	[mal.li.da]	[mɛl.li.da]	'to get dry'
/kullita/	[kul.li.da]	[kyl.li.da]	'to roll'
/pəllita/	[pəl.li.da]	[pɛl.li.da]	'to open'
/tol + li + ta/	[tol.li.da]	[tɔl.li.da]	'to turn' + caus.
/t͡sol + li + ta/	[t͡sol.li.da]	[t͡sɔl.li.da]	'to fall asleep'

independent rule of Post-obstruent Tensing (e.g. Kim-Renaud 1974), as in the second /k/ and /t/ in /jəkəkjəpta/ 'to feel sick'.

²³ The stem-final stop /t/ is affricated when followed by the causative suffix /hi/.

²⁴ The fricative /s/ is neutralized into [t] in coda position in Korean.

- i. when a native Korean or Sino-Korean word is followed by the subject marker /i/

		unlouted alternants	
/mam+i/	[ma.mi]	[mɛ.mi]	'mind'+subj.
/salam+i/	[sa.ra.mi]	[sa.rɛ.mi]	'person'+subj.
/kam+i/	[ka.mi]	[kɛ.mi]	'persimmon'+subj.
/tək+i/	[tə.gi]	[te.gi]	'virtue'+subj.
/kuk+i/	[ku.gi]	[ky.gi]	'soup'+subj.
/wəlkip+i/	[wəl.gi.bi]	[wəl.gi.bi]	'monthly payment'+subj.

- j. Sino-Korean words whose second morpheme contains /i/ or /j/

/t̥sənki/	[t̥sən.gi]	[t̥sen.gi]	'electricity'
/t̥səŋsin/	[t̥səŋ.sin]	[t̥seŋ.sin]	'spirit'
/səkju/	[sə.gju]	[se.gju]	'petroleum'
/amki/	[am.gi]	[ɛm.gi]	'memorizing'
/hakkjo/	[hak.k'jo]	[hɛk.k'jo]	'school'

Appendix 3

When the intervening consonant is /l/ (10 items)

- a. the Kyengsang dialect (10 subjects)

	F1	F2	F3	F4	F5	M1	M2	M3	M4	M5	Total "o" responses
[pe.ri.da]	o	x	x	o	x	o	x	x	x	x	3
[t̥s ^h ɛ.ri.da]	o	o	o	o	x	o	x	o	o	o	8
[tɛ.ri.da]	o	o	x	o	x	o	o	o	o	o	8
[kɛ.ri.da]	o	x	x	x	x	x	x	x	o	x	2
[s'i.ri.da]	o	x	o	x	x	o	o	o	o	o	7
[ki.ri.da]	o	o	x	x	x	o	o	o	o	o	7
[t̥se.ri.da]	x	o	x	x	x	o	o	o	o	o	6
[kɛ.rjəp.t'a]	x	x	x	x	x	x	x	o	x	x	1
[e.ri.da]	o	o	x	o	x	x	x	o	x	x	4
[e.rjəp.t'a]	o	x	x	o	x	x	x	x	x	o	3
											49
Total											
"o" responses	8	5	2	5	0	6	4	7	6	6	49

b. the Cella dialect (7 subjects)

	F1	F2	F3	F4	F5	M1	M2	Total "o" responses
[pɛ.ri.da]	x	x	o	x	x	x	o	2
[t͡sʰɛ.ri.da]	x	o	o	x	o	x	o	4
[tɛ.ri.da]	x	o	o	x	o	x	x	3
[kɛ.ri.da]	x	o	o	x	x	x	o	3
[sʰi.ri.da]	x	x	o	x	x	x	o	2
[ki.ri.da]	x	x	o	x	x	x	o	2
[t͡sɛ.ri.da]	x	o	o	x	x	x	o	3
[kɛ.rjɔp.t'a]	x	x	o	x	x	x	o	2
[e.ri.da]	x	x	o	x	x	x	o	2
[e.rjɔp.t'a]	x	x	o	x	x	x	x	1
								<u>24</u>
Total "o" responses	0	4	10	0	2	0	8	24

c. the Seoul dialect (8 subjects)

	F1	F2	F3	M1	M2	M3	M4	M5	Total "o" responses
[pɛ.ri.da]	x	x	x	x	x	x	x	x	0
[t͡sʰɛ.ri.da]	x	o	x	x	x	x	x	x	1
[tɛ.ri.da]	x	o	x	x	x	o	o	o	4
[kɛ.i.da]	x	x	x	x	x	x	o	x	1
[sʰi.ri.da]	x	x	x	x	x	x	x	x	0
[ki.ri.da]	x	x	x	x	x	x	x	x	0
[t͡sɛ.ri.da]	x	x	x	x	o	x	o	x	2
[kɛ.rjɔp.t'a]	x	x	x	x	x	x	o	x	1
[e.ri.da]	x	x	x	x	x	x	x	x	0
[e.rjɔp.t'a]	x	x	x	x	x	x	o	x	1
									<u>10</u>
Total "o" responses	0	2	0	0	1	1	5	1	10

d. the Kyengki dialect (5 subjects)

	F1	F2	F3	M1	M2	Total "o" responses
[pɛ.ri.da]	o	o	x	x	x	2
[fʰɛ.ri.da]	o	x	x	o	o	3
[tɛ.ri.da]	o	o	x	o	o	4
[kɛ.ri.da]	x	x	x	x	x	0
[s'i.ri.da]	x	x	x	x	o	1
[ki.ri.da]	x	x	x	x	x	0
[tʰɛ.ri.da]	x	x	x	x	x	0
[kɛ.rjəp.t'a]	x	x	x	x	x	0
[e.ri.da]	x	x	x	x	x	0
[e.rjəp.t'a]	x	x	x	o	x	1
						<u>11</u>
Total "o" responses	3	2	0	3	3	11

e. the Chwungcheng dialect (4 subjects)

	M1	M2	M3	M4	Total "o" responses
[pɛ.ri.da]	x	x	x	x	0
[fʰɛ.ri.da]	x	x	x	x	0
[tɛ.ri.da]	x	x	x	h	0
[kɛ.ri.da]	x	x	x	x	0
[s'i.ri.da]	x	o	x	x	1
[ki.ri.da]	x	x	x	x	0
[tʰɛ.ri.da]	x	x	x	x	0
[kɛ.rjəp.t'a]	x	x	x	x	0
[e.ri.da]	x	x	x	x	0
[e.rjəp.t'a]	x	x	x	x	0
					<u>1</u>
Total "o" responses	0	1	0	0	1

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