A Correspondence Analysis on Hiatus Resolution in Korean*

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Kang, Ongmi. 1999. **A Correspondence Analysis on Hiatus Resolution in Korean.** *Studies in Phonetics, Phonology and Morphology* 5, 1-24. A vowel hiatus context is resolved by vowel coalescence, vowel elision, glide formation, or glide insertion. These are all onset-driven phenomena. The formal speech form, which may show a vowel hiatus, is derived by IO-correspondence. A vowel hiatus is eliminated by deleting a V in a V+V sequence or by obligatory glide formation of the first vowel. On the other hand, the casual speech form, where vowel coalescence, optional glide formation and glide insertion occur, is derived by OO-correspondence. The difference between the formal speech form and the casual speech form is the constraint ranking between Onset and other constraints.(**Chosun University**)

Keywords: Vowel Coalescence, Vowel Elision, Glide Formation, Glide Insertion, IO-correspondence, OO-correspondence.

1. Introduction

There are four ways to avoid a vowel hiatus context in Korean; (i) glide formation, if V_1 is *o/u, y*, it becomes a glide *w, y*; (ii) vowel coalescence, a V + V sequence fuses into V:; (iii) vowel elision, V_2 is deleted when V_1 + V_2 are same vowels or one of them is *ɨ*; (iv) glide insertion, a glide *y, w* is inserted between V_1 + V_2.

In this paper I argue that the formal speech form, which has a vowel hiatus context, is mediated by IO-correspondence and the casual speech form, where optional glide formation, vowel coalescence, and glide

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insertion occur, is done by OO-correspondence. These hiatus resolution strategies are motivated to eliminate onsetless syllables in the output. The following table shows how a vowel hiatus is resolved in each context.

(1)

	① Glide Formation with Compensatory Lengthening			② Vowel Coalescence	③ Vowel Elision	④ Glide Insertion
① Glide Formation with CL	V_1 \ V_2	ə	a	i	ɨ	ə/e
	u	wəː		üː	u	uwə
	o		waː	öː	o	
	i	yəː			i	iyə/e
② VC	e	eː	eː	eː	e	eyə
	ɛ	ɛː	ɛː	ɛː	ɛ	
③Vowel Elision	a		a	ɛː	a	
	ə	ə		eː	ə	
	ɨ	ə		iː	ɨ	

This paper is organized as follows. First, I introduce a distinction between IO-correspondence and OO-correspondence to explain formal speech forms and casual speech forms. Second, I will show how a vowel hiatus is resolved by glide formation, vowel coalescence, vowel elision or glide insertion. Third, ɨ-deletion shows an asymmetry between root + derivational suffix and stem + inflectional suffix. To explain this, I adopt a distinction between a prosodic stem(PS) and a prosodic word(PW).

2. Correspondence Theory

Vowel hiatus strategies will be analyzed under Correspondence Theory, which restricts correspondence mapping between two given strings:

(2) Correspondence Theory(McCarthy and Prince 1995)
Given two strings S_1 and S_2, correspondence is a relation $\mathcal{R}$ from the elements of S_1 to those S_2. Segments α (an element of S_1) and β (an element of S_2) are referred to as correspondents of one another when $\alpha \mathcal{R} \beta$.

Correspondence theory requires mutual correspondence between S_1 and S_2. It was originally proposed to relate the identity between the input and the output, which is called IO-correspondence. Recently McCarthy and Prince (1995) and Benua(1995) extended it to explain the relation between the base and the reduplicant and between the full form and the truncated form(Benua 1995), which is called OO-correspondence.

Correspondence identity is regulated by faithfulness constraints, as shown in (3).

(3) Faithfulness Constraints
MAX: every segment in S_1 has a correspondent in S_2.
DEP: every segment in S_1 has a correspondent in S_2.
MAX(μ): every mora in S_1 has a correspondent in S_2.
IDENT(μ): mora associations in S_1 should be the same as those in S_2.
where S_1 is the input(I), the base, the formal speech form(F), and S_2 is the output(O), the reduplicant, the casual speech form(C).

Identity of the pairs of IO-correspondence and OO-correspondence is regulated by parallel but distinct sets of faithfulness constraints (MAX-IO[1]), MAX-FC, DEP-IO, DEP-FC, IDENT-IO(μ), IDENT-FC(μ), MAX-IO(μ), MAX-FC(μ), etc.), which will be referred to as IO-Faith and FC-Identity.

I assume that the formal speech form in Korean is an output derived by IO-correspondence while the casual speech form is another output by OO-correspondence(FC-Identity). The lines in (4) represent each correspondence relation.

[1]At the later part of this paper MAX-IO will be divided into two classes, MAX-V_{IO} and MAX-C_{IO} according to each segment(vowel or consonant).

(4)

FC-Identity

Base(formal speech form) casual speech form

[sa$^{\mu}$i$^{\mu}$] ---------------------- [sε$^{\mu\mu}$]

IO-Faith

Input /sa$^{\mu}$i$^{\mu}$/

Note that the casual speech form and the formal speech form in Korean are separate independent outputs. Korean native speakers tend to have onset in syllable rather than onsetless syllable. Casual speech forms resolve a vowel hiatus found in formal speech forms. Therefore, I claim that glide formation, vowel coalescence, and glide insertion are motivated to fulfill the constraint Onset in casual speech forms.

In the following sections I will consider how constraints in the formal speech form are reranked in the casual speech form.

3. Vowel Coalescence and Compensatory Lengthening

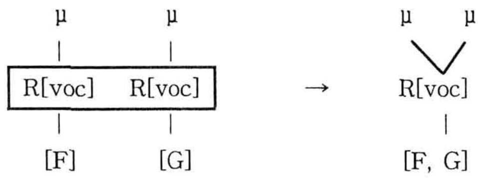
Before we discuss vowel coalescence, let us see vowel inventory in Korean. In this paper I assume 10 vowel system for Standard Korean, as shown in (5):

(5)

	front V		central V	back V
	unrounded	rounded	unrounded	rounded
high vowel	i	ü	ɨ	u
mid vowel	e	ö	ə	o
low vowel	ε		a	

Traditionally vowel coalescence has been defined as a fusion: segmentally adjacent two vowels fuse into one vowel, which has the feature combination of two vowels. The process is illustrated in (6).

(6) Vowel Coalescence



When a back vowel *o, u* or a central vowel *a, ə, ɨ* is followed by a high front vowel *i* in casual speech, they are optionally coalescenced into a front vowel *ö, ü, ε, e, i* at the same heightness. Vowel coalescence occurs morpheme internally or across morpheme boundaries. Compensatory lengthening applies only at the first syllable of the casual speech form.

Features involved in vowel coalescence are heightness of V_1 and [-back] of V_2, as shown in (7)-(11).[2]

(7) /a/ + /i/		→	[ε:]		
			formal speech form	casual speech form	
	/ai/	→	[ai],	[ε:]	'child'
	/sai/	→	[sai],	[sε:]	'gap'
	/sanai/	→	[sanε],	*[sanε:]	'man'
	/aiko/	→	[aigo],	[εgo][3]	'alas'
(8) /ə/ + /i/		→	[e:]		
	/ilɨlt^{h}əimyən/	→	[irɨlt^{h}əimyən],	[irɨlt^{h}emyən]	'so to speak'
	/əiku/	→	[əigu]	[egu]	'oh'
(9) /o/ + /i/		→	[ö:]		
	/oi/	→	[oi],	[ö:]	'cucumber'
	/po+i+ta/	→	[poida]	[pö:da]	'to be seen'

[2]Sung-Kyu Kim pointed out to me that *say* 'gap' in the late middle Korean became *sε*. Therefore, the vowel coalescence in (7)-(11) is not a synchronical process but a reflex of historical change. At the end of the 18th century diphthongs *əy, ay, uy, oy* changed into simple vowels *e, ε, ü, ö*. However, in present day Korean a sequence of V+V is coalescenced into a vowel. In fact, according to speech style the words in (7)-(11) have alternating forms. Therefore, I claim that vowel coalescence above is a synchronical process.

[3]Casual forms (7) [εgo] and (8) [egu] do not show compensatory lengthening.

	/čo+i+ta/	→ [čoida]	[čö:da]	'to be tightened'
(10)	/u/ + /i/	→ [ü:]		
	/onui/	→ [onui],	[onü]	'brother and sister'
	/nu+i+ta/	→ [nuida],	[nü:da]	'let (a child) urinate'
(11)	/ɨ/ + /i/	→ [i:]		
	/t'ɨ+i/	→ [t'ɨi],	[t'i:], *[t'i]	'to be found'
	/t^hɨ+i/	→ [t^hɨi],	[t^hi:], *[t^hi]	'to be opened'
(12)	/čɛu+ta/	→ [čɛuda]		'let sleep+Dec' 4)
	/seu+ta/	→ [seuda]		'let stand+Dec'
	/t^hɛu+ta/	→ [t^hɛuda]		'let burn up+Dec'
	/$č^h$ɛu+ta/	→ [$č^h$ɛuda]		'let pile up+Dec'

Let us first look at how constraints are ranked for the formal speech form (7) /sai/, as shown in (13). The form (13a) has the same number of syllables as its input and the quality of mora is preserved in the output. However, it violates Onset once. Both (13b) and (13c) violate Uniformity-IO since *ɛ* corresponds to *a* and *i*. Furthermore, (13b) violates MAX-IO(μ) since the total number of mora in the input is not preserved in the output. The form (13d) is filtered out by the highest constraint DEP-IO due to an insertion of a consonant. Therefore, (13a) is selected as optimal.

(13) Formal speech form: Uniformity-IO ≫ Onset

Input: /$s_1a^{\mu}_2i^{\mu}_3$/	a. MAX-IO b. DEP-IO	Uniformity-IO	Onset	MAX-IO(μ)
☞a. $s_1a^{\mu}_2i^{\mu}_3$			*	
b. $s_1ɛ^{\mu}_{23}$		*!		*
c. $s_1ɛ^{\mu\mu}_{23}$		*!		
d. $s_1a^{\mu}_2$□i^{μ}_3	b. *!			

[4]Etymologically these are called double causative construction. For example, /čɛ u/ could be analyzed as /ča/ root + /i/ causative suffix + /u/ causative suffix. The words in (12) are not formed by a synchronic word-formation rule but are diachronically lexicalized. It cannot be identified as /čɛ+u+ta/ since */čɛ+ta/ is not an actual word. Therefore, I claim that the internal structure is /čɛu+ ta/.

The form (13c), where vowel coalescence applied, is suboptimal. I claim that in formal speech forms Uniformity-IO dominates Onset.

Next let us consider how constraints are reordered in casual speech forms. The candidate (14a) is filtered out by the constraint Onset. A vowel hiatus in (13a) is eliminated by vowel coalescence in (14b) and (14c). In (14b) and (14c) *a* + *i* sequence in the formal speech form corresponds to *ε* in the casual speech form, violating Uniformity-FC. The vowel length in the base is preserved in (14c) while it is not in (14b), violating MAX-FC(μ). Therefore, the optimal output is (14c).

(14) Casual speech form: Onset ≫ Uniformity-FC

Base: [$s_1a^{\mu}{}_2i^{\mu}{}_3$]	a. MAX-FC b. DEP-FC	Onset	MAX-FC(μ)	Uniformity-FC
a. $s_1a^{\mu}{}_2i^{\mu}{}_3$		*!		
b. $s_1\varepsilon^{\mu}{}_{23}$			*!	*
☞c. $s_1\varepsilon^{\mu\mu}{}_{23}$				*
d. $s_1a^{\mu}{}_2$□$i^{\mu}{}_3$	b. *!			

Contrary to the formal speech form, Onset dominates Uniformity-FC in the casual speech form. Vowel coalescence in casual speech form is onset-driven.

Next let us look at vowel coalescence at the second syllable. Note that Seoul dialect allows long vowels only at the initial syllable of the word. The relevant constraint for this is from Yongsung Lee(1997):

(15) Align-$\sigma_{\mu\mu}$(Yongsung Lee 1997)
Heavy syllables are in the initial position of a PW.

The candidate (16c), which satisfies MAX-IO(μ), violates the highest constraint Align-$\sigma_{\mu\mu}$ since the second syllable of the word is heavy. The optimal output for the formal speech form is (16a).

(16) Formal speech form: Align-$\sigma_{\mu\mu}$ ≫ MAX-IO(μ)

Input: /$s^{\mu}a^{\mu}{}_{2}n_{3}a^{\mu}{}_{4}i^{\mu}{}_{5}$/	Align-$\sigma_{\mu\mu}$	Uniformity-IO	Onset	MAX-IO(μ)
☞a. $s_{1}a^{\mu}{}_{2}n_{3}a^{\mu}{}_{4}i^{\mu}{}_{5}$			*	
b. $s_{1}a^{\mu}{}_{2}n_{3}\varepsilon^{\mu}{}_{45}$		*!		*
c. $s_{1}a^{\mu}{}_{2}n_{3}\varepsilon^{\mu\mu}{}_{45}$	*!	*		

Let us look at candidates of causal speech forms. A vowel hiatus in (16a) is resolved by coalescence in (17b) and (17c). The form (17c) violates Align-$\sigma_{\mu\mu}$ since the second syllable is lengthened. This suggests that Align-$\sigma_{\mu\mu}$ outranks MAX-FC(μ). Therefore, the optimal output is (17b).

(17) Casual speech form: Align-$\sigma_{\mu\mu}$ ≫ MAX-FC(μ)

Base:[$s_{1}a^{\mu}{}_{2}n_{3}a^{\mu}{}_{4}i^{\mu}{}_{5}$]	Align-$\sigma_{\mu\mu}$	DEP-FC	Onset	MAX-FC(μ)	Uniformity-FC
a. $s_{1}\bar{a}^{\mu}{}_{2}n_{3}a^{\mu}{}_{4}i^{\mu}{}_{5}$			*!		
☞b. $s_{1}a^{\mu}{}_{2}n_{3}\varepsilon^{\mu}{}_{45}$				*	*
c. $s_{1}a^{\mu}{}_{2}n_{3}\varepsilon^{\mu\mu}{}_{45}$	*!				*
d. $s_{1}a^{\mu}{}_{2}n_{3}a^{\mu}{}_{4}\square i^{\mu}{}_{5}$		*!			

At first glance the vowel coalescence in (18) looks different from that in (7)-(11), but they are same. When V_1 + V_2 sequences have some feature specifications in common, they fuse into V_1 and the mora of V_2 in the formal speech form is preserved in V_1 of the casual speech form.

(18) $V^{\mu}{}_{1}$ + $V^{\mu}{}_{2}$ → $V^{\mu\mu}{}_{1}$

		formal speech form	casual speech form	
a. /ε + ə/	→	[ε:/e:][5]		
/kε + əsə/	→	[kεəsə]	[kε:sə]	'to fold'
/ponε + əla/	→	[ponεəra]	[ponεra][6]	'let … send'
b. /ε + i/	→	[ε:/e:]		

[5]Young speakers of Seoul dialect and Chŏlla dialect and speakers of Kyungsang dialect cannot differentiate *ε* from *e*. For them, (18b) and (18a) are pronounced the same.

[6]The casual form [ponεra] is pronounced as [ponε:ra] in Kyungsang Dialect. In Kyungsang Dialect longs vowels can appear non-initial position of the word.

/mε+i+ta/	→	[mεida]	[mε:da]	'to be bound'
c. /ε + a/	→	[ε:/e:]		
/p'εas+ki+ta/	→	[p'εatk'ida]	[p'ε:tk'ida]	'to be stolen'
/sεaŋčü/	→	[sεaŋǰü]	[sε:ŋǰü]	'mouse'
d. /e + i/	→	[e:]		
/pe + i /	→	[pei]	[pe:]	'to be cut'

When a bimoraic verb stem-final vowel is followed by a vowel, as shown in (19), the long vowel cannot surface.

(19) $V^{\mu\mu}_1 + V^{\mu}_2 \rightarrow V^{\mu\mu}_1$

a. /t'e: + ə/	→	[t'eə],	*[t'e:ə],	[t'e:]	'to take out'
b. /tö: + ə/	→	[töə],	*[tö:ə],	[tö:]	'to be stiff'

This is due to the constraint Short proposed by Casali(1996).

(20) Short(Casali 1996)
Prevocalic vowels should not be bimoraic.

The constraint Short does not allow phonetically long vowels in the prevocalic position and hence prevocalic bimoraic vowels get shortened in Korean. Therefore, the constraint Short dominates MAX-IO(μ).

Then, let us look at the formal speech form of (19a) /t'e: + ə/. The form (21a) is ruled out by Short since the long vowel *e:* is followed by a short vowel *ə*. The form (21c) is also ruled out by Align-$\sigma_{\mu\mu}$ since the long vowel *ə* shows up at the second syllable of the output. Therefore, (21b) is selected as optimal.

(21) Formal speech form: Short, Align-$\sigma_{\mu\mu}$ ≫ MAX-IO(μ)

Input: /t'$e^{\mu\mu}{}_1$+$ə^{\mu}{}_2$/	a. Short b. Align-$\sigma_{\mu\mu}$	Uniformity-IO	Onset	MAX-IO(μ)
a. t'$e^{\mu\mu}{}_1ə^{\mu}{}_2$	a. *!		*	
☞ b. t'$e^{\mu}{}_1ə^{\mu}{}_2$			*	*
c. t'$e^{\mu}{}_1ə^{\mu\mu}{}_2$	b. *!		*	
d. t'$e^{\mu\mu}{}_{12}$		*!		*

A vowel hiatus found in (21b) is coalescenced in the casual speech form (22a) by OO-correspondence, violating Uniformity-FC. The form (22b) is filtered out by MAX-FC(μ). The form (22c) violates Onset once. The form (22d) is ruled out by DEP-FC by the insertion of a segment. Therefore, the optimal output is (22a).

(22) Casual speech form:

Base: [t'$e^{\mu}{}_1ə^{\mu}{}_2$]	a. MAX-FC b. DEP-FC	Onset	MAX-FC(μ)	Uniformity-FC
☞ a. t'$e^{\mu\mu}{}_{12}$				*
b. t'$e^{\mu}{}_{12}$			*!	*
c. t'$e^{\mu}{}_1ə^{\mu}{}_2$		*!		
d. t'$e^{\mu}{}_1$□$ə^{\mu}{}_2$	b. *!			

In this section I have discussed vowel coalescence in Korean verbs. The constraint ranking involved in this section is summarized below:

(23) a. IO-Correspondence: formal speech forms
Align-$\sigma_{\mu\mu}$, Short ≫ MAX-IO, DEP-IO ≫ Uniformity-IO ≫ Onset ≫ MAX-IO(μ)
b. OO-Correspondence: casual speech forms
Align-$\sigma_{\mu\mu}$, ≫ MAX-FC, DEP-FC ≫ Onset ≫ MAX-FC(μ) ≫ Uniformity-FC

Formal speech forms and casual speech forms differ from each other by constraint ranking between Onset and Uniformity. In the formal speech form Uniformity-IO dominates Onset so that a vowel hiatus context occurs. On the other hand, in the casual speech form Onset dominates Uniformity-FC and hence a vowel hiatus is resolved.

4. Vowel Elision without Compensatory Lengthening

As noted in the previous section, vowel coalescence shows compensatory lengthening. However, vowel elision is accompanied by a mora deletion so that no compensatory lengthening is observed. In this section I will show that vowel elision is an instance of IO-correspondence.

Before we move into vowel elision, I claim that prosodic domains should be mentioned in constraints. Derivational(passive/causative) suffixes in Korean behave differently from inflectional suffixes in phonology. For example, when the root-final vowel *ɨ* is followed by the passive suffix *i*, both of them are fully pronounced in formal speech forms, as shown in (24). However, when the stem-final vowel *ɨ* in (26) is followed by the connective suffix *ə*, *ɨ* is deleted.

			formal speech	casual speech		
(24)	/t'ɨ+i/	→	[t'ɨ.i]$_{PS}$,	[t'i:]$_{PS}$,	*[t'i]$_{PS}$	'to be found'
	/tʰɨ+i/	→	[tʰɨ.i]$_{PS}$,	[tʰi:]$_{PS}$,	*[tʰi]$_{PS}$	'to be opened'
(25)	/t'ɨ+i+ə/	→	[t'ɨ.i.ə]$_{PW}$,	[t'ɨy.ə]~[t'ɨ.yə],	*[[t'i]$_{PS}$ə]$_{PW}$	'to be found'
	/tʰɨ+i+ə/	→	[tʰɨ.i.ə]$_{PW}$,	[tʰɨy.ə]~[tʰɨ.yə],	*[[tʰi]$_{PS}$ə]$_{PW}$	'to be opened'
(26)	/k'ɨ+ə/	→	[k'ə]$_{PW}$,	*[k'ɨ.ə]$_{PW}$,	*[k'ə:]$_{PW}$	'to extinguish'
	/s'ɨ+ə/	→	[s'ə]$_{PW}$,	*[s'ɨ.ə]$_{PW}$,	*[s'ə:]$_{PW}$	'to write'
	/ka+ɨmyən/	→	[ka.myən]$_{PW}$,	*[ka.ɨ.myən]$_{PW}$		'if go'
	/kʰyə+ɨmyən/	→	[kʰyə.myən]$_{PW}$,	*[kʰyə.ɨ.myən]$_{PW}$		'if play'
(27)	/s'iu+ə/	→	[s'i.wə],	*[s'i.u.ə],		'let ...be worn'[7]
	/tʰiu+ə/	→	[tʰi.wə]	*[tʰi.u.ə],		'let ...be opened'

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[7]These are etymologically classified as double causative construction, /s'ɨ+i+u/, /tʰɨ+i+u/. The words in (27) are composed of a lexicalized monomorphemic stem+inflectional suffix along the lines with (12).

With respect to prosodic constituents in the lexicon, No-Ju Kim(1997) differentiates the prosodic stem(PS) from the prosodic word(PW).[8] A morphological stem corresponds to a prosodic stem. Thus, a root + derivational suffix(passive/causative) forms a prosodic stem, while a morphological stem + inflectional suffix forms a prosodic word.[9]

(28) a. $_{stem}$[root + Der. suf] → $_{PS}$[ ]
b. [$_{stem}$[ ] + Inf. suf] → $_{PW}$[ ]

If we adopt (28), *ɨ*-deletion does not apply to (24)-(25) within a PS, while it does to (26) within a PW.

With these prosodic constituents, let us look at ɨ-deletion again. When a stem-final *ɨ* is followed by a vowel-initial suffix *ə*, as shown in (29), or when the stem-final vowel is followed by a ɨ-initial suffix, as shown in (30), both *ɨ* and the mora are deleted. Vowel elision occurs either across verb stem + inflectional suffix boundaries or across noun stem + inflectional suffix boundaries.

(29) stem-final ɨ + V → V

/pap'ɨ + ə/	→	[pap'ə],	*[pap'ɨə]	'to be busy'
/s'ɨ + ə/	→	[s'ə],	*[s'ɨə], *[s'əː]	'to write'
/k'ɨ + ə/	→	[k'ə],	*[k'ɨə], *[k'əː]	'to extinguish'

(30) V+ suffix-initial ɨ → V

a. verb stem + suffix

/k'ɛ + ɨmyən/	→	[k'ɛmyən],	*[k'ɛɨmyən]	'if wake up'
/s'o + ɨmyən/	→	[s'omyən],	*[s'oɨmyən]	'if shoot'
/ču + ɨni/	→	[čuni],	*[čuɨni]	'to give-effective'
/po + ɨni/	→	[poni],	*[poɨni]	'to see-effective'

b. noun stem + suffix

/no + ɨlo/	→	[noro],	*[noɨro]	'with an oar'

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[8]Oum(1996) suggests that there should be two levels in the lexicon based on the productivity of phonological phenomena: level 1(derivational suffixes) and level 2(inflectional suffixes).

[9]Ongmi Kang(1992) also proposed that the PW in Korean corresponds to the left end of a lexical category(N, V, Adj, Adv). Therefore, each stem in compounds and a prefix + stem in complex words form an independent PW.

/pata + ɨlo/ → [padaro], *[padaɨro] 'to the sea'

Why *ɨ* is deleted instead of other vowel? It has been known that *ɨ* is the least marked vowel in Korean. First, *ɨ* is easily deleted in a hiatus context, as shown in (29) and (30). Second, *ɨ* is inserted to syllabify onset or coda clusters of western borrowings(strike → $sɨt^hɨraik^hɨ$, milk → $milk^hɨ$). Deletion of *ɨ* in (29) and (30) is due to a phono-constraint $*[..V+ɨ..]_{PW}$(mirror image), which does not allow *V+ɨ, *ɨ+V within a PW. To satisfy $\%*[..V+ɨ..]_{PW}$, the unmarked *ɨ* is deleted. This requires that IO-Faithfulness constraint MAX-IO for vowels be ranked differently; MAX-IO(a, o, e...) outranks MAX-IO(ɨ) in *ɨ*-deletion. The constraint ranking between $\%*[..V+ɨ..]_{PW}$ and MAX-IO is as follows:

(31) $\%*[..V+ɨ..]_{PW}$ ≫ MAX-IO(ə, o, e...) ≫ MAX-IO(ɨ)

The form (32a) is filtered out by the phono-constraint $\%*[..V+ɨ..]_{PW}$. The form (32c) is ruled out by Align-$\sigma_{\mu\mu}$. The form (32d) violates MAX-IO(ə) since *ɨ* is realized. Therefore, (32b) is chosen as optimal.

(32) MAX-IO(ə) ≫ MAX-IO(ɨ)

Input: $/k_1ə^{\mu}{}_2n_3n_4ɨ^{\mu}{}_5+ə^{\mu}{}_6/$	a. %*V+ɨ b.Align-$\sigma_{\mu\mu}$	a.MAX-IO(ə) b.DEP-IO	Uniformiy -IO	Onset	a.MAX-IO(ɨ) b.MAX-IO(μ)
a. $k_1ə^{\mu}{}_2n_3n_4ɨ^{\mu}{}_5ə^{\mu}{}_6]_{PW}$	a. *!			*	
☞b. $k_1ə^{\mu}{}_2n_3n_4ə^{\mu}{}_6]_{PW}$					a. * b. *
c. $k_1ə^{\mu}{}_2n_3n_4ə^{\mu\mu}{}_{56}]_{PW}$	b. *!		*		
d. $k_1ə^{\mu}{}_2n_3n_4ɨ^{\mu}{}_5]_{PW}$		a. *!			b.*
e.$k_1ə^{\mu}{}_2n_3n_4ɨ^{\mu}{}_5$□$ə^{\mu}{}_6]_{PW}$		b. *			

The forms in (29)-(30) do not show any alternating form since a vowel hiatus context is eliminated by vowel elision as IO-correspondence.

Second case is what has been called identical vowel deletion. When a stem-final vowel a/ə is followed by a vowel-initial suffix ə/a, one of them is obligatorily deleted.

(33) a. /ka + a/ → [ka], *[kaa], *[ka:] 'to go'
/s'a + a/ → [s'a], *[s'aa], *[s'a:] 'to wrap'
b. /sə + ə/ → [sə], *[səə], *[sə:] 'to stop'
/k^hyə + ə/ → [k^hyə], *[k^hyəə], *[k^hyə:] 'to light'
/p^hyə + ə/ → [p^hyə], *[p^hyəə], *[p^hyə:] 'to unfold'

The non-occurrence of identical vowels in the output is due to Obligatory Contour Principle.

(34) OCP(V_i): Do not have same vowels(with mora) in the output.

Then, the phono-constraint OCP in (34) dominates MAX-V_{IO} and MAX-IO(μ).

The candidate (35a) is ruled out by the constraint OCP(V_i). The candidate (35c) violates Uniformity-IO. The candidate (35d) is ruled out by DEP-IO due to the insertion of a consonant in the output. The optimal output (35b) implies that Uniformity-IO outranks MAX-V_{IO} and MAX-IO(μ).

(35) Uniformity-IO ≫ OCP(V_i) ≫ MAX-V_{IO}, MAX-IO(μ)

Input:/$sə^{μ}_1$+$ə^{μ}_2$/	DEP-IO	Uniformity -IO	OCP(V_i)	Onset	a.MAX-IO(μ) b.MAX-V_{IO}
a. .$sə^{μ}_1$.$ə^{μ}_2$			*!		
☞ b .$sə^{μ}_1$.					a. * b. *
c. .$sə^{μμ}_{12}$.		*!			
d. $sə^{μ}_1$□$ə^{μ}_2$	*!				

However, the following data is opaque since each output contains identical vowels. Opacity effects are derived by a deletion of the final consonant h/s of irregular verbs.[10] Note that the stem final *s* or *h* of irregular verbs is deleted when followed by an inflectional suffix a/ə, as

[10]Seong-Kyu Kim claims that the consonant in the input should not be *s* since it never surfaces in the output followed by any suffix. That is true in Seoul dialect. Then, for Seoul dialect the consonant in the input would be *t* or an unspecified C. However, considering the fact that *s* is fully pronounced in Chŏnnam dialect, *s* in the input is better than *t* or *C*.

shown in (36).

(36) a. /na:s + a/	→	[naa]	~	[na:]	'to recover'
/ča:s + a/	→	[čaa]	~	[ča:]	'to weave'
/čəs + ə/	→	[čəə]	~	[čə:]	'to stir'
b. /na:h + a/	→	[naa]	~	[na:]	'to deliver a baby'
/s'a:h + a/	→	[s'aa]	~	[s'a:]	'to pile up'
/ta:h + a/	→	[taa]	~	[ta:]	'to reach'

To explain the opacity effects of OCP(V_i), I adopt McCarthy's(1998) Sympathy Theory. In Sympathy theory one failed candidate is chosen as a model, to which all the other candidates are required to resemble. In this model the sympathetic candidate must obey a certain IO-faithfulness constraint, which is called the sympathy selector. In (39) the sympathy selector is MAX-C_{IO} and (39a) is the sympathy candidate since it is the most harmonic one among the candidates which preserve *s*. In (39) sympathetic faithfulness constraint is ♧MAX-V_{IO}, which requires to preserve vowels of the sympathetic candidate.

(37) Sympathy related constraints

a. sympathy selector: MAX-C_{IO},

b. sympathy faithfulness:♧MAX-V_{IO}

The opacity effect of OCP(V_i) in (36) is derived when another phono-constraint *VsV dominates OCP(V_i).

(38) *VsV: intervocalic *s* is not allowed.

Intuitively *VsV outranks IO-faithfulness constraint MAX-C_{IO}. Then, (39b) is chosen as the optimal output. MAX-V_{IO} outranks *OCP(V_i) and MAX-C_{IO} and *VsV dominates MAX-C_{IO}.

(39)♣MAX-V_{IO} ≫ Uniformity-IO≫ *VsV ≫ OCP(V_i) ≫ MAX-C_{IO}

Input:/$č_1ə^{μ}_2s_3+ə^{μ}_4$/	♣MAX -V_{IO}	Uniformity -IO	*VsV	OCP(V_i)	Onset	MAX -C_{IO}
♣ a. $_1ə^{μ}_2.s_3ə^{μ}_4$.			*!			
☞ b. .$č_1ə^{μ}_2.ə^{μ}_4$.				*	*	*
c. .$č_1ə^{μμ}_{24}$.		*!				*

A sequence of V+V in (39b) becomes a V: in the casual speech form. In this case the constraint Onset plays an important role. Onset outranks MAX-FC(μ) and subsequently, MAX-FC(μ) dominates Uniformity-FC. The form in (40c) is out since the vowel *ə* and the mora do not have any correspondent in the output. The form (40a) shows a fatal violation of Onset. The optimal candidate (40b) incurs violation of Uniformity-FC.

(40)

Base: [$č_1ə^{μ}_2.ə^{μ}_3$]	a. MAX-FC b. DEP-FC	Onset	MAX-FC(μ)	Uniformity-FC
a. .$č_1ə^{μ}_2.ə^{μ}_3$.		*!		
☞ b. .$č_1ə^{μμ}_{23}$.				*
c. .$č_1ə^{μ}_2$.	a. *!		*	

Deletion of the stem-final *h* or *s* in Seoul dialect implies that the phono-constraints *VsV or *VhV dominates MAX-C_{IO}.

(41) Seoul dialect: *VsV, *VhV ≫ MAX-C_{IO}

However, in Chŏnnam dialect the stem-final *s* is fully pronounced when followed by a vowel-initial suffix.

(42) /pus+ə/	→	[pusə]	'to pour in'
/čəs + ə/	→	[čəsə]	'to stir'

Contrary to Seoul dialect, MAX-C_{IO} dominates the phono-constraint *VsV in Chŏnnam dialect. In (43b) *s* does not have a correspondent in the output, violating MAX-C_{IO}. It further violates Onset once. The candidate (43c) is worse than (43b) since it violates MAX-C_{IO} and Uniformity-IO. Therefore, (43a) which violates *VsV, is selected as optimal.

(43) MAX-C_{IO} ≫ *VsV

Input: /$\check{c}_1 ə^{\mu}_2 S_3 + ə^{\mu}_4$/	MAX-C_{IO}	Uniformity -IO	Onset	MAX-IO(μ)	*VsV
☞ a. .$\check{c}_1 ə^{\mu}_2 S_3 ə^{\mu}_4$					*
b. .$\check{c}_1 ə^{\mu}_2 . ə^{\mu}_4$.	*!		*		
c. .$\check{c}_1 ə^{\mu\mu}_{24}$.	*!	*			

The constraint ranking introduced in this section is summarized below.

(44) a. ɨ-deletion
%*[..Vɨ..]$_{PW}$, Align-$\sigma_{\mu\mu}$ ≫MAX-IO(ə), DEP-IO ≫ Uniformity-IO ≫ Onset ≫ MAX-IO(ɨ), MAX-IO(μ)
b. identical vowel deletion
DEP-IO ≫ Uniformity-IO ≫ OCP(V_i) ≫ Onset ≫ MAX-IO(μ), MAX-V_{IO}
c. Opacity in the formal speech form of Seoul dialect
MAX-V_{IO} ≫ Uniformity-IO ≫ *VsV ≫ OCP(V_i) ≫ Onset ≫ MAX-C_{IO}
d. Transparency in the formal speech form of Chŏnnam dialect
MAX-C_{IO} ≫ Uniformity-IO ≫ Onset ≫ MAX-IO(μ) ≫ *VsV

5. Glide Formation

Korean verbs have two types of glide formation, obligatory and optional glide formation.[11] The following words show alternating outputs, formal speech forms and casual speech forms. The second is what has been called optional glide formation, which eliminates vowel hiatus contexts found in formal speech forms. A stem-final vowel *u/o* surfaces as *w*, when followed by a vowel-initial suffix *ə/a,* as shown

[11]For a detailed analysis of glide formation in Korean, see Ongmi Kang(to appear).

in (45a). By the same token, the stem-final *i* surfaces as *y*, as shown in (45b).

(45) a. w-glide formal speech casual speech form

/k'u + ə/	→	[k'uə]	~	[k'wəː]	'to loan (money)'
/tu + ə/	→	[tuə]	~	[twəː]	'to place (something where)'
/po + a/	→	[poa]	~	[pwaː]	'to look at'

b. y-glide

/ki + ə/	→	[kiə]	~	[kyəː]	'to crawl'
/t'i + ə/	→	[t'iə]	~	[t'yəː]	'to wear a belt'
/si + ə/	→	[siə]	~	[ʃyəː]	'to be sour'

Formal speech forms in (45) are derived by IO-correspondence. In (46b) *o* in the input does not have a correspondent in the output so that it violates MAX-IO and MAX-IO(μ). An insertion of a new segment in (46c) violates the highest constraint DEP-IO. The candidate (46d), which has a complex onset, is ruled out by *Complex. The candidate (46a), which violates Onset once, is optimal.

(46) formal speech form: *Complex ≫ Onset

Input: /po$^{\mu}$+a$^{\mu}$/	a. MAX-IO b. DEP-IO	*Complex	a. Onset b. IDENT-IO(μ)	MAX-IO(μ)
☞ a. .po$^{\mu}$.a$^{\mu}$.			a. *	
b. .pa$^{\mu}$.	a. *!			*
c. .po$^{\mu}$.□a$^{\mu}$.	b. *!			
d. .pwa$^{\mu\mu}$.		*!	b. **(w, aː)	

Comparing (46a) and (46d), violation of *Complex is fatal than that of Onset in formal speech forms.

Let us look at the candidates of the casual speech form. In (47a) Onset is violated once. The vowel *o* in (47b) does not have any correspondent in the casual speech form, violating MAX-FC and MAX-FC(μ). An insertion of a new segment in the casual speech form in (47c) is ruled out by DEP-FC. A vowel hiatus in (46a) is eliminated by glide formation in (47d) and (47e). To eliminate (47e) from the optimal output, MAX-FC(μ) must dominate IDENT-FC(μ).

(47) optional GF(casual speech form): Onset ≫ *Complex

Base: [po$^{\mu}$a$^{\mu}$]	a. MAX-FC b. DEP-FC	Onset	MAX-FC(μ)	a.*Complex b. IDENT-FC(μ)
a. .po$^{\mu}$.a$^{\mu}$.		*!		
b. .pa$^{\mu}$.	a. *!		*	
c. .po$^{\mu}$.□a$^{\mu}$.	b. *!			
☞d. .pwa$^{\mu\mu}$.				a.* b.**(w,a:)
e. .pwa$^{\mu}$.			*!	a.* b.*(w)

In formal speech forms *Complex dominates Onset, allowing a V+V sequence. On the other hand, in casual speech forms Onset dominates *Complex, deriving optional glide formation.

Next let us consider obligatory glide formation in Korean verbs. As shown in (48), Korean verbs do not allow a sequence of two onsetless syllables. Therefore, less sonorous vowel *o/u*, *i* obligatorily becomes a glide *w*, *y* if it is followed by more sonorous vowel *ə/a*.

(48)	a. /meu + ə/	→	*[meuə],	[mewə],	*[mwə:]	'to be spicy'
	b. /s'au + ə/	→	*[s'auə],	[s'awə]	*[s'wə:]	'to fight'
	c. /o + a/	→	*[oa],	[wa]		'to come'
	d. /moi+ a/	→	*[moiə],	[moyə],	*[myə:]	'to gather'

Obligatory glide formation is derived by IO-correspondence and it does not undergo optional glide formation since each syllable in the output has an onset. This means that there is no OO-correspondence for obligatory glide formation.

In (49a) the Onset constraint is violated twice. In (49b) glide formation of *u* into *w* satisfies the constraint Onset, violating IDENT-IO(μ) and MAX-IO(μ). The form in (49f) violates IDENT-IO(μ) twice. Considering (49b) and (49f), MAX-IO(μ) is dominated by IDENT-IO(μ). The optimal output is (49b), which has onset in each syllable and does not violate Align-$\sigma_{\mu\mu}$ but violates MAX-IO(μ).

(49) obligatory GF: Onset, IDENT-IO(μ) ≫ MAX-IO(μ)

Input: /me$^{\mu}$u$^{\mu}$+ə$^{\mu}$/	Align-$\sigma_{\mu\mu}$	a.MAX-IO b.DEP-IO	a. Onset b. IDENT-IO(μ)	MAX-IO(μ)
a. .me$^{\mu}$.u$^{\mu}$.ə$^{\mu}$.			a. **!	
☞b. .me$^{\mu}$.wə$^{\mu}$.			b. *(w)	*
c. .me$^{\mu}$.wə$^{\mu\mu}$.	*!		b. **(w, əː)	*
d. .me$^{\mu}$._ə$^{\mu}$.		a. *!	a. *	*
e. .me$^{\mu}$.u$^{\mu}$.□ə$^{\mu}$.		b. *!	a. *	
f. .me$^{\mu\mu}$.wə$^{\mu}$.			b. **(eː, w)!	

In this section I have discussed obligatory glide formation and optional glide formation at different level. Both cases are onset-driven. Obligatory glide formation is produced by IO-correspondence while optional glide formation is done by OO-correspondence.

The constraint ranking discussed in this section is given below.

(50) a. formal speech form(IO-correspondence): obligatory GF
MAX-IO, DEP-IO ≫ *Complex ≫ Onset, IDENT-IO(μ) ≫ MAX-IO(μ)
b. casual speech form(OO-correspondence): optional GF
MAX-FC, DEP-FC ≫ Onset ≫ MAX-FC(μ) ≫ *Complex, IDENT-FC(μ)

6. Glide Insertion

In this section I will discuss glide insertion in causal speech forms as OO-correspondence. As noted above, speakers tend to have an onset in each syllable. Contrary to glide formation, speakers insert a glide *y* or *w* in a V+V sequence, as shown in (51a). In nouns only *y* is inserted as shown in (51b).

(51)

			formal speech	casual speech	
a.	/twe + əsə/	→	[tweəsə]	[tweyəsə]	'bo become'
	/ki + ə/	→	[kiə]	[kiyə]	'to crawl'
	/pi + ə/	→	[piə]	[piyə]	'to be empty'

/osip+si+o/	→	[osips'io]	[osips'iyo]	'to be welcomed'
/nanu + ə/	→	[nanuə]	[nanuwə]	'to divide'
/tat^{h}u + ə/	→	[tat^{h}uə]	[tat^{h}uwə]	'to quarrel'
b. /čəki+e/	→	[čəgie]	[čəgiye]	'over there'
/namu+e/	→	[namue]	[namuye]	'into the tree'

The formal speech form is derived by IO-correspondence. The form (52b) is filtered out by DEP-IO due to an insertion of a glide y. The form (52c) violates *Complex since glide formation of *i* derives a complex onset *ky*. The optimal form is (52a), which violates Onset once. In formal speech forms DEP-IO and *Complex outrank Onset.

(52) formal speech form: DEP-IO ≫ *Complex ≫ Onset

input:/ki + ə/	a. DEP-IO b. MAX-IO	*Complex	Onset	MAX-IO(μ)
☞ a. .ki^μ.ə^μ.			*	
b. .ki^μ.yə^μ.	a. *!			
c. .kyə^{μμ}.		*!		

In casual speech forms a glide y/w is inserted. In this case Onset outranks *Complex and DEP-FC as an onset-driven phenomenon.

(53) casual speech form: Onset ≫ *Complex ≫ DEP-FC

Base: [ki^{μ}ə^μ]	MAX-FC	Onset	MAX-FC(μ)	*Complex	DEP-FC
☞ a. .ki^μ.yə^μ.					*
b. .ki^μ.ə^μ.		*!			
c. .kyə^{μμ}.				*!	
d. .kyə^μ.			*!	*	

The difference between glide formation and glide insertion lies in the constraint ranking between DEP-FC and Onset(cf. (47)). In glide formation DEP-FC dominates Onset, while in glide insertion Onset dominates DEP-FC.

Note that a glide *w* is not inserted in nouns. Considering the fact that *y* is inserted to avoid vowel hiatus in noun+vocative suffix, I claim that the default glide for nouns is *y*.

(54) a. mira-<u>y</u>a *mira-<u>w</u>a 'Mira+vocative'
b. suni-<u>y</u>a *suni-<u>w</u>a 'Suni+vocative'
c. sin-i<u>y</u>ə *sin-i<u>w</u>ə 'God+vocative'

Preferring *y* rather than *w* for nouns can be explained by the ranking between DEP-FC_N(y) and DEP-FC_N(w).

(55) DEP-FC_N(w) ≫ DEP-FC_N(y)

With the constraint (55), let us look at the casual speech form of (51b) /namu+e/. The form (56a) is ruled out by Onset. The form (56c) is ruled out by DEP-FC_N(w). Therefore, (56c), which violates DEP-FC_N(y), is selected as optimal.

(56) Onset ≫ DEP-FC_N(w) ≫ DEP-FC_N(y)

Base: [namue]	MAX-FC	Onset	MAX-FC(μ)	DEP-FC_N(w)	DEP-FC_N(y)
a. .na.mu.e.		*!			
☞b. .na.mu.ye.					*
c. .na.mu.we.				*!	

In short the ranking involved in this section is given below:

(57) a. formal speech form
DEP-IO, MAX-IO ≫ *Complex ≫ Onset ≫ MAX-IO(μ)
b. casual speech form
MAX-FC ≫ Onset ≫ MAX-FC(μ) ≫ *Complex ≫ DEP-FC
c. y insertion after noun stem
MAX-FC ≫ Onset≫ MAX-FC(μ)≫ DEP-FC_N(w)≫ DEP-FC_N(y)

7. Conclusion

In this paper I have discussed vowel hiatus resolution strategies, vowel coalescence, vowel elision, glide formation, and glide insertion. I have claimed three arguments. First, these processes are all onset-driven. Formal speech forms are mediated by IO-correspondence: a vowel hiatus is eliminated by deleting a vowel in a V + V sequence or is resolved by obligatory glide formation of the first vowel in a V + V sequence. Casual speech forms are mediated by OO-correspondence: a vowel hiatus is resolved by optional glide formation, vowel coalescence or glide insertion. Second, ɨ-deletion applies only within the PW but not within the PS. Third, compensatory lengthening is only observed in the first syllable of the shortened form but it is not in vowel elision.

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