MULTIPLE INPUT, FAITHFULNESS, AND UNIFORM EXPONENCE[*]

Yongnam Um
State University of New York at Buffalo

1 Introduction

Certain verb stems in Korean have been called irregular in that they exhibit stem-final consonantal alternations that do not follow general phonological processes They exhibit these final consonantal alternations, depending on whether they are followed by a vowel-initial or a consonant-initial suffix Various abstract underlying structures have been posited for such verb stems However, without assuming unnatural rules or constraints that are still irregular, the surface forms cannot be derived from a single underlying form In this paper I will discuss *t-*, *p-*, and *s-*irregular verbs with reference to Korean dialects Such irregular stems show dialectal variations I will argue that such verb stems do not have abstract underlying structures and should not be analyzed with unnatural rules or constraints in view of the dialectal variations I will discuss how the forms in the irregular paradigms should be represented and how the surface forms are related to each other within a paradigm and across paradigms

The paper is organized as follows In section 2 I will present some aspects of Korean phonology as a background to later discussion In section 3 I show how the stem-final and suffix-initial segments alternate when the stems and suffixes concatenate In section 4 I will look at dialectal variants and discuss how they have arisen in the dialects In sections 4 and 5 I discuss how multiple surface relations are established in the lexicon and how the surface forms affect the others across paradigms as well as within a paradigm Finally, the conclusion is summarized in section 7

2 Preliminary Some Aspects of Korean Phonology

Before looking at the stem-final and suffix-initial segmental alternations in the next section, I will introduce some aspects of Korean phonology as a preliminary to help us understand the phenomena to be discussed later in this paper First, the Korean consonant phonemes are presented in table 1 below

Table 1 Korean Consonant Phonemes

		labial	alveolar	palatal	velar	glottal
stop	lax	p	t		k	
	tense	p'	t'		k'	
	aspirated	p^h	t^h		k^h	
affricate	lax			c		
	tense			c'		
	aspirated			c^h		
fricative	lax		s			h
	tense		s'			
nasal		m	n		ŋ	
liquid			l			

Since we are interested in the stem-final and suffix-initial segmental alternations with respect to the irregular verb stems, some understanding of the phonology of Korean consonants is necessary Specifically, we need to understand the obstruent system, how the three series of obstruents are related, in what contexts lax series are realized as voiced, aspirated, or tense counterparts, under what conditions aspirated and tense series are realized as lax counterparts, etc In Korean, stops and affricates have a three-way phonation contrast, and oral fricatives a two-way contrast lax (lenis or plain) obstruents are slightly aspirated, aspirated obstruents are heavily aspirated, and tense (fortis) obstruents are unaspirated Aspirated and tense series are quantitatively different from the lax series They have a longer duration of articulatory closure than the lax series, especially in intervocalic position Thus, in intervocalic position they occur as a geminate, that is, they are ambisyllabic This may be related to the fact that tense and aspirated obstruents are derived as well as underlying Tense and aspirated obstruents can be created through the concatenation of two morphemes For example, when a lax obstruent immediately follows another homorganic obstruent, they become totally fused, producing a tense obstruent, when the laryngeal fricative *h* is adjacent to another obstruent, they become fused, producing an aspirated obstruent There is no phonetic difference between underlying and derived tense and aspirated obstruents, as the following examples in (1) show

(1)   a kk ≈ kk' ≈ k' e g jak-kuk [jakk'uk ≈ jak'uk] 'drug store'

     b hk ≈ kh ≈ kk^h ≈ k^h e g coh-ko [cokk^{h}o ≈ cok^{h}o] 'good ', ip-hak [ipp^{h}ak ≈ ip^{h}ak] 'entrance'

In (2) below I summarize some phonological constraints in Korean

(2)   Some Constraints for Phonological Realization

    a *Neutralization* In syllable coda position three series of obstruents (lax, tense, aspirated) are neutralized into lax series, and coronal obstruents are neutralized into *t*, which is the least marked consonant in Korean The glottal fricative *h* is not realized in syllable coda position, and the stem-final *h* becomes fused with the following obstruent, producing aspirated obstruents That is, in coda position, three series of obstruents are not contrastive, and coronal obstruents are not contrastive either The laryngeal features [+constr gl], [+spr gl], [+voice], and the feature [+continuant] are not licensed (or specified) in syllable coda Thus, only seven consonants *p*, *t*, *k*, *m*, *n*, *ŋ*, and *l* can be realized in syllable coda position

    b *Post-obstruent Tensification* In Korean, tensification, by which lax obstruents are realized as their tense counterparts, takes place in various phonological and grammatical environments One such phonological environment arises when a lax obstruent immediately follows another obstruent In this case, the lax obstruent is realized as tense As a special case of this, when a lax obstruent immediately follows another (heteromorphemic) homorganic obstruent (whether the latter is original or assimilated), they become totally fused and realized as a tense obstruent As mentioned above, the tense obstruents that arise in this way are not phonetically different from the underlying ones

    c *Place Assimilation* Non-approximant consonants in syllable coda agree in the place of articulation to the adjacent consonants in syllable onset alveolars are assimilated to the following labials or velars, and labials are optionally assimilated to the following velars (but not vice versa)

    d *Nasalization* Obstruents are realized as nasals before another sonorant (a nasal or a lateral)

e *Fricativization* Coronal obstruents are totally assimilated to the following fricative *s/s'* the successive obstruents in sequence become fused and are realized as the tense fricative *s'*

f Syllable-final coronal obstruents are totally assimilated to the consonants that follow and geminates arise due to *Neutralization, Place Assimilation, Nasalization,* and *Fricativization* The geminate obstruents that arise in this way are realized as tense due to *Tensification* unless the syllable-initial consonant was an aspirated obstruent

g *Aspiration* The laryngeal fricative *h* is realized in word-initial position, but generally it is not realized between vowels (in native Korean words) or between sonorants (in Sino-Korean words) When it is adjacent to an obstruent, that is, preceded or followed by an obstruent, it becomes fused with the obstruent, and the obstruent is realized as its aspirated counterpart [1] The aspirated obstruents that arise in this way do not differ phonetically from the underlying ones

h *Voicing* Non-continuant lax obstruents are realized as voiced in intersonorantal position

i *Vowel Shortening* The stem-final long vowel is realized as short when the stem is followed by a suffix-initial vowel

3 Stem-final Regular and Irregular Segmental Alternations

Stem-final and suffix-initial segments show alternations when a stem and a suffix concatenate The stem-final coronal obstruents are nasalized before a sonorant, voiced before a vowel, and fused with the following obstruents As mentioned above, syllable-final coronal obstruents are totally assimilated to the following consonants due to *Neutralization, Place Assimilation, Nasalization,* and *Fricativization* Thus, they are not differentiated before consonant-initial suffixes but differentiated before vowel-initial suffixes

In this respect *t*-final regular verbs, *t*-irregular verbs, *s*-final verbs, and *s*-irregular verbs as well as other verbs ending in a coronal obstruent are alike they show no difference in the realization of their final segments before consonant-initial suffixes Let us consider the paradigms of *t*-final regular verbs, *t*-irregular verbs, *s*-final regular verbs, and *s*-irregular verbs along with other verb stems ending in a coronal consonant and those ending in the glottal fricative *h*, as shown in (3–14) below

(3) *t*-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a mu(t)t'a	mu(k)k'o	mu(s)s'o	munni	mudɨmjən	mudə	'bury'
b kə'(t)t'a	kə(k)k'o	kə(s)s'o	kənni	kədɨmjən	kədə	'collect'

(4) *t*-final verbs (segmentation)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a mut-t'a	muk-k'o	mus-s'o	mun-ni	mud-ɨmjən	mud-ə	'bury'
b kət-t'a	kək-k'o	kəs-s'o	kən-ni	kəd-ɨmjən	kəd-ə	'collect'

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[1] But in the case of *s*, which does not have a corresponding aspirated *s*ʰ, it is instead realized as tense *s'* due to structure preservation

t-final verbs	suffix-initial segment	t'	k'	s'	n	ɪ	a/ə
	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	d	d

(5) vowel-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a poda	pogo	poso	ponɪ	pomjən	poa ~ pwa	'see'
b oda	ogo	oso	onɪ	omjən	wa	'come'

(6) vowel-final verbs (segmentation)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a po-da	po-go	po-so	po-nɪ	po-mjən	po-a ~ pwa	'see'
b o-da	o-go	o-so	o-nɪ	o-mjən	wa	'come'

(7) t-irregular verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a muˑ(t)t'a	muˑ(k)k'o	muˑ(s)s'o	muːnnɪ	murɪmjən	murə	'ask'
b kəː(t)t'a	kəː(k)k'o	kəˑ(s)s'o	kəːnnɪ	kərɪmjən	kərə	'walk'

(8) t-irregular verbs (segmentation)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a muː(t)-t'a	muː(k)-k'o	muː(s)-s'o	muːn-nɪ	mur-ɪmjən	mur-ə	'ask'
b kəː(t)-t'a	kəː(k)-k'o	kəː(s)-s'o	kəːn-nɪ	kər-ɪmjən	kər-ə	'walk'

t-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɪ	a/ə
	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	r	r

(9) c-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a cɪc(t)t'a	cɪ(k)k'o	cɪ(s)s'o	cɪnnɪ	cɪcɪmjən	cɪcə	'bark'
a cʰa(t)t'a	cʰa(k)k'o	cʰa(s)s'o	cʰannɪ	cʰacɪmjən	cʰaca	'search'

c-final verbs	suffix-initial segment	t'	k'	s'	n	ɪ	a/ə
	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	dʒ	dʒ

(10) s-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a pɪ(t)t'a	pɪ(k)k'o	pɪ(s)s'o	pɪnnɪ	pɪsɪmjən	pɪsə	'comb
b uː(t)t'a	uˑ(k)k'o	uˑ(s)s'o	uːnnɪ	usɪmjən	usə	'laugh'

s-final verbs	suffix-initial segment	t'	k'	s'	n	ɪ	a/ə
	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(ʌ)	n/ʔ/(x)	s	s

(11) s-irregular verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a cɪː(t)t'a	cɪˑ(k)k'o	cɪː(s)s'o	cɪːnnɪ	cɪɪmjən	cɪə	'build'
b kɪː(t)t'a	kɪː(k)k'o	kɪː(s)s'o	kɪːnnɪ	kɪɪmjən	kɪə	'draw'

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s-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɨ	a/ə
	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	ø	ø

(12) *l*-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a muˑlda	muːlgo	muːlso	mu.nɨ	muːlmjən	murə	'bite'
b kə.lda	kə.lgo	kəːlso	kə.nɨ	kəːlmjən	kərə	'hang'

l-final verbs	suffix-initial segment	d	g	s	n	(ɨ)m	a/ə
	stem-final segment	l	l	l	ø	l	r

(13) *lh*-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a altʰa	alkʰo	als'o	allɨ	arɨmjən	ara	'get sick'
b sɨltʰa	sɨlkʰo	sɨls'o	sɨllɨ	sɨrɨmjən	sɨrə	'be hateful'

lh-final verbs	suffix-initial segment	tʰ	kʰ	s'	/n/ l	ɨ	ə
	stem-final segment	l	l	l	l	r	r

(14) *h*-final verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a nəː(t)tʰa	nəː(k)kʰo	nəː(s)s'o	nəːnnɨ	nəɨmjən	nəə	'insert'
b c'ɨ(t)tʰa	c'ɨ(k)kʰo	c'ɨ(s)s'o	c'ɨnnɨ	c'ɨɨmjən	c'ɨə	'pound'

h-final verbs	suffix-initial segment	tʰ	kʰ	s'	n	ɨ	a/ə
	stem-final segment	(h)	(h)	(h)	n	ø	ø

Table 2 Summary Stem-final and Suffix-initial Segmental Alternations

stem-final segment	suffix-initial obstruent	stem-final consonant before suffix-initial N	stem-final consonant before suffix-initial vowel	suffix-initial vowel ɨ
t-final regular	tensed	N	/t/ d	realized
tʰ-final regular	tensed	N	/tʰ/ tʰ	realized
s-final regular	tensed	N	/s/ s	realized
s'-final regular	tensed	N	/s'/ s'	realized
c-final regular	tensed	N	/c/ dʒ	realized
cʰ-final regular	tensed	N	/cʰ/ cʰ	realized
t-irregular	tensed	N	/l/ r	realized
s-irregular	tensed	N	ø	realized
h-final regular	aspirated	N	ø	realized
lh-final regular	aspirated	l	/l/ r	realized
l-final regular	voiced	ø	/l/ r	not realized
V-final regular	voiced	(V)	(V)	not realized

Stem-final coronal obstruents are totally assimilated to the following consonants when conso-
nant-initial suffixes are added Thus, they are not differentiated before consonant-initial suffixes Fur-
thermore, stem-final coronal obstruents and suffix-initial obstruents are totally fused and realized as
tense obstruents Thus, the stem-final and suffix-initial segments overlap, and the stem-suffix boundary

may not be clear when obstruent-initial suffixes are added When obstruent-initial suffixes are added, the only cue for the stem-final segment is the quantity or the laryngeal feature [+constr gl] of the suffix-initial lax obstruent, which is realized as geminate or tense As mentioned above, tense and aspirated obstruents are realized as geminate in intervocalic position, that is, they are ambisyllabic Hence, the boundary between the stem and the suffix may not be clear-cut before obstruent-initial suffixes However, a nasal geminate is realized when the stems ending in a consonant other than *l* are followed by a nasal-initial suffix, which shows the presence of a stem-final consonant In the paradigms of the stems ending in a coronal obstruent and those of the stems ending in a vowel, the initial consonants of the suffixes beginning with a lax obstruent are realized contrastingly as voiced and tensed, respectively

The difference between the regular and irregular verbs shows up before vowel-initial suffixes Before vowel-initial suffixes, *t*-final regular verbs have final *d*, which is the allophonic variant of *t*, due to voicing in intersonorantal position, and *s*-final regular verbs have final *s* On the other hand, before vowel-initial suffixes, *t*-irregular verbs have final *r*, which is the allophonic variant of *l*, realized in syllable onset position,[2] and *s*-irregular verbs show no final consonant However, *t*-irregular verbs and *s*-irregular verbs are different from *l*-final verbs and vowel-final verbs, respectively They become geminate (or tense) obstruents when they occur with obstruent-initial suffixes and geminate nasals when they occur with nasal-initial suffixes Like *l*-final verbs and vowel-final verbs, *t*-irregular verbs and *s*-irregular verbs have final *l* and no final consonant, respectively Before vowel-initial suffixes, the suffix-initial vowel *ɨ* is not lost after the stems unlike after *l*-final or vowel-final verb stems Furthermore, when they are followed by a *n*-initial suffix, *t*-irregular verb stems have their final *n*, but *l*-final verb stems do not have their final *l* Thus, despite their differences before consonant-initial suffixes, when followed by vowel-initial suffixes, *t*-irregular verb stems and *s*-irregular verb stems correspond to the verb stems ending in *l* plus a glottal fricative *h* and to those ending in a glottal fricative *h*, respectively, rather than to *l*-final verb stems and vowel-final verb stems They have similarities in that the initial vowel of *ɨ*-initial suffixes is tolerated after the stem-final *l* or vowel In sum, the verb stems that we have compared show similarities as well as differences depending on the context When they occur before consonant-initial suffixes, *t*-irregular verb stems and *s*-irregular verb stems correspond to *t*-final regular verb stems and *s*-final regular verb stems (or rather with the verb stems ending in any coronal obstruent) Also, when they occur before vowel-initial suffixes, they correspond to the verb stems ending in *l* plus a glottal fricative *h* and to those ending in a glottal fricative *h*, respectively

Now let us consider *p*-irregular verbs Below in (15) are the paradigms of *p*-irregular verbs, which exhibit stem-final alternations depending on whether they are followed by vowel-initial or consonant-initial suffixes

(15) *p*-irregular verbs

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a koːptʼa	koːpkʼo	koːpsʼo	koːmnɪ	koumjən	kowa	'be pretty'
b mæptʼa	mæpkʼo	mæpsʼo	mæmnɪ	mæumjən	mæwə	'be spicy'
c toˑptʼa	toˑpkʼo	toːpsʼo	toːmnɪ	toumjən	towa	'help'
d kuːptʼa	kuːpkʼo	kuːpsʼo	kuːmnɪ	kuumjən	kuwə	'bake'

p-irregular verbs	suffix-initial segment	tʼ	kʼ	sʼ	n	(ɪ)	a/ə
	stem-final segment	p	p	p	m	u	w

[2] In Korean, /l/ is realized as [r] in syllable onset position unless it is a geminate, and as [l] in syllable coda position When it is ambisyllabic as a geminate, that is, when it is associated both with onset position and coda position, it is realized as [l], as in syllable coda position

The *p*-irregular verb stems have final *p* when followed by consonant-initial suffixes, but they have final *u* or *w* when followed by vowel-initial suffixes They are irregular in that their alternations do not follow general phonological processes Neither the change of $p \rightarrow u/w$ / __ V nor $u/w \rightarrow p$ / __ C is general since there are regular verbs like *p*-final verbs and *u*-final verbs, which are not subject to such changes in the same environment, as shown in (16) and (17) below, respectively

(16) *p*-final verbs

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a kopt'a	kopk'o	kops'o	komnı	kobımjən	koba	'bend'
b cıpt'a	cıpk'o	cıps'o	cımnı	cıbımjən	cıbə	'pick'

p-final verbs	suffix-initial segment	t'	k'	s'	n	ı	a/ə
	stem-final segment	p	p	p	m	b	b

(17) *u*-final verbs

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a mæuda	mæugo	mæuso	mæunı	mæumjən	mæwə	'fill'
b cıuda	cıugo	cıuso	cıunı	cıumjən	cıwə	'erase'

u-final verbs	suffix-initial segment	d	g	s	n	(ı)m	a/ə
	stem-final segment	u	u	u	u	u	w

If we compare the paradigms of *p*-irregular verbs with those of *p*-final verbs and *u*-final verbs, we can see that *p*-irregular verbs show a similar pattern to *p*-final verbs before consonant-initial suffixes and to *u*-final verbs before vowel-initial suffixes However, they show a different pattern from *p*-final verbs and *u*-final verbs before vowel-initial suffixes and before consonant-initial suffixes, respectively Thus, the *p*-irregular verbs show a unique paradigmatic pattern like the other classes of irregular verbs

4 Dialectal Variants

In this section, we will consider dialectal variants of the irregular verbs The irregular verbs do not have irregular patterns in all the dialects There are dialects in which the irregular verbs have regular patterns but in different forms Let us examine how the irregular verbs have regular patterns in such dialects Before considering the paradigmatic patterns of *t*-irregular verb stems, let us first consider those of the *s*-irregular verb stems, which will also shed light on the *t*-irregular verb stems

There are three distinct dialects with respect to *s*-irregular verbs in Korean The paradigms of the verb stem *ıs*- 'connect' in the three dialects are given in (18) below

(18) *s*-irregular verbs (surface forms)

Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a ı(t)t'a	ı(k)k'o	ı(s)s'o	ınnı	ısımjən	ısə	'connect'
b ı(t)t'a	ı(k)k'o	ı(s)s'o	ınnı	ıımjən	ıə	'connect'
c ı(t)tʰa	ı(k)kʰo	ı(s)s'o	ınnı	ıımjən	ıə	'connect'

a'

s-irregular verbs	suffix-initial segment	t'	k'	s'	n	ı	a/ə
(regular)	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	s	s

b'

s-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɪ	a/ə
(*irregular → regular*)	stem-final segment	(x)	(x)	(x)	n	ø	ø

c'

t-irregular verbs	suffix-initial segment	tʰ	kʰ	s'	n	ɪ	a/ə
(*regularized*)	stem-final segment	(h)	(h)	(h)	n	ø	ø

The stem-final segments that are realized depending on the initial segments of the suffixes may be summarized as in (19) below

(19) a   s-   s-   s-   n-   s-   s-   (*regular*)   /s/ cf ʂ-regular verbs
      b   ʔ-   ʔ-   ʔ-   n-   ø-   ø-   (*irregular → regular*) /ʔ/ cf *h*-final verbs
      c   h-   h-   h-   n-   ø-   ø-   (*regularized*)   /h/ cf *h*-final verbs

Let us consider how these differences in the paradigmatic patterns have arisen in the dialects Whether they are regular or irregular, the verb stems ending in a coronal obstruent show no difference before consonant-initial suffixes, and their difference shows up before vowel-initial suffixes, as we saw in section 3 above. The verb stems, which are bound forms, must always have inflectional suffixes, and the stem-final coronal obstruents are always assimilated to the suffix-initial consonants before consonant-initial suffixes, thereby coalescing with suffix-initial obstruents and producing tense obstruents While in the case of regular verbs, the stem-final consonants show themselves before vowel-initial suffixes, in the case of s-irregular verb stems, the stem-final consonant is not realized before vowel-initial suffixes (18b) Thus, it would be impossible for a learner/speaker to construct a stem-final coronal obstruent such as *s* for *s*-irregular verb stems on the basis of the stem forms before consonant-initial suffixes since the stem-final consonant always ends up assimilating to the following consonant It is also not realized before vowel-initial suffixes In this situation, it may be rather natural for him/her to construct a laryngeal consonant ʔ or a featureless segment x (a skeletal position, timing unit) on the basis of the overall pattern of the paradigms (cf (14), (18b, c))

In the dialect (18c), *s*-irregular verbs have the same paradigmatic pattern as *h*-final verbs Let us compare the paradigms of *s*-irregular verb stems with those of *h*-final verb stems in order to see how this has happened in this dialect Below in (20), the examples of *h*-final verbs in (14) are repeated for our convenience

(20)   *h*-final verbs (surface forms) (= (14))

	Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a	nə (t)tʰa	nəˑ(k)kʰo	nə.(s)s'o	nə nnɪ	nəɪmjən	nəə	'insert'
b	c'ɪ(t)tʰa	c'ɪ(k)kʰo	c'ɪ(s)s'o	c'ɪnnɪ	c'ɪɪmjən	c'ɪə	'pound'

If we compare the paradigms of *s*-irregular verb stems in (18b) with those of *h*-final verb stems in (20), we can see that the difference between them arises only when the stems are followed by the suffixes beginning with a non-continuant obstruent in the laryngeal features of their suffix-initial segments Thus, the dialect in which *s*-irregular verb stems have the pattern as in (18b) actually has the pattern comparable to the pattern of the paradigms of *h*-final verb stems, contrasting in laryngeal features as [+constr gl] versus [+spr gl] Thus, in this dialect *s*-irregular verb stems have a stem-final glottal stop ʔ or a featureless segment x, e g cɪːʔ- 'build' By contrast, in the dialect in which *s*-irregular verb stems have the pattern as in (18c), the stems have followed the pattern of the paradigms of *h*-final verb stems as in (20),

e g *ct h-* 'build' In this dialect, a pattern (with a novel phoneme *ʔ*) as in (18b) is avoided by following an already existing paradigmatic pattern as in (20)

Now let us consider the dialectal variants of *t*-irregular verb stems with reference to *s*-irregular verb stems, *h*-final verb stems, and *lh*-final verb stems [3] There are four distinct dialects with respect to *t*-irregular verbs in Korean In some dialects, *t*-irregular verbs have undergone paradigmatic leveling The paradigms of the verbs *tɨt-* 'hear' and *sɪ.t-* 'load' in the four different dialects are shown in (21) below

(21) *t*-irregular verbs (surface forms)

	Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a	tɨ(t)t'a	tɨ(k)k'o	tɨ(s)s'o	tɨnnɪ	tɨdɨmjən	tɨdə	'hear'[4]
b	sɪː(t)t'a	sɪː(k)k'o	sɪː(s)s'o	sɪːnnɪ	sɪrɨmjən	sɪrə	'load'
c	sɪ lt'a	sɪːlk'o	sɪˑls'o	sɪˑllɪ	sɪrɨmjən	sɪrə	'load'
d	sɪ.lt^ha	sɪˑlk^ho	sɪ ls'o	sɪ llɪ	sɪrɨmjən	sɪrə	'load'

a'

t-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɨ	a/ə
(regular)	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	k/ʔ/(x)	k/ʔ/(x)	d	d

b'

t-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɨ	a/ə
(irregular)	stem-final segment	t/ʔ/(x)	k/ʔ/(x)	s/ʔ/(x)	n/ʔ/(x)	r	r

c'

t-irregular verbs	suffix-initial segment	t'	k'	s'	/n/ l	ɨ	a/ə
(regularized)	stem-final segment	l	l	l	l	r	r

d'

t-irregular verbs	suffix-initial segment	t^h	k^h	s'	/n/ l	ɨ	a/ə
(regularized)	stem-final segment	l	l	l	l	r	r

The stem-final segments that are realized depending on the initial segments of the suffixes may be summarized as in (22) below

(22) a   t-   t-   t-   n-   d-   d-   *(regular)*   /t/   cf *t*-final verbs
      b   t-   t-   s-   n-   r-   r-   *(irregular)*   /t/ /l/
      c   lʔ-   lʔ-   lʔ-   l-   r-   r-   *(regularized)* /lʔ/
      d   lh-   lh-   lh-   l-   r-   r-   *(regularized)* /lh/   cf *lh*-final verbs

The paradigms in (21c) and (21d) show that leveling has taken place The stem-final *l* [r] that occurs only before vowel-initial suffixes in the irregular paradigm in (21b) has been extended throughout in the paradigms in (21c) and (21d) However, when the stem is followed by the suffixes beginning with a non-continuant obstruent, (21c) and (21d) show a difference in the laryngeal reflex of *t*, just as in the reflex of *s* in (18b) and (18c) In (21c), the suffix-initial obstruents have the laryngeal feature [+constr gl], just as in the irregular paradigm (21b), whereas in (21d), they have the laryngeal feature [+spr gl] This difference between the paradigms in (21c) and (21d) is comparable to that between the paradigms in (18b) and (18c) of *s*-irregular verb stems Except for the fact that the stem-final *l* that oc-

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[3] There are three types of verb stems ending in a laryngeal consonant *h* in Korean (ɪ) the stems ending in *h*, (ɪɪ) the stems ending in *nh*, and (ɪɪɪ) the stems ending in *lh*

[4] Among the *t*-irregular verbs, only this verb retains this regular pattern in the dialect (Phyengan, Northwest) in which the verb has the regular pattern

curs before vowel-initial suffixes has been generalized throughout in (21c, d), the same observations for *s*-irregular verb stems can be made with respect to the dialectal variants of *t*-irregular verb stems Their difference arises simply because *t*-irregular verbs have final *l* before vowel-initial suffixes, whereas *s*-irregular verbs have no final consonant before vowel-initial suffixes Aside from the extension of *l*, the pattern in (21b) with [+constr gl] on the suffix-initial obstruents is maintained in (21c), but the suffix-initial obstruents have the laryngeal feature [+spr gl] in (21d) In the paradigms of (18c) and (21d), the emergence of *ʔ* as a reflex of *s* and *t* is avoided, it is replaced with another laryngeal, *h* In (21d), the paradigmatic pattern of the *lh*-final stems, such as in (13c), has been followed for *t*-irregular verb stems, just as in (18c), the paradigmatic pattern of the *h*-final stems, such as in (14), has been followed for *s*-irregular verb stems Thus, the reflex of the original *t*, which is realized on the suffix-initial obstruents as in (21b), has emerged differently as *ʔ* [+constr gl] and *h* [+spr gl] in (21c) and (21d), the different base forms *siʔʔ-* and *siʔlh-* obtaining in (21c) and (21d), respectively Notice that unlike *l* before vowel-initial suffixes, the laryngeal reflex of *s* or *t*, which is realized on obstruent-initial suffixes, appears not to have been generalized throughout in the dialects in (21c, d) and (18b, c) the conjugated forms in which the stem is followed by a vowel-initial suffix are not different in the dialects in (21b–d) and (18b, c) But this is because, as a general rule, a laryngeal segment is not realized in intersonorantal position in a word

Now let us consider the dialectal variants of *p*-irregular verbs The *p*-irregular verbs show dialectal variation like the other classes of irregular verbs In some dialects, *p*-irregular verbs have undergone leveling The paradigms of the verbs *mæp-* 'be spicy', *top-* 'help', and *kup-* 'bake' in the dialects are shown in (23) below

(23) *p*-irregular verbs

	Declarative	Gerund	Propositive	Interrogative	Conditional	Stative	
a	mæpt'a	mæpk'o	mæps'o	mæmni	mæbɨmjən	mæbə	'be spicy'
b	mæpt'a	mæpk'o	mæps'o	mæmni	mæumjən	mæwə	'be spicy'
c	mæupt'a	mæupk'o	mæups'o	mæumni	mæumjən	mæwə	'be spicy'
d	touda	touko	touo	touni	toumjən	towa	'help'
e	ku da	ku.ko	ku:o	ku.ni	ku mjən	kuwə	'bake'

a'

p-irregular verbs	suffix-initial segment	t'	k'	s'	n	ɨ	a/ə
(regular)	stem-final segment	p	p	p	m	b	b

b'

p-irregular verbs	suffix-initial segment	t'	k'	s'	n	(i)	a/ə
(irregular)	stem-final segment	p	p	p	m	u	w

c'

p-irregular verbs	suffix-initial segment	t'	k'	s'	n	(i)	a/ə
(regularized)	stem-final segment	up	up	up	um	u	w

d', e'

p-irregular verbs	suffix-initial segment	d	g	s	n	(i)	a/ə
(regularized)	stem-final segment	u	u	u	u	u	w

The stem-final segments that are realized depending on the initial segments of the suffixes may be summarized as in (24) below

(24)	a	p	p	p	m	b	b	(regular)	/p/		
	b	p	p	p	m	u	w	(irregular)	/p/	/u/	
	c	up	up	up	um	u	w	(regularized)	/up/	/uø/	(still irregular)
	d	u	u	u	u	u	w	(regularized)	/u/		
	e	u	u	u	u	u	w	(regularized)	/u/		

In (23c) and (23d), the stems followed by vowel-initial suffixes have been analyzed like *mœu-ni* (← *mœu-ini*) and *mœw-ə/a* (← *mœu-ə/a*), and the vowel *u* has been generalized throughout in the paradigms However, the *p* that is realized before consonant-initial suffixes is not generalized, it is still retained in (23c), whereas it is deleted in (23d) The stem form in (23e) shows that *kuu-*, which was restructured from *ku p-* 'bake', has undergone vowel coalescence The verb stems in (23d) and (23e) show the same pattern as *u*-final verb stems Further, we can see that one class of irregular verbs in a dialect does not behave as a set in restructuring Each verb may undergo different restructuring, as the examples in (23c–f) show (see fn 4)

5 Multiple Input and Faithfulness

Faithfulness constraints require one form to preserve the characteristics of another Originally, faithfulness was proposed for underlying-surface mappings (Prince and Smolensky 1993), but similar relations were also found in base-reduplicant mappings (McCarthy and Prince 1993, 1994) and among morphologically related surface forms (Benua 1997) Benua (1997) extended the surface-to-surface identity between base and reduplicant to include surface-to-surface relations between all surface forms that share a base Correspondence theory (McCarthy and Prince 1995) generalizes over these various types of faithfulness Since the work of Benua (1997), the notion of Output-to-Output faithfulness (OO-F) has received considerable interest (Burzio 1996, Kenstowicz 1996, Steriade In press) Once the need for surface-to-surface faithfulness constraints is recognized, there has arisen the tendency to develop the constraint-based morphology, based on the pairings between morphologically related surface forms, in which the work that the old morphology did in series is done in parallel Hammond (1995), Russell (1995), and Burzio (1996) argue that URs are not necessary to encode the phonological information of morphemes and that morphemes are directly encoded in the constraints (cf Golston 1996)

Burzio (1999) suggests that morphology should be reinterpreted as a set of constraints and proposes a theory of surface-to-surface relations that has full morphological capabilities His theory is based on the assumption that representations are clusters of entailments that directly condition other representations He asserts that Word Formation Rules (WFRs), which are rigid/inviolable devices, are incorrect in view of the phenomenon of morphological irregularity, as in *compel/compUlS-ive, problem problemAT-ic*, etc He argues that morphological irregularity comes from the fact that Output-Output faithfulness (OO-F), which can do the job of the WFRs, is dominated by Input-Output faithfulness (IO-F) He illustrates the example *compel/compUlS-ive* as in (25) (= his (3)) below

(25)	*Input / U S-ive/,*	*Base /compel/*	IO-F	OO-F
	a	compell-ive	*	
	b ☞	compuls-ive		*

In this system, as he points out, derived forms are no longer related to their bases by a common UR, but rather only by OO-F Thus, derived forms are assigned their own independent input, which will have an effect only under the ranking IO-F >> OO-F, as in (25) above Burzio (1999 2) observes that this account of morphological irregularity is parallel to that of phonological markedness in standard OT in

that both result from IO-F dominating the relevant source of regularity OO-F and Markedness constraints, respectively In this system, the problem of morphological irregularity is reduced to constraint ranking

Burzio (1999 3) suggests the following concept in (26) to account for word-to-word relations in the lexicon

(26) **Gradient Attraction** (= his (5))
     a The overall structure of a word w (in both its phonological and semantic components) is influenced by that of other words in the lexicon to which w is independently similar, and which can be thought of as 'attractors' of w
     b Attraction is stronger where independent similarity is greater

He also suggests that an account of the effect in (26) above can be attained by means of the assumption, as in (27) below, that representations are clusters of entailments that directly condition other representations (p 6)

(27) **Representational Entailments** (RE) (= his (12))
     Mental representations of linguistic expressions constitute sets of entailments -- a representation with the structure AB generating the entailments $A \Rightarrow B, B \Rightarrow A$

As he points out, "on this assumption, representations which are similar but not identical violate some of each other's entailments, giving precisely an invariance or 'attraction' effect " (p 6) "That assumption is shown to yield a faithfulness function that automatically manages distance among representations, by pressuring close neighbors to 'neutralize' " (p 1) Thus, the faithfulness function has the effect of maximizing phonological identity between morphologically related forms This suggests that faithfulness should be evaluated multiply among surface forms
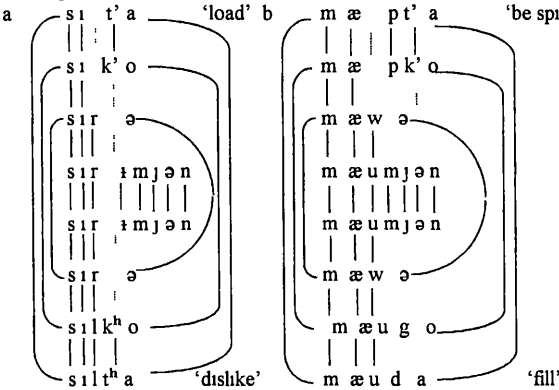
Let us consider the paradigms of the Korean irregular verbs from this perspective In previous analyses, it was assumed that in the irregular paradigms the stem-final segment that is realized before a consonant-initial suffix ($t/?, p$, etc) has a derivational ('corresponding') relation to what occurs before a vowel-initial suffix (l [r], u [w], etc) However, without assuming unnatural rules or constraints, the surface forms of irregular verbs cannot be obtained from one UR This is because the stem-final consonants have split into too disparate sounds (turning irregular) depending on the context Dialects show that their relations have become obscured In the irregular paradigms, phonologically or semantically, no priority can be granted either to the stem forms before vowel-initial suffixes or to those before consonant-initial suffixes vowel-initial suffixes and consonant-initial suffixes cannot be categorized in terms of their semantics (cf Bybee 1988) Neither the derivation of the stem-final segment before a consonant-initial suffix nor before a vowel-initial suffix can be motivated phonologically from the other Or else neither can be derived naturally from another segment that is neither of them With t- and p-irregular verbs, the corresponding relation between the stem-final segments that are realized before consonant-initial suffixes and those that occur before vowel-initial suffixes are not transparent Thus, they should be given equal status the alternating segments that do not stand in transparent correspondence with each other should be assigned their own independent input We saw that in some dialects alternating segments have come to be realized in sequence in surface forms through leveling and also that more than one stem-form can still be tolerated after leveling in a paradigm (p-irregular verbs)

In Korean, verbal stems are bound forms and must be inflected They constitute phonological words with the inflectional suffixes Thus, the stem forms that are realized differently depending on the

suffixes should be considered together with the added suffixes for identity between the surface forms If the morphological irregularity is due to the fact that OO-F is dominated by IO-F, a base form is not necessarily needed nor can it be postulated, especially in the case of bound forms like Korean verbal stems Inputs are assigned multiply to the surface stem forms The irregularity in the irregular verbal paradigms is not due to the phonological rules a base form undergoes but to mis-identity between the surface forms The difference between the regular and irregular paradigms reduces to the difference in consistency between the surface stem forms or constraint ranking Surface stem forms are more similar in regular paradigms than in irregular paradigms, as in the allophonic versus allomorphic contrast However, both cases are in parallel if representations are considered as clusters of entailments that condition other representations and if multiple surface correspondence relations are established in the lexicon (Bybee 1988, Burzio 1999)

Let us look at some examples of the correspondence relations between the surface forms, in which some OO-F constraints are violated, in the diagrams in (28)

(28)   Correspondence Diagrams for Violations of OO-F (MAX, DEP, IDENT (F), LINEAR, CONTIG)

a   s ɪ t' a _____ 'load'   b   m æ   p t' a   'be spicy'

       s ɪ k' o   m æ   p k' o

       s ɪ r   ə   m æ w ə

       s ɪ r ɨ m j ə n   m æ u m j ə n

       s ɪ r ɨ m j ə n   m æ u m j ə n

       s ɪ r   ə   m æ w ə

       s ɪ l kʰ o   m æ u g o

       s ɪ l tʰ a _____ 'dislike'   m æ u d a _____ 'fill'

In these diagrams a number of lines that would represent obvious correspondence relations are not drawn for typographical limitations (three-dimensional representations would seem more appropriate) However, it will be clear how some faithfulness constraints are violated In the next section, I will discuss how the surface forms in these kinds of relations interact in the dialects so that the faithfulness function has the effect of maximizing phonological identity between morphologically related forms

6 Uniform Exponence

Let us re-examine the dialectal variations of the irregular verbs from the perspective that representations are clusters of entailments that condition other representations and that multiple surface correspondence relations are established in the lexicon In this theory of morphology, Uniform Exponence can be explained through Gradient Attraction in (26) Neighbors (items that are close to each other phonologically or semantically) in the lexicon can attract each other It is obvious that the surface forms within a paradigm behave as strong attractors to each other since the attraction is stronger where the similarity is greater, and items that are closest to each other phonologically and semantically comprise a

paradigm (see Hooper [Bybee] 1979, Bybee 1988 for differences in lexical proximity depending on grammatical (semantic) categories within a paradigm)

We can see that surface-to-surface relations are multi-dimensional The surface forms attract other forms across the paradigms (Interparadigmatic or Cross-paradigmatic Uniformity) as well as within a paradigm (Intraparadigmatic or Paradigm-internal Uniformity), as Gradient Attraction and Representational Entailments predict As we saw in (18a), (21a), and (23a), the irregular verbs do not have irregular patterns at all in these dialects It is hard to tell how much Intraparadigmatic Uniformity or Interparadigmatic Uniformity plays a role in retaining the regular pattern It may be that both—the pressure outside of the paradigm (regular s-, t-, and p-final verbs) as well as that within the paradigm (anti-allomorphy)—have joined forces In the dialect in (21c), the stem forms have become more similar under general constraints such as in (2g, fn 2) This is due to Intraparadigmatic Uniformity (via the extension of l) It is clear that Interparadigmatic as well as Intraparadigmatic Uniformity played a role in the dialect in (21d), in which suffix-initial lax obstruents are realized as aspirated rather than tense obstruents for the t-irregular verbs In the case of s-irregular verbs, Interparadigmatic Uniformity played a role in the dialect in (18c), in which suffix-initial lax obstruents are realized as aspirated rather than tense obstruents Here we saw that the paradigms of the s-, t-, and p-irregular verbs may be closely related to the paradigms of the verbs ending in h and u due to their phonological similarities Overall, allomorphy tends to be reduced within a paradigm However, it can persist over time (maintaining the ranking IO-F >> OO-F) rather than being eliminated rapidly, as shown in (21b) and (23b, c) above (Bybee 1988)

7 Conclusion

In previous analyses, it was assumed that even in irregular paradigms the stem-final segment that is realized before a consonant-initial suffix has a derivational or corresponding relation to the one before a vowel-initial suffix However, without assuming unnatural rules or constraints, surface forms of irregular verbs could not be obtained from a single underlying form This is because the stem-final consonants have split into too distant sounds depending on the context Dialects show that their relation has become obscured Thus, I have argued that alternating segments that do not stand in transparent correspondence with each other should be represented in the input This position is supported by the fact that alternating segments have come to be realized in sequence in surface forms through leveling and that more than one stem-form can still be tolerated in a paradigm after leveling (p-irregular verbs)

I have argued that in the irregular paradigms, the segments which alternate do not stand in correspondence with each other, and that they should be represented in the input and given equal status in evaluation for faithfulness (IO, OO) I have also showed how OO Correspondence is operative for Paradigm Uniformity Opaque correspondents in outputs come to be readjusted as (transparent) non-correspondents through the restructuring of inputs In this restructuring that generates novel inputs, correspondence constraints for IO Correspondence also play their part for OO Correspondence

REFERENCES

Benua, Laura 1997 Transderivational identity phonological relations between words Amherst, MA University of Massachusetts dissertation

Burzio, Luigi 1996 Surface constraints versus underlying representation Current trends in phonology models and methods, ed by Jacques Durand and Bernard Laks, 118–36 CNRS, Paris X, and University of Salford University of Salford Publications

—— 1999 Surface-to-surface morphology when your representations turn into constraints [ROA-341, http //ruccs rutgers edu/roa html]

Bybee, Joan L 1988 Morphology as lexical organization Theoretical morphology approaches in modern linguistics, ed by Michael Hammond and Michael Noonan, 119–41 San Diego, CA Academic Press

Choi, Myong-Ok 1985 On phonological aspects of irregular verbs Kwukehak 14 149–88

Golston, Chris 1996 Direct optimality theory representation as pure markedness Lg 72 713–48

Hammond, Michael 1995 There is no lexicon! Tucson University of Arizona MS

Hooper, Joan Bybee 1979 Child morphology and morphophonemic change Linguistics 17 21–50

Kenstowicz, Michael 1996 Base-identity and uniform exponence alternatives to cyclicity Current trends in phonology models and methods, ed by Jacques Durand and Bernard Laks, 355–85 CNRS, Paris X, and University of Salford University of Salford Publications

McCarthy, John, and Alan S Prince 1993 Prosodic morphology I constraint interaction and satisfaction Amherst, MA and New Brunswick, NJ University of Massachusetts and Rutgers University MS

——, —— 1994 The emergence of the unmarked optimality in prosodic morphology North Eastern Linguistic Society 24 333–79

——, —— 1995 Faithfulness and reduplicative identity Papers in optimality theory, ed by Jill N Beckman, Laura Walsh Dickey and Suzanne Urbanczyk, 249–384 (University of Massachusetts Occasional Papers in Linguistics 18) Amherst, MA Graduate Linguistic Student Association

Prince, Alan, and Paul Smolensky 1993 Optimality theory Constraint interaction in generative grammar New Brunswick, NJ and Boulder, CO Rutgers University and University of Colorado, MS

Russell, Kevin 1995 Morphemes and candidates in Optimality Theory Winnipeg University of Manitoba MS

Steriade, Donca In press Paradigm uniformity and the phonetics-phonology boundary Papers in laboratory phonology 5, ed by Michael Broe and Janet Pierrehumbert Cambridge Cambridge University Press