The phonetics and phonology of vowel length variation in Korean reduplicated ideophones*

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Kim, Hyung-Soo. 2008. The phonetics and phonology of vowel length variation in Korean reduplicated ideophones. *Studies in Phonetics, Phonology and Morphology 14.2*. 39-60. Reduplicated ideophones in Korean present interesting problems in phonetics and phonology of vowel length variation. The vowel in the first syllable is short in the partially reduplicated type, e.g. *sălɨli* 'gently', but long in the fully reduplicated type, e.g. *sālsal*. The long vowel in the corresponding ideophone of the latter type, on the other hand, often appears as short after laryngealized obstruents, e.g. *s'ăls'al*. In this paper three attempts are made to explain this length variation. The first of these is phonetically based, on the hypothesis that laryngeal onsets influence the duration of the following vowel, while the remaining analyses are based on two independent phonological theories, one making use of the feature [long] for tense and aspirated consonants and the Obligatory Contour Principle and the other the concepts of strength fluxion and the Inertial Development Principle. Although some questions are left for future studies, analyzing this and related problems illuminates many of the skills required of a typical phonetic/phonological analysis: sorting out the data and interpreting its relevance, establishing viable hypotheses using one's phonetic and phonological knowledge, and integrating them for a plausible explanation. **(Jeonju University)**

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1. Introduction

The vowel length in Korean reduplicated ideophones presents a number of problems in phonetics and phonology. This is because the length is phonemic in Korean but is in the process of disappearing in many dialects and ideolects, causing much confusion and frustration among phoneticians as well as phonologists. As the point of departure for our discussion, consider the following examples:

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(1) Vowel length in Korean

a. Length constrast and shortening in noninitial syllables

pām ‘chestnut’ păm ‘night’
nūn ‘snow’ nŭn ‘eye’
kūnpăm ‘roasted chestnut’
hampaknŭn ‘large snowflakes’

b. Glide formation and compensatory lengthening

Infinitive	Continuative	
po-ta	poa ~ pwā	‘see’
o-ta	¢oa[1] ~ wă	‘come’

c. Irregular predicates

Infinitive	Continuative	
kāt-ta	kăr-ə	‘walk’
tōp-ta	tŏw-a	‘help’
kōp-ta	kōw-a	‘be pretty’
tɨ̄t-ta	tɨ̆r-ə	‘hear’

d. Reduplicated ideophones

Full red.	Partial red.	
sālsal	sălɨ̆lɨ̆	‘gently’
pālpal	pălɨ̆lɨ̆	‘shiveringly’
$p^hălp^hal$	$p^hălɨ̆lɨ̆$	‘bubblingly’
k’ălk’al	k’ălɨ̆lɨ̆	‘laughing loudly’

The above examples all exhibit vowel length alternation in one way or another. (1a) shows that vowel length is distinctive in Korean and this distinctiveness is observed only in the first syllable, due to shortening of long vowels in noninitial syllables. In (1b), loss of a syllable by optional glide formation is compensated by lengthening of the suffixal vowel, although the same lengthening fails in the verb *o-ta* ‘come’: *¢o-a ~ wă*. In (1c), vowel length alternates in the first two stems of irregular verbs, although the same alternation is not observed in the last two verbs. And in (1d), the main focus of the paper, a similar length alternation occurs between ideophones of full vs. partial reduplication, even though the same alternation is not observed in pairs such as, e.g. *$p^hălp^hal$ ~ $p^hălɨ̆lɨ̆$*.

All of these examples, except perhaps (1d), have received considerable attention in the phonological literature of Korean. The vowel shortening in noninitial syllables in (1a) has previously been attributed to the initial syllable stress in Korean. In (1b), the Continuative form of the verb *o-ta* fails to undergo optional glide formation and compensatory lengthening because the underlying stem of this verb is **wʌ-*.[2] The stem vowel /ʌ/

[1] The symbol ¢ indicates an incorrect form. The asterisk is reserved for an underlying or reconstructed form.

[2] Glide formation may be considered to have occurred to *wa* from **o-a,* in which case the question becomes why only this verb has obligatory glide formation with no compensatory lengthening.

drops in hiatus with a suffixal vowel and it is typical in Korean that no compensatory lengthening ensues when this truncation of minimal vowel /ʌ/ occurs:[3]

(2) Glide formation and compensatory lengthening

po-ta	po-a	wʌ-ta	wʌ-a	
"	"	"	wa	vowel truncation: ɨ/ʌ → Ø/ __+V
"	"	ota	"	contraction: wʌ → o
"	pwa	"	"	glide formation: o → w / __ V
"	pwā	"	"	compensatory lengthening

The vowel length alternation in (1c) has also been dealt with in many previous analyses, most of which have assumed long underlying vowel which shortens if there is a CV syllable following it. This 'open syllable shortening' is against the universal tendency that vowels lengthen in an open syllable but shorten in a closed syllable. An alternative analysis first proposed by Ramsey (1978) and adopted by H-S. Kim (1999) has it that these verbs end with a stem final minimal vowel /ɨ/, which drops by syncope if a consonant-initial suffix follows, lengthening the preceding vowel in compensation. If a vowel initial suffix follows, it simply drops by the same truncation rule as in *wa* <**wʌ-a* in (1b):

(3) Syncope and compensatory lengthening

kəti-ta	kəti-ə	
"	kətə	vowel truncation: /ɨ/ → Ø / __ +V
kətta	"	syncope
kātta	"	compensatory lengthening
"	kərə	lenition: t → r /V_V

The length alternation in (1d) is in many ways similar to that in (1c). The long vowel in the full reduplication form, e.g. *sālsal*, is in complementary distribution with the short vowel in the corresponding partial reduplication form, e.g. *sălɨlɨ*: just as in (1c), the long vowel occurs in a closed syllable, the short vowel in an open syllable. But vowels tend to lengthen in an open syllable and shorten in a closed syllable. We therefore cannot simply say that the long vowel shortens when it is followed by a CV syllable. This suggests that what we have here is another example of compensatory lengthening. I have argued at length in a recent article that the base here is **sălɨ-*, which occurs in the partially reduplicated *sălɨlɨ* with duplication of the final CV syllable. In the fully reduplicated *sālsal,* on the other hand, the apocope drops the stem final vowel, compensatorily lengthening the preceding vowel as in (3) above. A problem however arises because as a

[3] E.g. *k'ə* <**k'ɨ-ə* (cf. Inf. *k'ɨ-ta* 'extinguish') as explained below. Note that /ɨ/ and /ʌ/ are harmonic variants of the same vowel in Korean. For a summary of previous analyses and arguments for this new solution, consult H-S. Kim (1999; 2002).

general principle a morphological process such as reduplication should precede phonological processes such as apocope and compensatory lengthening. One way to remedy this problem is simply assume that reduplication does precede these phonological processes but being productive in Korean it persists. Consider the following derivation.[4]

(4) Derivation of *sālsal* and *salɨlɨ* (cf. H-S. Kim 2008)

salɨ	salɨ	
salɨ-salɨ	salɨ-lɨ	copy (full and partial reduplication)
salɨ-sāl	salī-l	apocope and compensatory lengthening
sāl-sāl	salī-lī	copy (reduplicative identity)
sālsăl	salɨlɨ	shortening in noninitial syllable

In this analysis, after apocope of the final vowel and compensatory lengthening of the preceding vowel in the outputs of full and partial reduplication, the copying occurs again, due to Wilbur's (1973) identity constraint, resulting in overapplication of apocope and compensatory lengthening in the fully reduplicated *sālsăl* but their underapplication in the partially reduplicated *salɨlɨ*.

There still are, however, problems of length left unaddressed in (1d). One of them is the aforementioned lack of lengthening in ideophones such as, e.g. *p^{h}ălp^{h}al* and *k'ălk'al,* where the first syllable vowel is generally short, even though they strike us as having a same reduplication pattern as *sālsal* and *sălɨlɨ*.

Another concerns the free variation caused by the recent loss of phonemic length distinction in Korean. For example, the length alternation in reduplicated ideophones in (1d), e.g. *sālsal* but *sălɨlɨ*, is not made by all: some obviously pronounce the former as *sălsal*, with a short vowel in the first syllable just as in the latter. So, one may argue that the vowel length alternation does not exist for these ideophones. But does it really not?

The problem, however, does not end here. In addition to the phonemic length, and its free variation, there is another type of length that is often referred to as 'expressive'. For example, Bae (2003) regards the vowel length in, e.g. *sālsal* 'gently' and *sīlsɨl* 'slowly, leisurely' as being long due to the 'expressiveness' of these ideophones. But in my speech and in general these long vowels in fully reduplicated forms are in alternation with the short vowels in their partially reduplicated counterparts, *sălɨlɨ* and *sɨlɨlɨ*. So, the question arises if these long vowels are really expressive and how we are to distinguish between expressive and non-expressive vowel length in ideophones.

[4] Full reduplication here is assumed to be prefixal. Space limitation prohibits further elaboration of this derivation. Readers are referred to H-S. Kim (2008), which also discusses a possible analysis in Optimality Theory of the recent, productive full reduplication of the type *salɨlɨ*~*salɨlɨ* and its ramifications for phonological theory in general.

These three problems, summarized in (5), are then the main topics of this paper.

(5) Problems of length in Korean reduplicated ideophones
a. lack of lengthening in, e.g. *p^{h}ălp^{h}al* and *k'ălk'al*
b. free variation of length: *sālsal ~ sălsal*
c. expressive length in ideophones.

In the following sections, we consider these problems in an order of increasing difficulty: the free variation of length is discussed in (2.1), the expressive length in (2.2), and the lack of lengthening in *p^{h}ălp^{h}al* and *k'ălk'al* in (2.3).

2. The phonetics and phonology of vowel length in Korean reduplicated ideophones

Unlike the examples of length alternation in (1), which are typically phonological, the length variation observed in (5) above initially appears to be all phonetic; (5a) is caused perhaps by the influence of the laryngeal consonants on duration of the following vowel, (5b) by the loss of phonemic distinction of length, and (5c) looks like a case of phonetic length pragmatically used for expressive purposes. But it turns out that only the last two, (5b) and (5c) are phonetic, but the first, (5a), is rather phonological.

2.1 Free variation of categorical length in reduplicated ideophones

Some obviously have questioned the length alternation in (1b), saying that the said length distinction is no longer operative in modern Korean, especially among young generation speakers.[5] Since the same loss of phonemic distinction seems to underly the long-short variation of the first syllable vowel in, e.g. *sālsal ~ sălsal*, is it possible, in a phonological analysis, to ignore such phonetic variation of length all together?

Well, one thing is clear: the problem will not go away simply because the length distinction is no longer observed synchronically for most Koreans. For, even if not all native speakers of Korean distinguish the length, there are some who still do in their idiolect. We cannot therefore simply ignore the length variation. What we can do instead, in such cases of variation and change, is to regard the length as 'categorical', and deal with the variation in a separate sociolinguistic analysis. The former will be a typical traditional phonological analysis such as (4) above, while the latter will complement the former by explaining where and how the length

[5] Cf. J-W. Park (1993). H-S. Kim (2002) presents an answer to this question and a detailed discussion of this and other related questions concerning the vowel length problem in (1b).

variation is being observed in the population.[6]

Then what does it mean, in phonological terms, that the first syllable vowel in ideophones such as e.g. *sālsal* should be treated as categorically long even though for some it may be short? It means that when it comes to explaining its length alternation with the short vowel in, e.g. *sălɨlɨ*, you need to choose between the two vowel lengths to set up your underlying base: should it be underlyingly short but lengthened (by compensatory lengthening) as in (4) above or underlyingly long but shortened (in an open syllable) as have been supposed in some analyses of similar length alternation?

Failure to recognize this vowel length alternation can crucially affect your analysis, as, for example, in previous analyses where the underlying base is generally considered to be **sal-* for the fully reduplicated *salsal* but **salɨ-* for the partially reduplicated *salɨlɨ*, with no explanation of how the two base forms are related. Y-S. Kim (1984) adopts **sal* as the base, and a morphological duplication of /l/, for which no independent evidence exists in Korean, while Kang (1999) regards **salɨ-* as an extension of **sal-* with no explanation of why such /ɨ/-extension should occur only with this class of reduplicated ideophones. Interestingly, recognition of the categorical vowel length in *sālsal* increases the number of choices available for underlying base (from two above to four because each will have the long vowel option) but this has not resulted in complication of the problem: on the contrary, it has provided the basis for a well motivated explanation of why this class of ideophones contrasts between full and partial reduplications in the first syllable length as well as in the base forms themselves.[7]

A similar oversight is made by Park (2003), who does recognize that the vowel in the first syllable of *sālsal* is phonetically long,[8] but does not consider the vowel length alternatives for his underlying representation. He simply regards **sal* as the base root to which an epenthetic vowel /ɨ/ is added to yield *sălɨlɨ*.[9] He thus includes many examples like *sălɨlɨ* as a partial reduplication type where a monosyllabic CVC root undergoes /ɨ/-epenthesis and CV-suffixing reduplication. Had he recognized the categorical vowel length difference between the full vs. partial reduplication of the type *sālsal* and *sălɨlɨ* and considered **salɨ-* as the alternative underlying base, the outcome of his statistical analysis of the 'productivity of Korean partial reduplication' would have been very different: instead of being a type with a monosyllabic root with /ɨ/-

[6] Perhaps this will be an analysis similar to what Prof. Labov and his colleagues have done. Cf. Labov (1994-2001).

[7] Cf. H-S. Kim (2008) for further elaboration.

[8] Note also Kim-Renaud (1974: 10) who also recognizes the vowel length in /sālsal/, although she is only concerned with nonvoicing of /s/ in intervoiced environment. Cf. Iverson (1983: 196).

[9] Park does not elaborate on the conditions of this epenthesis rule but a similar analysis has been proposed by Y-S. Kim (1984).

epenthesis, many of these examples would have belonged to a type with a bisyllabic base (with apocope and compensatory lengthening), even though they would still be CV-suffixing.

2.2 Expressive vowel length and description of length in pronouncing dictionaries

In this section we first take up the question of expressive length and then look at various pronouncing dictionaries to see how they have recorded the vowel length for reduplicated ideophones of the type, e.g. *sālsal, p^{h}ălp^{h}al*, etc. The focus of this section is thus on presenting the data and how they should be sorted out and interpreted for a fruitful analysis.

The claim made by Bae (2003) is that the long vowel in *sālsal* and *sːālsːal* is expressive. But what is expressive length and how can we distinguish it from categorical length, for example?

The expressive vowel length, in my view, has two characteristics in ideophones. One is that unlike the categorical distinction between long and short vowels, the expressive length carries iconic expressiveness with it: the longer the vowel is, the stronger the iconic connotation that such vowel length is intended to carry. For example, if you further lengthen the vowel that is already long in *s'āls'alhada* 'The weather is chilly', it would mean that the weather is really chilly. But even if you lengthen further the categorically long vowel in *kə͡ːt-ta* 'to walk' (cf. Continuative *kər-ə*), it would not add any expressiveness to it.[10]

The other characteristic is that unlike the categorical length, which is only observed in the first syllable in Korean as in (1a), the expressive length is sometimes observed to occur in non-initial syllables, e.g. *s'ːals'ːalhada ~ s'ːals'ːalhada* 'The weather is gloomy.' Similarly, *s'āls'alhada ~ s'als'ālhada*. But according to C-S. Kim (1991) this is not always possible. A further study is necessary to understand how the nuances of words are affected by the various positions in which the expressive length occurs.

The problem with the vowel length in the fully reduplicated ideophones such as *sālsal* is that in addition to being in alternation with the short vowel in its partial reduplication sister *sălːilːi*, it can also be lengthened further for emphasis. Examples in (6) illustrate this point:

[10] Note the same observation made by C-S. Kim (1991: 746). P-K. Lee (1986) shows that there can be a length difference between *khːn cip* 'large house' vs. *khːn-cip* 'uncle's (father's elder brother's) household', even though both contain the same adjective 'khːn' meaning 'big'. The vowel of this adjective can be lengthened for emphasis in the former but not in the latter: *khːn cip* 'a really big house' but *ɕkhːn-cip*.

(6) Use of length in Korean reduplicated ideophones[11]
a. *sālsal* noknunta ~ *sălsal* noknunta '(It) melts gently (in the mouth)'
b. *sălɨlɨ* noknunta ~ ¢*sālɨlɨ* noknunta '(It) melts gently (in the mouth)'
c. (ku kwaja-ka) ip anese *sălsal* noknunta '(The candy) melts gently in the mouth'
d. *sālsal* noknunta ~ *salsāl* noknunta '(It) melts ever so gently (in the mouth)'
e. ip anese *salsāl* noknunta '(It) melts ever so gently in the mouth'

These examples all exhibit use of vowel length in the reduplicated ideophones of *sālsal* and *sălɨlɨ* 'gently'. (6a) shows the aforementioned free variation of length due to loss of phonemic distinction, but in (6b) the same variation does not occur, supporting our claim that the long-short alternation in the first syllable of *sālsal* and *sălɨlɨ* is categorical. (6c) shows that if the ideophone is not utterance-initial, or not in the initial position of an intonational phrase (IP), the first syllable vowel is short, just as a long vowel gets shortened in the noninitial syllable of a compound (1a). (6d) shows that the long vowel of *sālsal* in utterance intial position can be prolonged to express emphasis (the long macron over a vowel, e.g. $\bar{V}$, indicates an overlong vowel); it also shows that the same expressive elongation can also occur in a noninitial syllable. Finally, unlike the categorical length that undergoes shortening in (6c), this expressive lengthening seems possible in utterance medial position as in (6e), even though the other alternative 'ip anese *sālsal* noknunta' sounds awkward perhaps due to the interference from the rule prohibiting categorical length in utterance medial position (6c).

The intrinsic iconicity of ideophones makes this expressive lengthening a frequent occurrence, which complicates any attempt to analyze vowel length systematically. In addition to the categorical length alternation between *sālsal* and *sălɨlɨ* and the free variation of length between *sālsal* and *sălsal*, we now have to contend with the possibility of vowel length incurred by the so-called expressive length. How are we to know which one of these three types of length is occurring in the first syllable of an ideophonic word?

Perhaps these variables of length are the main reasons behind the inconsistency in some dictionaries of recording vowel length in ideophones. Consider the following table (abbreviated from the full table appearing in the appendix) which tabulates how six pronouncing dictionaries of Korean describe the vowel length alternation of the type, e.g. *sālsal /sălɨlɨ*.

[11] The judgements for these sentences are based on the author's native intuition, for which an independent confirmation is necessary but currently lacking.

(7) Length description in pronouncing dictionaries of Korean

SDK	Nam et al. (1984)	U-J. Lee (1992)	KBS (1993)	H-B. Lee (2003)	Y-W. Jun (2007)	J-H. Lee (2008)
taltal	L &S	S	L	L	S	L
toltol	S	S	S	S	S	S
pəlpəl	(L)	L	S	S	L	L
salsal	(L)	S	L	L	S	L
sɨlsɨl	L	L	L	L	L	L
culcul	(L)	L	S	S	L	S
hulhul	S	L	S	S	L	S
p^halp^{h}al	S	S	S	S	S	S
c^halc^{h}al	S	S	S		S	S
k^hwalk^{h}wal	S	S		S	S	
k'alk'al		S	S	S	S	S
t'olt'ol		S	S	S	S	S
c'alc'al	S	S	S	S	S	S

First, some comments on how this table has been compiled:

1) The ideophone entries for this table have been compiled from the *Standard Dictionary of Korean* (SDK; The National Academy of Korean Language Research, 1999), by selecting only the ones that have both full and partial reduplication, e.g. *taltal/talɨlɨ* 'stirringly', *pəlpəl/pəlɨlɨ* 'tremblingly', *salsal/salɨlɨ* 'gently', etc.[12] If a full reduplication form does not meet this criterion, it has been excluded from the entry: e.g. *kolkol* 'suffering from a lingering illness' does not have the corresponding partial reduplication *¢kolɨlɨ*, so it is not included in the table.

2) Nam et al. (1984) is the only dictionary that has assiduously recorded expressive length, which appears in parenthesis. But interestingly enough there is no instance of expressive length appearing in the noninitial syllable of the above reduplicated ideophones. For example, for *salsal*, it says the first syllable vowel of this ideophone could be expressively long, but as we have seen above, the same expressive length could appear in a noninitial syllable, e.g. *salsāl noknunta*. This suggests that perhaps they were actually marking the categorical length that can also be prolonged for emphasis in ideophones.

3) Nam et al. (1984) has carefully recorded the different vowel length in homonyms, e.g. *tăltal t'ə̆lda* 'shiver tremblingly' vs. *tāltal pokta* 'roast or annoy stirringly'.[13] This is interesting because it evinces contrastive vowel length in ideophones (even though it is in the process of being lost), which in part justifies setting up the categorical length alternation between pairs

[12] The entries, however, are all marked as short in SDK, even though the dictionary does mark long vowels in nonideophonic words. For this reason, its length description does not appear in the table.

[13] Note also Y-W. Jun (2007) which distinguishes between *k^{h}ōlk^{h}ol* 'sound of snoring' vs. *k^{h}ŏlk^{h}ol* 'sound of water flowing'.

such as *sālsal* vs. *sălɨlɨ*.

4) Finally and most importantly, note the bold demarcation line that separates between laryngeal and nonlaryngeal consonants in the base initial position: below the line the vowel is uniformly short, e.g. *k^{h}ălk^{h}al, p^{h}ălp^{h}al, t^{h}ălt^{h}al, k'ălk'al, t'ălt'al, p'ălp'al,* while above the line it is generally marked long, e.g. *kālkal, tāltal, pālpal, sālsal, cālcal,* etc, even though the description varies due to the loss of phonemic distinction of length. The ideophones with base initial /h/ are however problematic: even though /h/ is also laryngeal, these ideophones vary length between dictionaries just like the plain obstruents.

What should a phonologist do when faced with such complex set of data as in the above table? The first thing to do is sort out the types of length, as we have done at the outset of this section. Then care must be taken in interpreting the data according to the problems and the subdisciplines that best suit them. For example, the varied length description between the dictionaries, e.g. *sālsal* ~ *sălsal*, can be interpreted as reflecting the change still in progress in modern Korean: the loss of phonemic length distinction. A sociolinguistic study would be suitable for this type of free variation; perhaps a dialectal study on the possibe variation of length in ideophones is also in order. These studies will presumably confirm our suspicion that the length distinction was perhaps categorical among old generation of Korean speakers but it is now in the process of disappearing.[14] Sorting these out then leaves us with a phonological problem that needs to be addressed phonologically: the alternation of the categorical length between the full vs. partial reduplication in *sālsal* and *sălɨlɨ*. An analysis of this interesting problem has been provided in (4) above.

What remains now is this question that still calls for explanation: why are the bases with initial laryngeal consonants uniformly marked with a short vowel (cf. the S's below the bold line in (7)), even though corresponding bases with nonlaryngeal consonants have a long vowel categorically (cf. the S's and L's above the bold line in (7) which have been interpreted as indicating the loss of this categorical length distinction in progress), e.g. *p^{h}ălp^{h}al* 'bubblingly' vs. *pālpal* 'tremblingly', etc.? Why is /h/ an exception in this onset dichotomy concerning the onset laryngeality and the length of the vowel that follows, behaving like a nonlaryngeal even though it is also a laryngeal consonant, e.g. *hūlhul* ~ *hŭlhul* ' (birds flying) lightly'.

Once the problem is identified, then we need to ask: is this a problem most suitably analyzed in phonetics or phonology? This question is raised because it appears, initially at least, that there is a direct correlation

[14] See, for example, Choi (2002: 48) who shows the generational tendency of transfer from long to short as we go down from old to young generation. Note also that the shortening seems to have occurred first with the alveolar initial bases, as can be seen in the full table (given in the appendix) where the /t/-initial bases are marked short in (almost) all of the dictionaries.

between the laryngeality of the onset and the duration of the following vowel, in which case the problem is most suitably explained by a phonetic study.[15] But as it turns out, previous phonetic studies do not bear out this intuitive presumption, which thus calls for an alternative phonological approach. The possible ways to resolve this problem are then probed in the next section (2.3), first under the hypothesis that laryngeal onsets may shorten the vowel duration in the same syllable (2.3.1), followed by two phonological analyses, one based on laryngeal feature specification (2.3.2) and the other on the concept of consonant strength (2.3.3). An evaluation of these solutions follows in (2.3.4), and the concluding remark with a brief comment on the relationship between phonetics and phonology appears in (3).

2.3 Explanation of vowel length in *p^{h}alp^{h}al* and *k'alk'al*

2.3.1 A possible phonetic explanation: laryngeal influence on vowel duration?

It is of course well known that laryngeal consonants in the onset position may influence the pitch of the vowel in the same syllable, often resulting in tonogenesis in languages. But what is affected in such case is the pitch or the F0 value of the vowel, rather than its duration; so it cannot be directly related to the question we are seeking an answer to. A couple of previous studies, however, may just shed some light on our problem. One is K-O. Kim (1974), which measures the duration of Korean vowels in relation to neighboring consonants. The other is Chung et al. (1999) who work with a large set of artificial utterances to check the 'consonantal and prosodic influences on Korean vowel duration'.[16]

The result of these experiments, however, is only in partial agreement with our hypothesis, showing, inter alia, the general tendency of aspirated obstruents shortening the following vowels most, followed by lax obstruents and, lastly, by tense unaspirated obstruents. Thus while the first part of the result agrees with our hypothesis, the last part rather refutes it. Similarly, the tense fricative /s'/ is said to shorten the following vowel less than the lax /s/. This again contradicts the general shortening effect found

[15] This was the position I took at the conference presentation, in which the phonetic nature of the problem had been suggested; it was pointed out, however, that a phonetic explanation in terms of laryngeal influence on vowel duration is in conflict with the previous experimental findings of Chung et al. (1999). This paper thus began with the modest aim of reconciling the disagreement between the 'impressionistic' and 'mechanically measured' length descriptions by finding an alternative explanation of the vowel length variation, which has turned out, surprisingly enough, to be phonological in nature. One further note on terminology: I have used 'duration' when the problem appears to be 'phonetic' but 'length' when it is 'phonemic'. The vacillation of the terms between 'variation' and 'alternation' should be understood along the same line: the same phenomenon may be referred to as length variation when it appears to be allophonic but as alternation when it is finally defined as (morpho-)phonological.

[16] These studies have all assigned the aspiration portion to the consonants, following the tradition of Han (1964) and others.

after laryngealized consonants in Korean reduplicated ideophones.

These studies thus show that the short vowels in ideophones such as *p^{h}ălp^{h}al* and *k'ălk'al* cannot be due to the direct influence of the laryngeal consonants on vowel duration. Contrary to what we initially thought, the problem cannot be explained phonetically.

2.3.2 A possible phonological explanation: laryngeal features

If the above vowel shortening cannot be explained phonetically, the alternative approach would be to analyze it phonologically. Here we have two choices depending on how you go about doing your phonological analysis. The first thing that comes to mind is perhaps that the laryngeal features may be responsible for the shortening effect. (8) is the laryngeal feature matrix given by Iverson (1983) for Korean stops and /s/:

(8) Laryngeal specification for Korean stops and /s/ (Iverson 1983: 195)

	Fortis (C')	Lax (C)	/s/	Aspirated (C^h)
Spread glottis	-	-	+	+
Contr. glottis	+	-	-	-
Stiff vocal folds	+	-	-	+
Slack vocal folds	-	-	-	-

Iverson does not include any specification for /h/ because he is mainly concerned with the behavior of Korean /s/, especially its lack of voicing in intervoiced environment; but as a fricative it presumably has the same laryngeal specification as /s/, but differs in its specification of the nonlaryngeal feature [strident].

The above specifications allow for a simple vowel shortening rule by grouping tense and aspirated consonants under [+stiff, -slack], which will exclude the plain (lax) stops as well as the fricatives /s/ and /h/. But why would a long vowel be shortened when it is preceded by a consonant with stiff vocal folds? Iverson introduces the features of stiff vocal folds and slack vocal folds to characterize voicing of Korean lax stops in intervoiced environment, so they do not have any direct bearing on the length of the following vowel. If anything, it should be the features of contricted glottis and spread glottis that may affect the length of the vowel that follows. But the tense and aspirated consonants have opposite values for these features, making it impossible to group them as a natural class. Besides, it is difficult to imagine why a vowel would be shortened when preceded by these features. This again raises the question of what phonetic factors if any are behind this shortening rule.

A possible answer to this question could be found in the timing factor: the general consensus is that, ceteris paribus, a vowel that occurs after an onset with longer consonantal duration would be shorter than the same vowel that occurs after an onset with shorter consonantal duration. This 'inverse

length correlation' rule makes sense because the measurement for the tense and aspirated consonants in utterance medial position shows that they are generally longer than plain consonants (cf. Cho and Keating 2001). The vowels would be naturally shorter after these consonants than after lax stops and fricatives including /h/.

In utterance initial position, on the other hand, consonant duration is longest for aspirated consonants, followed by plain stops and, lastly, by tense stops. The inverse length rule thus predicts, and it is confirmed by experiments of K-O. Kim (1974) and Chung et al. (1999), that vowels are longest after the tense stops, medium after the plain stops and shortest after the aspirated stops. The problem is the lack of fit between these findings and the vowel length in reduplicated ideophones, which was precisely the reason why we abandoned the phonetic approach.

Why is the consonant duration of tense consonants so short in utterance initial position, even though they are generally long in medial position? Cho and Keating (2001) conjecture that tense consonants in Korean are like geminates, which often degeminate in contact with a word boundary. Thus in medial position in which no word boundary abuts, the tense consonant as a geminate naturally has long consonantal duration. Because a word boundary abuts in initial position, however, degemination occurs to the tense consonant, naturally reducing its long consonantal duration (not to half but to about two-thirds).

To explain the shortening in reduplicated ideophones, we therefore need to refer to the inherent (geminate) length of the tense consonant, which, together with the long aspirated consonants, shorten the following vowel. Unlike the surface duration which is measurable mechanically, this length is not there to be measured phonetically but exists in the system, phonologically.[17]

How do we represent this inherent consonantal length? Length as a suprasegmental feature is usually associated with the syllabic elements, but if we want, perhaps we can also extend its use to consonants as well. We could specify, for example, tense and aspirated consonants are [+long] whereas plain stops, /s/ and /h/ are [-long], even though such use of feature [long] would be quite unwieldy. There would be one advantage though: having this feature entered into specification of consonants will make it possible to subsume the vowel shortening in ideophones under an OCP constraint that prohibits two [+long] features in succession, *[+long]

[17] This is also reflected in Korean orthography in which a singleton letter is written for plain stops /p, t, k/ and sibilants /s, c/ but a geminate letter for /p', t', k'/ and /s', c'/. The word boundary often serves the function of a consonant, facilitating the reduction of geminate consonants in a long (essentially three if we count the word boundary as a consonant) consonant cluster. By all indications this degemination of tense consonants in initial position is a rule that occurs at the phonetics-phonology interface, while the rule shortening a long vowel after the tense and aspirated consonants is a neutralization rule that occurs in the phonological component.

[+long].[18]

2.3.3 An alternative explanation under strength fluxion

Let us now try another approach, one that utilizes the concept of strong vs. weak consonant types. This concept, perhaps not as familiar as distinctive features, nevertheless has been used by phonologists to characterize certain phonological phenomena. Thus people often speak of lenition (weakening) and fortition (strengthening). Not only that but the tense consonants are referred to in Korean as 'fortis' (strong), the plain obstuents as 'lax' or 'lenis' (weak). In our new phonological analysis, we may thus want to group tense and aspirated consonants as a strong consonant type, the lax obstruents including /s/ and /h/ as weak consonant types.

But labeling processes and phonemes in languages is one thing, using such labels as a basis for a phonological analysis is quite another. To use the concept of strength as a phonological prime, we need some evidence that it does play a role in the scheme of phonological explanation. Most of such ground work has been laid in Foley (1977). Here I will present a case for the tense and aspirated consonants being strong as opposed to weak lax obstruents.

We first consider intervocalic voicing, which is traditionally referred to as lenition. In many languages, this process comprises such routines of change as *p* → *b* → *β* → *w* and the parallel shifts for the alveolar and velar stops. While the same routine has occurred historically in Korean /p/-irregular predicate, e.g. *tow-a* <**top-a* (cf. *top-ta* 'help'; MK *toβ-ʌ*), its first stage is repeated synchronically in modern Korean where /p/ (and other lax obstruents except /s/) undergoes voicing in intervoiced environment, e.g. *kup-ə* [kubə] (cf. *kup-ta* 'bend'). Note, however, that the tense and aspirated stops are exempt from this rule, e.g. *nop^h-a* 'is high (Continuative)', *ap'a* 'father' etc., because these are strong consonants.

Not only consonants but the environments can be also divided into strong and weak types. For example, the intervocalic position in which the weakening process of lenition occurs must be a weak environment, while the initial position in which many of the strengthening processes are observed is a strong environment. Generally speaking, domain initial position is a strong environment, domain medial and final positions are

[18] The consonantal use of feature [long] could be justified by defining the tense and aspirated consonants as diphthongs composed of two timing units, as a long vowel would naturally have two morae. The term 'geminate' has sometimes been used to refer to these consonants phonologically (cf. Oh and Johnson 1997; Choi and Jun 1998) but as we have shown in this paper the term is more appropriately reserved in Korean for tense consonants only, which, unlike aspirated consonants, have short consonant duration in initial position. The long vowel duration after tense consonants is due to degemination of this 'geminate' consonant and the inverse length correlation rule, while shortening of long vowels in reduplicated ideophones occurs after tense and aspirated consonants because these are long consonants and succession of long consonants and long vowels is prohibited under OCP.

often weak environments.

There is also a general principle governing these processes: according to the Inertial Development Principle (IDP), strengthening processes such as fortition occur preferentially in strong environment, weakening processes such as lention preferentially in weak environment. For a number of examples in which this principle is applied for phonological processes in Korean, see H-S. Kim (1993).

We could thus group tense and aspirated consonants under a strong consonant type, after which a long vowel becomes short in reduplicated ideophones such as, e.g. *p^{h}ălp^{h}al*. But a question that immediately arises is, why would a categorically long vowel become short when preceded by a strong consonant? Recall that we rejected the featural explanation on a similar ground. As we recall, prodding ourselves with this question of explanatory adequacy eventually led to a phonological explanation in terms of OCP, that no two [long] features should occur in succession (i.e. *[long][long]). It thus behooves us to answer the above question properly, in an explanatorily adequate manner.

The explanation begins with the observation that these strong consonants occur in word initial position, a strong environment. Thus in consonance with the IDP that strong consonants strengthen preferentially in strong environment, the strong tense and aspirated consonants undergo strengthening. Under the principle of strength conservation that 'morphological units such as words and syllables maintain constant, rather inherent amount of strength,'[19] a weakening will occur in reaction to such strenthening, resulting in a strength fluxion. Although we cannot go too much into the details concerning the mechanism of this strength fluxion, we can provide a simple example, from Korean deverbal nouns with the suffix *-ɨm*.

(9) Deverbal nouns with the suffix *-ɨm*

Infinitive	Deverbal noun
əl-ta 'to freeze'	əlɨm 'ice'
ul-ta 'to cry'	ulɨm 'a cry'
nol-ta 'to play'	nolɨm 'play, gambling'
col-ta 'to drowse'	colɨm 'sleepiness'
al-ta 'to know'	alm 'knowledge'
sal-ta 'to live'	salm 'life'

These examples show that nouns are often derived in Korean from verb stems by attaching the suffix *-ɨm*. When the stem vowel is /a/, however, the suffixal vowel drops as in the last two examples. Many have noticed this vowel elision but have not been able to explain it; Ko (1989: 523), for example, simply regards the forms without the suffixal vowel as exceptional.

These examples are, however, not execeptions; they are a result of

[19] For a detailed explanation of this principle, see Foley (1979) and H-S. Kim (1993).

strength fluxion between the stem vowel and the suffixal vowel. Note that the suffixal vowel is missing only when the stem vowel is /a/, the strongest of all vowels.[20] Thus in consonance with the IDP that a strong element strengthens in preference to a weak element, the strong vowel /a/ strengthens in preference to weaker /o/, /u/ and /ə/, concomitantly weakening the suffixal vowel /ɨ/ by strength fluxion. The vowel thus weakened then drops preferentially because the IDP dictates that elision, a prime example of weakening process, occurs preferentially to a weak element.

(10)

sal-ɨm	col-ɨm	
$sa^{+}l\bar{ɨ}m$	"	strength fluxion
salm	"	preferential vowel elision

The same strength fluxion also occurs in the reduplicated ideophones, even though the interaction is not between the stem and suffix vowels but between an onset consonant and the following vowel. The strong tense and aspirated consonants in the strong word initial position undergoes strengthening in consonance with the IDP; in reaction to this strengthening the following vowel in the first syllable, which is already long due to the processes in (4) above, concommittantly weakens. The vowel thus weakened then manifests as a short vowel: $p^h\bar{a}lp^hal > *p^{h+}\bar{a}p^hal > p^{h+}\check{a}p^hal$, $k'\bar{a}lk'al > *k'^{+}\bar{a}lk'al > k'\check{a}lk'al$.[21]

2.3.4 Evaluation of the solutions

Even though a phonetic explanation has failed, we have managed to put forward two phonological solutions to the problem of vowel length alternation in reduplicated ideophones. Both of these solutions are workable within their respective framework, so this should not be an issue. For example, the OCP constraint, *[long][long] can be readily used in an Optimality-Theoretic analysis, if one wants to do the analysis in that framework. The strength fluxion analysis is also within the bounds of the theoretical constructs as proposed in Foley (1977; 1979). Both also offer a principled analysis in their respective framework: the featureal solution uses the well known principle of OCP, the strength fluxion analysis the IDP.

A criticism may be raised against the nontraditional (and unwieldy) use

[20] See Foley (1977; 1979) for ranking of vowels in phonological strength scale and other principles mentioned above.

[21] As another example of strength fluxion between a consonant and the following vowel, note Latin syncope in gen. *carnis*<**caron-is* (cf. nom. *carō* 'flesh' <**caron*) but gen. *hominis*<**homon-is* (cf. nom. *homō* <**homon* 'man') where the strong liquid strengthens preferentially in consonance with the IDP and the following medial vowel weakens correspondingly, resulting in strength fluxion. The weakened vowel then drops by syncope. See H-S. Kim (1993: 197) for further details.

of [long] as a consonantal feature. Perhaps an alternative would be a nonlinear analysis in which diphthongal sounds have complex timing units, even though how one maintains OCP as the constraint responsible for vowel shortening in such an analysis remains to be worked out.[22]

On the question of insightfulness, on the other hand, we need to take the goals of each framework into account, so it is no simple matter to do the comparison. A typical question for a featureal solution is whether the analysis has in any way contributed to furthering our understanding of the language faculty of native speakers, whether the rules and constraints are psychologically real. The framework that advocates strength fluxion has goals quite different from these; rather than probing the psychological aspect of language, it puts more emphasis on understanding language, by subsuming various phonological phenomena under higher order concepts such as strengthening and weakening and their interaction. Both frameworks, however, share the same goal of finding what commonly constitutes language, the universals of language, the evaluation of which is beyond this paper.

3. Conclusion: the relationship between phonetics and phonology

Perhaps a more pertinent issue is the relationship between phonetics and phonology. We have seen how this issue plays out in the analysis of vowel length variation in reduplicated ideophones. The root of the problem lies in the misfit between the duration of vowels experimentally measured and the length descriptions in pronouncing dictionaries. According to the experiments, in initial position anyway, the vowel is longest after the tense consonants, medium after the lax consonants, and shortest after the aspirated consonants. But according to the dictionary description, the vowels are uniformly short after tense and aspirated consonants, but vary in length after lax consonants.

Why do we have this descrepancy in vowel length pattern? The main reason is that the former is a mechanical measurement of vowel duration, but the latter an 'impressionistic' recording of length in reduplicated ideophones. How should we then reconcile the two different judgements in length? We note that the mechanical measurement of consonantal duration in initial position differs from the same measurement in medial position in that the tense consonants come out about one-third shorter in the former, giving room for longer duration for the vowel that follows. If we

[22] Another point to consider is the negativity of the rule statement, which bans certain constituent structures. This contrasts with the positive statement of the second solution, which reveals the underlying processes. Such negative formulation seems to be especially common in constraint-based approaches, while rule- (or process-) based approaches generally prefer positive fomulation of rules. The difference seems to stem from one's view of linguistic change: does change occur because languages prefer to have certain 'optimal' structures or such structures are rather the result of change by the basic processes that occur preferentially?

mechanically measure the vowel lengths in the first syllables of *s'ăls'al* and *sălsal*, it is very likely that it will come out longer in the former than in the latter as will be predicted by the experiments of Chung et al. (1999).[23] Does this mean that we should not care about such results of phonetic experiments? The answer is an emphatic no. For, if we compare the consonant length in medial position, it clearly shows that the tense and aspirated consonants are durationally longer than the plain lax consonants. It is just that the tense consonants have a geminate quality that disappears in initial position when it abuts a word boundary. What is relevant therefore is the inherent length of consonants which interacts with the following vowel under the inverse length correlation rule: the longer the consonant, the shorter the following vowel. A virtually same rule also operates in English: the vowels are generally longer before voiced obstruents than before voiceless obstruents, because a voiced obstruent has a consonant duration shorter than a voiceless obstruent (cf. Chen 1970).

The above assessment of phonetic/phonlogical analyses thus confirms the old adage concerning the inseparable relationship between phonetics and phonology: a phonetic study can illuminate a phonological problem, and vice versa.[24] We have seen, for example, a blind attempt to apply the results of phonetic experiments fails to explain the problem of vowel length variation in reduplicated ideophones because there is no direct match between the mechanical measurement of vowel duration and the impressionistic recording of length in reduplicated ideophones. The main reason behind this descrepancy is the fact that the tense consonants, despite having a long duration in medial position, are relatively short in initial position, shorter than the lax consonants. Since the consonant duration generally affects duration of the vowel that follows under the inverse length correlation between neighboring consonants and vowels, it is natural that the vowel after a short initial tense consonant should have a longer duration. This however presents two problems, one in phonetics and the other in phonology. Phonetically, why the initial tense consonants are short in duration despite being long in medial position requires an explanation because the initial position is strongly articulated in Korean. Certainly, this problem in phonetics cannot be resolved by any of the mechanical procedures of phonetics. Rather, it requires using phonological knowledge that tense consonants in Korean function as geminates of their corresponding lax consonants and degeminate in contact with a word boundary. Under this phonological thinking, it is now possible to conjecture that a similar degemination has shortened the tense consonants

[23] But an error-free measurement in this case is not going to be easy because some people obviously have a long vowel in the first syllable of the latter form.

[24] Cf. Hayes (2001) commenting on articles published in Gussenhoven and Warner, eds., *Laboratory Phonology 7*: "Broadly, we can see Sole and Chitoran et al.'s papers as attempts to use phonetics to illuminate phonology, and Frota's paper as an attempt to use phonology to illuminate phonetics."

in initial position allowing a longer vowel to follow.

Similarly, an adequate explanation of length alternation in reduplicated ideophones certainly requires phonetic knowledge. Since the short vowels appear after the aspirated and tense consonants only, we may simply write a rule that shortens a long vowel after these consonants, using laryngeal features such as [+stiff, -slack]. Or in the strength fluxion analysis, we can simply say that the vowels are shortened after the strong consonants in Korean. But an adequate explanation is required of why these laryngeal features would have the shortening effect. The phonetics plays a doubly important role here: first, we raise this question because there seems to be no phonetic reason why laryngeality should influence the length of the following vowel; second there seems to be an inverse correlation between durations of neighboring consonant and vowel. Typically, if a consonant is long, the vowel duration is short before or after that consonant, which suggests that it is not the laryngeality of these consonants but their diphthongal length that is relevant. In featural terms, therefore, it is this juxtaposition of two [long] features that is disallowed under the OCP, while in the strength fluxion analysis, the inverse length correlation is a manifestation of the strength conservation principle in segmental duration. Both of these solutions therefore have relied on the results of previous phonetic studies. The analysis thus calls for a more cooperative approach, not just phonetically based phonology but also phonologically inspired phonetics.

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Appendix: Vowel length description for reduplicated ideophones in six pronouncing dictionaries

SDK	Nam et al. (1984)	U-J. Lee (1992)	KBS (1993)	H-B. Lee (2003)	Y-W. Jun (2007)	J-H. Lee (2008)
taltal	L &S	S	L	L	S	L
təltəl	S	S	S	S	S	S
toltol	S	S	S	S	S	S
tultul		S	S	S	S	S
tɨltɨl	(L)	S	S	S	S	S
palpal	S		L	L	L	L
pəlpəl	(L)	L	S	S	L	L
salsal	(L)	S	L	L	S	L
solsol	L		L	L	L	L
sɨlsɨl	L	L	L	L	L	L
swalswal		S	S	S	L	S
sulsul	L	L	L	L	L	L
calcal	S					
cəlcəl	S	S		S		S
colcol	S	S	S	S	L	S
cilcil	L	L	L	L	L	L
cwalcwal	(L)	L	S	S	L	S
culcul	(L)	L	S	S	L	S
hwalhwal	L	S	L	L	L	L
hulhul	S	L	S	S	L	S
holhol	L	L	L	L	L	L
p^halp^{h}al	S	S	S	S	S	S
p^həlp^{h}əl	S	S	S	S	S	S
p^holp^{h}ol	S	S	S	S	S	S
p^hulp^{h}ul			S	S	S	S
c^halc^{h}al	S	S	S		S	S
k^hwalk^{h}wal	S	S		S	S	
k^hwəlk^{h}wəl		S				
k'alk'al		S	S	S	S	S
k'walk'wal		S				
k'wəlk'wəl		S				
k'ɛlk'ɛl		S				
t'alt'al		S			S	
t'olt'ol		S	S	S	S	S
t'ult'ul		S			S	
t'ɨlt'ɨl		S			S	
p'alp'al		S				
s'wals'wal						
c'alc'al	S	S	S	S	S	S
c'əlc'əl		S	S	S	S	S
c'olc'ol		S	S	S	S	S
c'ilc'il		S		S	S	S
c'walc'wal		S			S	S
c'ulc'ul					S	S