A reconsideration of phonological leveling: a case of noun inflection in Korean*

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Kim, Jin-hyung. 2005. A reconsideration of phonological leveling: a case of noun inflection in Korean. *Studies in Phonetics, Phonology and Morphology* 11.2. 83-98. In this paper, I examine the current trends of phonological leveling observed among younger generations and offer a more unified account of attested leveling patterns in Korean, arguing that paradigm leveling is just instantiated by lexically restructured representations. Once it is recognized that certain words of Korean are lexically restructured, the conspiracy of paradigm uniformity exerts grammatical pressure on the phonology of other members within the paradigm. As a result, paradigm leveling does occur. Another notable fact underlying paradigm leveling is that leveling is running consistently in one direction, and its directionality can be described in terms of phonetic and functional attractors. In this paper, it will be argued that phonologically overapplied and unmarked member with high frequency has a greater chance to influence the others within the gangs. **(Korea University of Technology and Education)**

Keywords: paradigm, leveling, restructuring, attractor, frequency, directionality

1. Introduction

The phenomenon of phonological opacity has been the subject of much debate in the literature. Some solutions proposed within the Optimality Theory framework (hereafter OT), such as sympathy theory and stratal OT, have proved to be unsatisfying even to many OT proponents, who have found these proposals to be inconsistent with OT's authentic parallelism. In what follows, I reexamine the best known cases of opacity observed in the Korean noun inflection, and argue that these could simply be due to the interaction between paradigmatic forces and restructured lexical representations.

This paper is organized as follows: In section 2, we will consider some leveling patterns of Korean noun inflection so collected, discussing the phonetic and functional forces that may have given rise to these patterns. Section 3 is devoted to the proposal of lexical restructuring, comparing it with the analysis based on output-output correspondence and arguing in support of its efficiency. In section 4, an account of directionality is provided to describe and predict the uniform direction in evidence today.

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Section 5 summarizes the hitherto discussions and concludes this paper with further implications.

2. Paradigm leveling

At the angle of some departure from a speaker-motivated phonology, apparently problematic phonological phenomena can be given a more natural explanation. It has long been argued that, while such phenomena as assimilation, laxing and elision are speaker-oriented, the correspondingly opposite phenomena, i.e., dissimilation, tensing, and epenthesis, are hearer-oriented. This paper illustrates other phenomena which can be explained from the learner's point of view.

The processes of consonant cluster simplification and palatalization are well-known in Korean. With respect to consonant cluster simplification, codas are allowed in Korean syllables, but complex codas are strictly forbidden. Therefore, underlying consonant clusters are simplified through the process of syllabification. Due to another process of palatalization, stem-final coronal stops are realized into palatals before /i/ if there is a morpheme boundary intervening. These are illustrated in (1) and (2), respectively.

(1) Consonant cluster simplification in noun inflection[1]

stem	/kaps/ kap 'price'	/talk/ tak 'chicken'	/moks/ mok 'portion'
nom.	/kaps-i/ kap.si	/talk-i/ tal.ki[2]	/moks-i/ mok.si
acc.	/kaps-ɨl/ kap.sɨl	/talk-ɨl/ tal.kɨl	/moks-ɨl/ mok.sɨl
'also'	/kaps-to/ kap.t'o	/talk-to/ tak.t'o	/moks-to/ mok.t'o
con.	/kaps-kwa/ kap.k'wa	/talk-kwa/ tak.k'wa	/moks-kwa/ mok.k'wa

(2) Palatalization in noun inflection

/pat^h/: [pa.c^{h}i], [pa.t^{h}e], [pa.t^{h}ɨl], [pa.t^{h}ɨn], ... 'field'
/k'ɨt^h/: [k'ɨ.c^{h}i], [k'ɨ.t^{h}e], [k'ɨ.t^{h}ɨl], [k'ɨ.t^{h}ɨn], ... 'end'
/mit^h/: [mi.c^{h}i], [mi.t^{h}e], [mi.t^{h}ɨl], [mi.t^{h}ɨn], ... 'bottom'

The above phonetic realizations are the cases of regular alternation, where phonotactically unmarked forms do surface. Input-output faithfulness is irrelevant, and output-output faithfulness is not achieved. The results are alternating paradigms.

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[1] Clusters vary in the way they are typically realized in reduction. For example, cluster /ps/ has high percentage of C_1 realization, whereas cluster /lk/ has high percentage of C_2 realization between and within individuals (/kaps/ → [kap] 'price', /talk/ → [tak] 'chicken' etc.). It is not relevant to our discussion which segment will be doomed to be deleted in the unlicensed position.

[2] In Korean, voiceless plain stops become voiced between voiced segments. But I will disregard these phonetic complications here, since they do not bear on the main point.

As shown in (3), however, the innovating speakers of recent younger generations nationwide tend to display a wide range of variation.

(3) Variant realizations in younger generations
a. /kaps-i/: [kap.si] ~ [ka.pi] 'price-nom.'
/hɨlk-ɨl/: [hɨl.kɨl] ~ [hɨ.kɨl] 'earth-acc.'
/moks-ɨn/: [mok.sɨn] ~ [mo.kɨn] 'portion-top.'
b. /pat^{h}-e/: [pa.t^{h}e] ~ [pa.c^{h}e] ~ [pa.se] 'field-loc.'
/k'ɨt^{h}-ɨl/: [k'ɨ.t^{h}ɨl] ~ [k'ɨ.c^{h}ɨl] ~ [k'ɨ.sɨl] 'end-acc.'
/mit^{h}-ɨn/: [mi.t^{h}ɨn] ~ [mi.c^{h}ɨn] ~ [mi.sɨn] 'bottom-top.'

As can be seen above, the regular alternation loses its naturalness and leads to the opacity in that it is phonologically unjustified or unexpected. When considering the opacity is defined in terms of a counterexample to a predictable change, the examples in (3a) are opaque because consonants are deleted even in vowel initial suffixed forms. In (3b), a stop would be expected phonotactically, but in fact a palatal sound occurs at the cost of complicating the process of palatalization by breaking the phonological regularity in the distribution of non-palatal and palatal sounds.

As time goes by, these variants are adopted unambiguously as normal parts of language by listeners, and are likely to be produced as such when these listeners become speakers. Slowly then, over the succeeding generations of speakers, these forms may evolve towards a stable state and produce the effect on the whole system, with the result that allomorphs of a morpheme merge completely throughout the paradigm. Of course, there may be an intermediate phase where different types of paradigms co-exist and that means a change in progress in the grammar. As the generation proceeds, however, the conflict between the substantive constraint of paradigm leveling and the formal constraint of phonological well-formedness is resolved in favor of paradigm leveling.

In the case of cluster simplification, for example, words which have undergone cluster simplification are stored as such in the mental lexicon and thus accessed directly in recognition and production. Then, the other members of the paradigm are analogically pronounced on the basis of the simplex forms as in (4a). The cases of (4b) show that the paradigmatic pressure for a consistently palatalized root-final consonant has spread to the other paradigmatically related forms as well. The underlying cause of overapplied palatalization is the desire to reduce intraparadigmatic variation and allow the coda consonant of root to surface in a uniform manner. In effect, the palatal and non-palatal distinction is leveled in favor of the palatalized consonant.

(4) Paradigm leveling in noun inflection
a. /kaps/ 'price': [kap], [ka.pi], [ka.pɨl], [ka.pɨn], ...
/hɨlk/ 'soil': [hɨk], [hɨ.ki], [hɨ.kɨl], [hɨ.kɨn], ...

/moks/ 'portion': [mok], [mo.ki], [mo.kɨl], [mo.kɨn], ...
b. /pat^{h}/ 'field': [pa.c^{h}i], [pa.c^{h}e], [pa.c^{h}ɨl], [pa.c^{h}ɨn], ...
/k'ɨt^{h}/ 'end': [k'ɨ.c^{h}i], [k'ɨ.c^{h}e], [k'ɨ.c^{h}ɨl], [k'ɨ.c^{h}ɨn], ...
/mit^{h}/ 'bottom': [mi.c^{h}i], [mi.c^{h}e], [mi.c^{h}ɨl], [mi.c^{h}ɨn], ...

The principal question that must be addressed at this point is how such an opaque form is grounded in the requirements of speech act, in the broad sense of production, perception, and acquisition. It has been generally assumed that the structure and development of language is guided by the requirements of producibility, perceptibility, and learnability, each of these factors operating at various levels of language structure. Ease of production, perception, and acquisition cannot be simultaneously increased, and improvements in any one respect necessarily entail sacrifices in the others. In this view, the inclination to paradigm leveling can be said to be motivated by the ease of acquisition at the expense of the other two forces, thereby upholding the economy of "one meaning - one form" (Humboldt's Universal).

Complexity, as a measure of the amount of information which must be processed and stored, is an important factor in the learnability of a system, since it involves the distance between paradigmatically related surface forms. The more memory space the complex information takes up to be processed and stored, the more difficulty it has in learning. Therefore, learners tend to preferentially level paradigms by minimizing the differences in the realization of a lexical item and thus reducing the intraparadigmatic variation. This is because the uniform surface form of a morpheme is easier to learn than several different allomorphs of the same morpheme.

The apparent opacity observed in leveled paradigms is one example of linguistically significant generalizations which cannot be expressed under an otherwise adequate formal framework, but which are truly explicable on a functional basis. To recapitulate, paradigm uniformity as an independent factor in language change checks the outputs of grammars and assigns a cost to allomorphic variations within the paradigm. The regularization of paradigm through the elimination of allomorphy is more convenient and more highly valued by a principle of economy on the part of learner.

There have been proposals for analyzing paradigm uniformity effects under the purview of Optimality Theory, of which Paradigm Uniformity (Steriade 1996) and Transderivational Correspondence Theory (Benua 1997) are the most notable examples, and this is not the place to discuss the merits and liabilities of each. Alternatively I will argue that the emergence of opacity by the loss of regularity in alternation is lexicon-driven. In section 3, I focus on the system underlying leveling strategy, maintaining that it is the consequence of the joint operation of innovative pronunciations and subsequent restructuring of the lexical representation.

3. Restructuring of the lexical representation

The standard Korean, where regular alternation is observed, is expressed by the crucial dominance of markedness constraints above the faithfulness constraints. For example, consider the alternation of cluster simplification and palatalization discussed above. Where the surface forms exhibit the alternation, a question is raised as to what would be the optimal input, namely the lexical representation. The lexical representation should be the one which best explains the alternating paradigm as a whole. The following tableaux demonstrate the selection of the optimal input in the alternating paradigm:

(5) Lexical representation in the alternating paradigm

a. Consonant cluster simplification

Inputs	Outputs	DepSeg	MaxSeg
☞ /kaps/	[kap]		*
☞ /kaps/-i	[kap.si]		
/kap/	[kap]		
/kap/-i	[kap.si]	*!	

b. Palatalization

Inputs	Outputs	Max[ant]	Dep[ant]
☞ /pat^{h}/-i	[pa.c^{h}i]		*
☞ /pat^{h}/-ɨl	[pa.t^{h}ɨl]		
/pac^{h}/-i	[pa.c^{h}i]		
/pac^{h}/-ɨl	[pa.t^{h}ɨl]	*!	

The tableau (5a) demonstrates that the ranking of DepSeg above MaxSeg selects the optimal lexical representation of the alternating surface forms [kap] ~ [kap.si]. If we assume /kap/ as the underlying form, the surface form [kap.si] violates the higher ranked constraint DepSeg. However, assuming /kaps/ as the underlying form, the output [kap] violates the lower ranked constraint MaxSeg. Therefore, the underlying form /kaps/ is the one which best explains the alternating paradigm as a whole.

The same is with the palatalization process. As can be seen in (5b), the strict dominance of Max[ant] above Dep[ant] correctly chooses the optimal underlying representation. The higher-ranked faithfulness constraint Max[ant] selects the underspecified or unmarked form to be the optimal. In general, when a segment alternates for some features in different contexts, in the lexicon it is specified with unmarked values for the features for which it alternates. See Kim (2002) for further discussion.

Now let us consider what is happening in the non-alternating paradigm. If a stem form shows no alternation at all across its paradigm as does among the innovating young speakers, the perception and reinterpretation on the part of the listeners induces a different lexical representation from

the one which can be obtained in the alternating paradigm. Although there is a considerable amount of intra- and inter-speaker variation, a process of lexical restructuring is clearly assumed to gradually happen. In other words, an innovation in pronunciation is a change in the way speakers of a language execute the phonological representations and restructuring is the resulting revision in the lexical representations. In the OT version, lexical restructuring can be addressed by the principle of Lexicon Optimization, which demands that non-alternating morphemes be stored in their constant underlying form.

(6) Lexicon Optimization (Prince/Smolensky 1993: 192)
Suppose that several different inputs I_1, I_2, ... , I_n when parsed by a grammar G lead to corresponding outputs O_1, O_2, ... , O_n, all of which are realized as the same phonetic form ϕ - these inputs are all phonetically equivalent with respect to G. Now one of these outputs must be the most harmonic, by virtue of incurring the least significant violation marks: suppose this optimal one is labeled O_k. Then the learner should choose, as the underlying form for ϕ, the input I_k.

As stated in (6), the Lexicon Optimization principle favors the analyses which minimize input-output disparities, and which maximize faithful mapping by avoiding *Faith marks. With Lexicon Optimization, the learner, given a set of inputs which yield the same result and a set of ranked constraints of the language, will select as the optimal underlying representation the input form which most closely resembles the output form, thus leading to the fewest faithfulness violations. In short, the most well-formed output parse is chosen as the proper underlying representation among the universal set of input candidates. Let us consider the way lexical restructuring can be addressed within the Lexicon Optimization principle.

(7) Lexical representation in the non-alternating paradigm
a. Consonant cluster simplification

Inputs	Outputs	Faith
/kaps/	{[kap], [ka.pi], [ka.pɨl], ...}	*! (MaxSeg)
☞ /kap/	{[kap], [ka.pi], [ka.pɨl], ...}	

b. Palatalization

Inputs	Outputs	Faith
/pat^h/	{[pa.c^{h}i], [pa.c^{h}e], [pa.c^{h}ɨl], ...}	*! (Dep[ant])
☞ /pac^h/	{[pa.c^{h}i], [pa.c^{h}e], [pa.c^{h}ɨl], ...}	

The tableaux (7) demonstrate that the principle of Lexicon Optimization correctly selects the optimal lexical representation which is the most well-parsed output form. When comparing the change in the lexical representations of alternating and non-alternating paradigm, we can assume

that paradigm leveling can be described as a difference in the lexical entry between the grammar of older speakers and that of younger speakers. In other words, younger speakers can be assumed to have restructured the input representation with consonant clusters into the one with singletons.[3] For example, younger speakers never exhibit consonant clusters in any forms of the word as evidenced in (7a), so the null hypothesis is that there is no cluster underlyingly. The well-attested historical process of the restructuring of underlying forms has clearly taken place in younger generations. Thus, they will posit the constant simplified surface form as the underlying lexical representation, and contrariwise this makes possible the prediction that there will be no chance for consonant clusters to go into effect even before vowel-initial suffixes. This approach is completely compatible with the principle of Lexicon Optimization.

With respect to palatalization, the change from the grammar of standard speakers to that of innovating speakers can also be captured by reference to a difference in the lexical entry. As stated above, a speaker with the standard grammar has /pat^{h}/ as the underlying representation, whereas in the innovating grammar the lexical representation of the word must be /pac^{h}/ to generate the correct output forms. This is lexically stored as such to ensure that it is always realized with palatalized consonant. Based on the newly-restructured lexical representation, the paradigm of {pat^{h}} is being leveled with no allomorphic alternations, which can be explained in a unified fashion only by positing changes in underlying representations.

One thing to be notable with respect to (7) is that members of an inflectional paradigm do not stand in a cyclic relationship to each other, or rather, each member of the paradigm is morphologically derived from a shared base root. The generalization we can draw from the leveling pattern of (7) is that a shared string of all the related forms within the paradigm has to be as similar as possible for some phonological property. In other words, every member of a paradigm is co-equal in their potential to influence the surface phonology of the other members of the paradigm. This nonderivational interrelationship is obviously not accessible within the derivational frameworks originating from *SPE*.

However, it can be formalized in terms of output-output constraints requiring identity for some phonological property to hold for all members of a paradigm. The Optimal Paradigm model developed by McCarthy (2001) posits a symmetrical relationship among members of a paradigm, with all members potentially able to influence the pronunciation of the others, instead of one member having priority. In essence, the Optimal Paradigm model argues that candidates for evaluation are not single forms but entire paradigms and that these paradigms are evaluated for the satisfaction of identity and markedness constraints. In OP, every output

[3] Of course, there is a period of inbetween fluctuation, which explains the co-existence of variant realizations. As time goes by, these variations may subsequently merge throughout the paradigm. This shows that a process of lexical restructuring is gradually on-going.

form in a candidate paradigm stands in correspondence with every other output form, and marks may be incurred by means of pairwise comparisons. OP constraints, faithfulness constraints on this intraparadigmatic output-output correspondence relation, resist alternation within the paradigm. Through interaction with markedness and other faithfulness constraints, the optimal paradigm is the one which minimally violates only the lowest-ranked constraints.

(8) Optimal paradigm

a. OP-Ident ≫ *Complex ≫ IO-Faith

/kaps/	OP-Ident	*Complex	IO-Faith
{[kaps-i], [kaps-ɨl], [kap-to], ...}	*!***		*
☞ {[kap-i], [kap-ɨl], [kap-to], ...}			***
{[kaps-i], [kaps-ɨl], [kaps-to], ...}		* !	

b. OP-Ident[ant] ≫ *Ti ≫ IO-Faith[ant]

/pat^{h}/	OP-Ident[ant]	*Ti	IO-Faith[ant]
{[pac^{h}-i], [pat^{h}-ɨl], [pat^{h}-e], ...}	*!***		*
☞ {[pac^{h}-i], [pac^{h}-ɨl], [pac^{h}-e], ...}			***
{[pat^{h}-i], [pat^{h}-ɨl], [pat^{h}-e], ...}		*!	

As evidenced in (8), paradigm leveling is achieved through the crucial dominance of an output-output correspondence constraint and the relevant markedness constraint. Apparently, there is no empirical difference between the Optimal Paradigm model and the solution based on lexical restructuring. However, I will argue in support of lexical restructuring for the following reasons.

Despite its evident strengths, OP deals only with leveling that is total in nature. Leveling is not, however, an all-or-nothing change, but rather the sum of a series of individual changes. In other words, all members within a paradigm do not undergo leveling all at once. Rather one member, called “an attractor”, exerts pressure on another member, and such progression proceeds until all members are uniformly represented with no alternant forms left. During the intermediate stages of this progression, there still exist some alternations. It is unclear how OP could accommodate these gradual stages in progress. Although OP may predict the final state of paradigm leveling, it does not appear to be equipped to account for the intervening intermediate stages.

Overall investigation into Korean noun inflectional patterns also reveals that all the nouns do not undergo leveling. Whether paradigm leveling is active or not is determined by various factors, which will be discussed in the next section. In effect, a morpheme is restructured only in the non-alternating situation so that it can be subjected to paradigm leveling. This morpheme-specific restructuring is part of the lexical entry of a morpheme in the relevant grammar, and thus must be encoded as a property of

individual morphemes.[4] Therefore, paradigm leveling can only apply to this morpheme if its lexical entry has been restructured by the addition of some lexical marking. In contrast, ranking or reranking in the Optimal Paradigm model alone can have no way to selectively affect an arbitrary set of morphemes, so it additionally relies on lexical marking to ensure that this set of morphemes do show paradigm leveling. By Occam's razor, the theory that needs lexical restructuring alone is to be preferred to that which needs both lexical marking and output-output correspondence.

To complete this part of the argument, regular alternation in the initial state of the standard Korean is represented by the crucial dominance of markedness constraints above faithfulness constraints. The markedness constraints force unmarked outputs to emerge regardless of the input. But evidence of the complete loss of alternation by some of the innovating speakers directs us to assume a process of lexical restructuring through lexicon optimization. In view of the notion of grammar optimization, this state of lexical restructuring is regarded as the gain of optimal grammar through a uniformed paradigm at the expense of the loss of a phonological generalization.[5]

To review briefly, I have shown that lexical restructuring has taken place as a change in the grammar of the younger generations, the sum of which presents a leveled paradigm through a series of analogies or diffusions. At this point, there remains one question to be raised as to why a given change of leveling operates in the direction it does. On this, I will propose that certain alternant in the paradigm matters more than the others to learners and it serves as the "attractor" in leveling other members. In other words, a particular member of the paradigm has a privileged status because of its frequency, its perceptual salience, its relative markedness, and so on. The issue of identification of the attractor will be dealt in the next section.

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[4] The appeal to the underlying specification has not been unusual in the literature. With respect to English stress, the following examples are of particular interest, which are taken from *SPE*.

(1) agénda, uténsil, appéndix, aróma, hiátus, horízon, aréna
(2) vanílla, Mississíppi, Kentúcky, anténna, confétti, abscíssa

The words with light penult stress in (2) contrast in a striking way with those in (1) in that they violate the generalization that the stressed penults of nouns are heavy, since the penultimate vowel is short and has no apparent closing consonant. The *SPE* solution for this problem is to postulate underlying geminates, so that the stress rule treats them like the words in (1). The solution taken here is similar to that in *SPE*, though the underlying diacritics are slightly different.

[5] It has been argued in the literature that grammar has a strong inherent tendency to be as transparent as possible. This optimal transparency is achieved in two ways: (a) paradigms with alternation, in which the input-output disparities involved are transparent due to the regularity of the alternation; (b) paradigms without alternation or a uniformed paradigm.

4. The directionality of leveling

From the data presented so far, there does seem to be a universal tendency towards paradigm leveling. At this point, we can ask further how paradigm leveling is implemented in a given speech community, that is, why paradigmatic change should have channeled in this specific direction and to these particular words. This must be answered if our understanding of paradigm leveling is to move beyond simple description up to actual explanation.

Speakers tend to make some formal connection between members of morphological gangs[6] and try to maintain the identity of their roots even though there is no independent motivation for linking these forms together. Thus, the phonological structure of a member is influenced by that of other members in the paradigm, which can be regarded as attractors. Under the assumption that there exist different weights in lexical strength among the paradigm members, attraction is stronger where phonetic or functional connection is greater. In this way, allomorphy is eliminated within the morphological gangs in order to show that they stand in a closer relationship.

There could be any number of conceivable variables at work that would exert varying degrees of influence and directions of leveling change. These forces must be determined empirically, and we can also consider the possibility that certain social trends are likely to favor one realization over another. Here, I isolate some of the major forces that guide the directions of paradigm leveling. One predictable pattern appears to be overapplication -only, which is in line with the general concept of fuller utilization of rules in the generative phonological theory. Some regular phonological rules do overapply within a paradigm to the effect that they serve to highlight the formal connection between the paradigm members saliently. Given a process of palatalization, for example, there are two ways to level alternations within the paradigm of /pat^h/: {pac^h, pa.c^{h}i, pa.c^{h}ɨl, ...} or {pat^h, pa.t^{h}i, pa.t^{h}ɨl, ...}. The first of these paradigms shows overapplication of the palatalization process. There is palatalization of /t^h/ even in the unsuffixed form, where the conditioning *i* is absent. The second paradigm shows underapplication of palatalization in that the process is blocked in the suffixed form *pat^h-i*. Paradigm leveling is satisfied either way, but the paradigm with underapplication cannot win out. Overapplication satisfies the high-ranking constraint that is responsible for the palatalization process, but underapplication does not. Underapplication does better on IO faithfulness, but that is irrelevant because there already happened a process of restructuring into /pac^h/. The resulting paradigm is one which satisfies

[6] The concept of morphological gangs was introduced by Carol Fehringer (2003). The term 'gang' has been commonly used in the psycholinguistic literature in connection with neighborhood effects when referring to word recognition.

both paradigmatic and phonotactic constraint of the language such as palatalization in this case.

Somewhat related with overapplication, another factor in the directionality of paradigm leveling is attraction to the unmarked. The allomorph consistent with the well-formedness constraints in the relevant grammar plays a role as an attractor in leveling the other members.[7] With reference to the Korean paradigm of {pat^h}, the unmarked form *pac^{h}i* with respect to palatalization acts as an attractor in the not-yet-leveled paradigm {pat^h, pa.c^{h}i, pa.t^{h}ɨl, ...}, with *pat^h* forced to resemble it by paradigm uniformity. Thus, the palatal and dental alternations are leveled to the effect that they are regularized in favor of the palatal consonants and restructured as /pac^h/. To regularize <[pac^h-i], [pac^h-ɨl], [pac^h-e], ...> as <[pat^h-i], [pat^h-ɨl], [pat^h-e], ...>, on the other hand, is not probable, because *pat^h-i* in the latter paradigm continues to satisfy the structural description of palatalization and therefore has every chance to surface with a palatal consonant. We can safely conclude that strictly physiologically motivated unmarked form has a privileged status in the conditioning of directionality.

Another factor that conditions the directionality is the relative token frequency of individual members of a paradigm. The more frequent a lexical item, the more likely it is that it will be stored in the lexicon. Frequent words of higher memory strength are thus processed more easily and retrieved faster from memory than infrequent words. As a result, paradigm leveling tends to extend the more frequent word to the less frequent forms within the paradigm. For instance, many speakers of English have eliminated the alternation in *house/houses*, where it is the singular form not the plural that is extended ([haʊs]/[haʊzəz] ⇒ [haʊs]/[haʊsəz]). This is by no means arbitrary, in that noun singulars are in general more frequently used in relation to noun plurals. This is not unique to English. With respect to cluster simplification in Korean nouns, since independent citation form is most frequently used of all the declensional forms, the independent stem alternant is prone to extend to the other word-forms of the paradigm. The surface phonology of the base citation form [hik] of /hɨlk/ 'soil', for instance, is carried over to the derived form /hɨlk-i/, which is realized as [hɨ.ki]. This is so-called base-priority effect.[8] In this respect, Korean verb stems show a stark contrast with nouns, since they are bound morphemes and so cannot stand in isolation

[7] One well-studied example involves the fate of the Classical Latin nominative *honos*. Originally, the paradigm displayed a consonant alternation (*hono**s*** ~ *honō**r**is*) resulting from a regular rule that rhoticized /s/ intervocalically. Nominative singular *honos* was later leveled in favor of the /r/- alternant, thus: *hono**r*** ~ *honō**r**is*. This demonstrates leveling that favors an unmarked alternant.

[8] The attractor in leveling need not necessarily be the independent citation form. There are many instances in which base-priority does not hold. Leveled paradigm of {pac^h, pa.c^{h}i, pa.c^{h}ɨl, ...} from /pat^h/ is one example, where the derived form of [pac^h-i] serves as the basis for the leveling of the other forms. Thus, it is in principle possible that the formal properties of any member may influence those of the others in the paradigm concerned.

but necessarily appear in the morphologically conjugated forms, which explains the asymmetrical rarity of leveling in verb paradigms.

(9) Contrast in leveling between nouns and verbs
a. Leveling in nouns
/kaps/ 'price': {kap, ka.pi, ka.pɨl, ka.pɨn, ...}
/hɨlk/ 'soil': {hɨk, hɨ.ki, hɨ.kɨl, hɨ.kɨn, ...}
/salm/ 'life': {sam, sa.mi, sa.mɨl, sa.mɨn, ...}

b. No leveling in verbs
/əps-/ 'be absent': {[əp.s'ə](*[ə.pə]), [əp.s'ɨl](*[ə.pɨl]), [əp.c'i], [əp.k'o], ...}
/kɨlk-/ 'scratch': {[kɨl.kə](*[kɨ.kə]), [kɨl.kɨl](*[kɨ.kɨl]), [kɨk.c'i], [kɨk.k'o], ...}
/salm-/ 'boil': {[sal.ma](*[sa.ma]), [sal.mɨl](*[sa.mɨl]), [sam.c'i], [sam.k'o], ...}

What is of significance is that young speakers have restructured the input representation as identical to the simplified form only in the case of nouns, whereas it has not happened in the case of verbs in spite of the fact that they have the same combination of consonants.

Before leaving the issue of a predictable pattern based on frequency, I do want to point out that the extent of the susceptibility of leveling shows some gradient variations: paradigms of higher frequency words cave in to the leveling change sooner than those of lower frequency words. For example, cluster simplification process is available in any noun paradigm, but every noun inflectional paradigm does not actually undergo that process. Words which are more frequent are more susceptible to simplification over time than less frequent words. The following sample from the corpus shows that the degree of paradigm leveling is proportionally based on frequency ratio.[9]

(10) Gradient leveling degree
a. {hɨlk} 'soil' (0.000096) > {talk} 'chicken' (0.000053) > {salk} 'wildcat' (0.000001)
b. {k'ɨt^{h}} 'end' (0.000831) > {pat^{h}} 'field' (0.000068) > {pyot^{h}} 'sunshine' (0.000004)

Once again, frequent words are more likely to be affected by leveling than infrequent words. We can account for this asymmetry straightforwardly if lexical restructuring has occurred in frequent words earlier than in infrequent words. With relation to this, it is also interesting to note that leveling effects appear to be favored in some morphological categories, while the other derivatives of the same base are outsiders in that they are not included in the leveling change. In the case of palatalization, for example, inflected forms of {pat^{h}} 'field', such as {[pa.c^{h}i], [pa.c^{h}ɨl], [pa.c^{h}e], ...}, display the characteristics of leveling membership, while, by contrast, compound words of the given base, such as {[pan.ni.raŋ] 'field

[9] The corpus used in this study is KAIST Concordance Program (http://csfive.kaist.ac.kr/kcp).

rows', [pan.nil] 'field farming', ...}, do not show the formal identity of their palatalized stems. In this regard, we can conclude that the more tightly words are associated with each other, the stronger the preference for uniform paradigms.

There is also a possibility that the size of morphological gang or the number of the leveled members may affect the direction of analogical change. This is similar to what McCarthy calls a "majority rules" effect. The more members of a paradigm share an output string, the more pressure there is for all members of the paradigm to share the same output string by analogy. Returning to cluster simplification, stems followed by a consonant-initial suffix or a syllable boundary are more common and more frequent than those followed by a vowel-initial suffix: /kaps/, /kaps-to/, /kaps-man/, /kaps-kwa/, /kaps-cita/, /kaps-s'ata/, /kaps-nata/, etc. Thus, cluster simplification process tends to spread from the stems followed by a consonant-initial suffix to those followed by a vowel-initial suffix.

So far we have isolated some of the major forces that play a role in determining the actual leveling pattern. Here we should note that the direction of leveling cannot be attributed solely to any one particular factor at all. Rather, the interplay of the above-mentioned phonetic and functional factors has effected the favored paradigm pattern in evidence today. Viewing things from the perspective of language use, grammar is seen as something dynamic. So accounting for the conditioning of directionality does not necessarily imply that it must be deterministic. In other words, it is impossible to arrive at a categorical statement of the conditioning. Rather, the factors which can predict the directionality of the paradigm can only be described probabilistically. Further empirical studies will hopefully substantiate these gradient properties by bringing the use of language into the picture.

5. Conclusion

In this paper, I have tried to argue that the preference of paradigm uniformity widely observed in Korean noun inflection is morphologically or lexically motivated, rather than purely phonological. In accounting for the triggering forces of leveling paradigm, I hope to have shown that some analyses that have relied on output-output correspondence should be recast with a different assumption concerning the role of the lexical representation. By positing lexical restructuring of underlying representation, both alternating and non-alternating paradigm can be explained in a unified fashion in line with the principle of Lexicon Optimization.

One step further, the fact that the direction in which paradigms are leveled is never capricious or arbitrary invokes a question as to how paradigm leveling is implemented in a speech community. In conditioning the pattern of paradigm, there appear to be at least five determining factors: overapplication of phonology, attraction to the unmarked, token frequency,

base priority, and majority effects. Through the interplay of these phonological and functional forces, the paradigm pattern evidenced today has emerged.

Of course, the account of paradigm leveling proposed here is far from complete. A fuller account of the leveling data needs to address extragrammatical factors from the perspective of language use as well. The patterns of phonological leveling discussed above reflect a tendency rather than a true condition, and the varying patterns in the community also seem to encourage a study of extragrammatical factors such as style, social class and tempo. In this regard, Bybee (2001) maintains that grammar is seen not as something autonomous but as a dynamic system which emerges from language use.

The approach taken in this article can be extended as our understanding of lexically conditioned alternations improves. I am hopeful that this and other works of similar kind will provide enough motivation to shift the current of phonology from formalism to functionalism.

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