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On the Issue of the Stratified Phonological Lexicon and Optimality Theory

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Lee, Juhee. 2006. On the Issue of the Stratified Phonological Lexicon and Optimality Theory. *Linguistic Research* 23.2, 1-31. This paper considers a range of cases which exhibit differences of phonological behavior among categories. There are two kinds of phonological alternations: a. Those that are only phonologically conditioned. b. Those that are conditioned by an amalgam of phonological, morphological and lexical information. The latter one raises an important general question: how exactly do phonological, morphophonological, and lexical information interact in the grammar? This question has a long history of diverse answers in phonological theory. Hence, in this paper, I shall focus on this type of phonological alternations. (**Kyung Hee University**)

Keywords optimality theory, lexicon, lexical stratification, core and periphery

1. Introduction

In the literature, many researchers have discussed a number of processes of adaptation of English loanwords in Korean. Some of these processes require, in the face of it, a different ranking from the native one (see tableaux in (2) below). This issue is the central point of this paper, which addresses and resolves it.

The issue stands whether or not one OT grammar can account for the different phonological behaviours of native and loan words. The apparent solution involves re-ranking of the faithfulness constraints in order to explain the different phonological behaviours. However, this solution runs against the assumption of *invariant ranking*. I will instead argue that the difference between the phonological behaviour of loan and of native words can be solved by means of *indexed-faithfulness* constraints without using *re-ranking of faithfulness* constraints. Two different rankings would create two different grammars within one and the same language.

Let us now look at examples of the conflict in the grammar between native and loan words in Korean phonology. In Korean, consonant clusters (henceforward CC) are not permissible within a syllable and, therefore, such underlying clusters will be syllabified as C.C, in conjunction with the following vowel segment. Alternatively, it

will be necessary to delete one of the consonant within the word level,[1] a process called Consonant Cluster Simplification (henceforth CCS) in Korean. The following examples show that loanwords behave differently from native items:

(1)	Native (CCS applies)[2]			Loan (CCS does not apply)	
	/talk/	[tak]	'chicken'	[k^{h}ɨ.ri.sɨ.ma.sɨ]	'Christmas'
	/kaps/	[kap]	'price'	[t^{h}ɨ.rəm.p^{h}ɨ]	'trump'
	/hɨlk/	[hik]	'soil'	[sɨ.t^{h}ɨ.ra.i.k^{h}ɨ]	'strike'
	/salm/	[sam]	'life'	[sɨ.t^{h}a.il]	'style'

CCS is found in the Hangeul(native) and Sino-Korean lexical strata, and this creates a differential ranking problem in OT: it creates two different grammars, as in pre-OT analysis, because it contradicts the assumption that loanword phonology is the same as native phonology. Consider the tableau in (2). In (2a), DEP-IO is ranked higher than MAX-IO, while MAX-IO is ranked higher than DEP-IO in (2b):

(2) a. Hangeul(native) and Sino-Korean (DEP-IO ™ MAX-IO)

/kaps/	*COMPLEX	CODA-COND	DEP-IO	MAX-IO
kaps	*!			
☞ kap				*
kas		*!		*
kap.sɨ			*!	

b. Loanword (MAX-IO ™ DEP-IO)

/toust/	*COMPLEX	CODA-COND	MAX-IO	DEP-IO
toust	*!			
tous		*!	*	
☞ tousitɨ				**

This differential ranking problem has to be addressed. In the literature, lexically prespecified phonological patterns have long been accepted within the generative framework. It is widely acknowledged that classes exist within languages, e.g. lexical strata, roots vs. affixes, nouns vs. other word classes, heads vs. dependents. These

[1] I am focusing on the word level here
[2] Compare the following examples with the data in (1):
/talk+i/ → [talgi], /kaps+i/ → [kapʃi], /hɨlk+i/ → [hɨlgi], /salm+i/ → [salmi]

classes contain morphemes that may differ in terms of size, alignment, phonological content, or all three, even when identical semantic information is being introduced. In a number of languages, words that belong to different lexical categories behave differently with respect to phonological contrast and neutralization.

In the light of this, I shall consider a range of cases which exhibit differences of phonological behaviour between loan and native categories in Korean.

It is generally assumed that there are two kinds of phonological alternation: a) those that are only phonologically conditioned, and b) those that are conditioned by an amalgam of phonological, morphological and lexical information. The latter alternation raises general question especially important for our discussion: how exactly do phonological, morphophonological and lexical information interact in the grammar? This question has a long history of diverse answers in phonological theory. I shall focus on this type of phonological alternation in order to solve the problem of loanword phonology as against native phonology.

2. Historical Background for the Integration of Loanword Phonology into Native Phonology

2.1 Pre-Generative Analysis

According to Saciuk (1969), one of the contributions of the Prague School of Linguistics to the theory of phonology was the realization that a subset or subsystem of the vocabulary of a language exhibits structural features which are not found in the majority of the words in the language. It was pointed out by members of this group that the larger subset of lexical items, which behave uniformly, corresponds to the native vocabulary, whereas the smaller subsystems, displaying sounds or combinations of sounds not found in the native vocabulary, are from borrowed words and foreign words.

It is reported that the first person to write about these two different subsets of the phonological system was Vilém Mathesius (cited by Saciuk 1969). He discusses foreign borrowings which entered the language a long time ago and which have adapted to the native phonological system. They consist of segments common to the native subset, but are different from the native vocabulary because of the unusual grouping of these segments or because of the environments in which they appear (Mathesius 1929:157-8). Thus, for example, in German [x] and [č] occur word-initially only in foreign borrowings.

Mathesius developed this topic in the synchronic study of loanwords (1934). In that paper, he argued that the foreign vocabulary, i.e. the non-native subset of the lexicon

of a language, is different from native forms on purely synchronic grounds. That is, 'foreign words', i.e. non-native forms, often exhibit phonemes which do not appear at all in the native layer of the lexicon. In colloquial modern Czech, for example, [g] is a variant of /k/ in native words, but in non-native words /k/ that is word-initial, intervocalic or precedes or follows a liquid, is pronounced [g], while in native forms /k/ is pronounced as a voiceless velar stop in these environments.

On the other hand, Bloomfield (1933), an American structuralist, discussed languages which contained 'foreign-learned layers' with 'a separate style of pattern and derivation.' To explain this, he gives the examples of 'Latin-French forms' in English, the 'Latin type' in the Romance languages, 'forms from Old Bulgarian' in Russian, 'a stratum of Persian and Arabic words' in Turkish, 'Persian words' in Arabic, and 'Sanskrit' in the languages of India. On the basis of this evidence, Bloomfield divided phonological systems into native and non-native subsystems.

Harris (1951), however, was reluctant to follow this idea of Bloomfield. He essentially denied any interaction between phonemics and morphophonemics by maintaining a sharp conceptual distinction between them.

In the 1940s and 1950s, other American linguists made indirect suggestions about the necessity of partitioning the phonological system into native and non-native subsets. Martin (1952) divided Japanese morphs into two classes: one for the Sino-Japanese component and the other for 'Yamato', or native Japanese. He goes on to show how these two classes are different from one another.

These early studies of the theory of the lexicon in pre-generative analysis have been discussed broadly by Saciuk (1969), Kiparsky (1968), and SPE, with regard to the facts and the theoretical significance of lexical stratification. We discuss the generative analysis in the next section.

2.2 Generative Analyses

The development of generative grammar enriched the theory of phonology. The problem of the existence of native and non-native components in the phonological system is viewed from the perspective of rules, boundaries, features, etc.

The first generative phonologist to tackle the existence of native and non-native components was Lees (1961). He made a distinction between the native and the borrowed lexicon, showing that some rules are typical of the native component and that some special rules are not applied to non-native forms, e.g. the geminate consonant rules, the voicing cluster rules, etc.

Saciuk (1969) reports that in the 1960s, there were four dissertations on phonology written at M.I.T., by Schane, Foley, McCawley, and Lightner dealing with the native and non-native subdivision of several languages.

Schane (1968) divided the native subset into 'inflectional' and 'derivational' morphological classes, subdividing the latter into 'learned' and 'nonlearned'. He argued that the 'learned' forms behave differently from all other subclasses of the French native vocabulary. For example, underlying /al/ becomes [ŏ] in nonlearned formatives, but remains [ăl] in learned forms. The alternation of [ŏ] : [ăl] provides some evidence for the necessity of the learned vs. non-learned dichotomy within French.

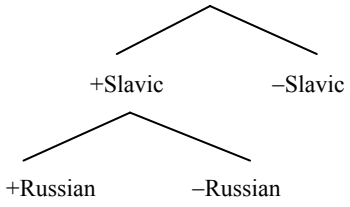
Foley (1965) subdivided the Spanish vocabulary into two classes: one is 'vulgar' and the other, 'erudite'. He argued that the same underlying morpheme may show different phonetic reflexes in 'vulgar' and 'erudite' related forms, such that some rules apply to members of the 'vulgar', i.e. native, class, and not to 'erudite', i.e. non-native, lexical items. For example, 'vulgar' reír 'to laugh' vs. 'erudite' risa 'laughter' and ridículo 'ridiculous', all come from the underlying root /ríd/. These examples reveal that vowel lowering only applies to 'vulgar' forms.

Of the four scholars cited, McCawley and Lightner contributed most to the understanding and theoretical formulation of the subdivision of the lexicon. McCawley's (1968) dissertation deals with the phonological component of a grammar of Japanese. He divided the Japanese vocabulary into four strata: Native, Sino-Japanese, Onomatopoeia, and Foreign. He argues that these strata differ from one another in that some rules are specified to apply to morphemes belonging to one or several of them, but not to morphemes of the other strata. Thus, the phonology of Japanese contains rules which specify a morpheme feature distinction, such as [+Sino] and [–origin].

Lightner's (1965) analysis of Russian has that morphemes in the lexicon marked + or − for the morpheme marker [R], meaning Russian, i.e., native. For example, he distinguishes the t:č alternation in otvetit 'to answer' otveču 'I will answer' from the t:šč alternation in vozvratit 'to return' vozvrašč 'I will return'. The lexical morpheme in the former is [+R], and in the latter, [–R].

Moreover, he makes a further subdivision in the Russian lexicon by introducing [+S] and [–S] diacritics. The [–S] forms undergo almost none of the phonological rules that apply to the [+S] subset. For classifications of [±R] and [±S], he represents the relationship as in (3):

(3)



The existence of several lexical strata in languages is also discussed in Postal (1968), SPE (1968), and Hyman (1970). I turn now to developments since the publication of SPE in 1968.

2.3 Case studies since SPE

As already mentioned, stratal divisions of phonology in many languages have been reported by several linguists (for Japanese, see McCawley 1968, Itô and Mester 1995a.b. 1999, Vance 1987; for Korean, see O. Kang 1992; for other languages, Chomsky and Halle 1968, Kiparsky 1968, Postal 1968, Saciuk 1969, Holden 1976, and Mohanan 1982). The posited stratal divisions for some languages are well motivated to account for some phonological processes which may or may not be applicable to certain strata of the vocabulary.

The ongoing work of stratal divisions in phonology has received a good deal of attention within OT grammar recently. In this section, I shall introduce some of this work and elucidate how phonology can vary depending on the morphological category of lexemes.

2.3.1 English

As can be seen, various languages have undergone extensive borrowing. In SPE, Chomsky and Halle (1968:373) state the following:

(4) 'In the phonology proper, we also find quite commonly that rules apply in a selective fashion and thus impose an idiosyncratic classification on the lexicon. Often there is a historical explanation for this idiosyncratic behaviour, but this is obviously irrelevant as far as the linguistic competence of the native speakers is concerned. What the speakers know is, simply, that a given item or set of items is treated differently from others by the phonological component of the grammar.'

By way of example, English needs to distinguish items of Germanic origin from other items for the purpose of certain rules, such as velar softening. Non-Germanic items also need to recognize sub-divisions such as words of Greek or Romance origin. Crucially, the motivation for this sub-stratal division is its idiosyncratic behaviour from a phonological viewpoint. Let us look at an example from English.

Giegerich (1992) argues that the vast majority of English words containing tense vowels have to be marked as vowel shift exceptions: vowel alternations only occur in a small, mainly Latinate, subsection of the vocabulary.[3]

[3] Giegerich (1992, 1999) further argues that this is the 'free-ride' problem of generative phonology. To avoid large-scale exception marking for rules that are not fully productive, words

Giegerich (1999) also discusses the productivity of Latinate affixes which is considerably impaired by their tendency only to attach to Latinate bases, while native (Germanic) affixes do not suffer from such a systematic restriction on their productivity. In other words, Latinate affixes fail to attach to Germanic affixes while Germanic affixes are free to stack onto Latinate bases, e.g. **home-lessity* vs. *atomicness*; Latinate affixes fail to attach to Germanic roots, e.g. **shortrity*, **bookic* vs. *solemnly*, *disdainful* etc. The very fact is that bound roots in English are, with few exceptions, of Latinate origin.[4]

2.3.2 Malayalam

Mohanan (1982) discusses the Dravidian vs. Sanskrit contrast in verbal compounds in Malayalam. In verbal compounds ([N+V+-I], for example), the stem final nasal of the first stem deletes only if the second stem is of Sanskrit origin. In subcompounds and cocompounds ([N+N]), the nasal deletes irrespective of the etymology of the second stem. Thus, nasal deletion takes place in the verbal compound *ambarācumbi* 'skyscraper' (*ambarām* 'sky), because *cumb* is of Sanskrit origin, but not in *marāṅcaaṭi* 'tree swinger', because *caaṭ* is a Dravidian verb. In contrast, deletion takes place in the [N+N] compound *marāccaŋŋala* 'wooden chain', even though *caŋŋala* 'rope' is Dravidian. Let us consider more examples in (6):

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are allowed to take a free ride through derivations. However, I believe that this problem is obviated by the concept of *'Richness of the Base'* in OT grammar.

[4] Giegerich (1999) argues that 'base-driven lexical stratification' has to replace 'affix-driven lexical stratufication'. However, my main concern in this thesis is not whether or not the English Lexicon is driven by affix or base. For more discussion see Giegerich (1999). Within the framework of OT, Benua (1997) explains the affix-driven class in the English lexicon. Similar cases can be found in Korean morphology. Derivational prefixes and suffixes come from both the native language and Sino-Korean, whereas inflectional suffixes are exclusively native. Interestingly, there are no loan affixes. According to H-M Sohn (1999), a native affix can occur with a native root or stem, but rarely with a Sino-Korean root or stem, and vice versa. There are many exceptions, however, as illustrated in (5), where affixes are in bold-face: (data from H-M Sohn 1999)

kwun-umsik (native 'extra' + SK 'food') 'snack'
amh-saca (native 'female' + SK 'lion') 'lionesss'
sin-nayki (SK 'new' + native 'person') 'new person'
sayk-**kkal** (SK 'colour' + native intensifier) 'colour'
kan-kan-**i** (SK 'space-space' + native adverbializer) 'at times'
sa-nyen-**ccay** (SK '4-year' + native '-th') 'the fourth year'
Sewul-**sik** (native 'Seoul' + SK 'style') 'Seoul style'.

(6) Mohanan (1982:141)

Dravidian second element	ṟasaŋkolli ‘kill joy’ (ṟ asam ‘interest’; koll ‘to kil’) waiṟamwiʐuŋŋi ‘diamond swallower’ (waiṟam ‘diamond’; wiʐuŋŋ‘swallow’) maanamn̲ookki ‘ski gazer’ (maanam ‘sky’; nookk ‘look’)
Sanskrit second element	Janad̲roohi ‘enemy of the people’ (janam ‘people’ ;d̲roohikk ‘harm’) maargad̲arsi ‘path shower’ (maargam ‘path’; d̲arsikk ‘see’) maṯawid̲weeṣI ‘religion hater’ (maṯam ‘religion’ ; wid̲weeṣikk ‘hate’)

2.3.3 Japanese and Korean

We now discuss the case of Japanese lexical stratification (McCawley 1968, Itô and Mester1995a.b, 1999, Vance 1987 and many others) to show that Japanese is one of the languages which shows clear evidence of lexical stratification.[5] Itô and Mester’s work is crucially different from the sub-lexicon model of McCawley (1968), which needs its own specific rules and constraints for each sub-lexicon.

Arguing against the sub-lexicon model, Itô and Mester develope a model of Core-Periphery structure in OT in order to explain the character of lexical stratification in Japanese. The rationale for this proposal is based on the phonological differences shown in (7) (Itô et al. 1999:41):

(7)	Yamato	Sino-Japanese
a. roots are maximally one foot	--	Yes
b. all vowels are high (first root vowels exempted)	--	Yes
c. vowel syncope and fusion of obstruents	--	Yes
d. $C^{y}o$, $C^{y}u$ sequences are excluded	Yes	--
e. Rendaku voicing	Yes	--
f. Lyman’s Law	Yes	--
g. postnasal voicing	Yes	--

Itô et al. (1999) argue that the two lexical classes in question are also distinguished according to morpheme combinations. Sino-Japanese morphemes are bound roots that combine largely with each other, forming a large, learned and technical vocabulary

[5] For the time being, I will not discuss the core vs. periphery structure in Japanese, since the main purpose of this section is to present various languages which exhibit a tendency to sub-lexical division. The concept of ‘core and periphery’ will be discussed in a later section.

analogous to the Latinate vocabulary of English. In the case of Korean, I assume that Sino-Korean words share similarity with the Sino-Japanese and Latinate classes of vocabulary, in the sense that native speakers use them so frequently that they do not consider them foreign as such.

To put it another way, I suggest that for the synchronic classification of items, such as Sino-Korean, Sino-Japanese, etc., it is not important to identify their etymological history, since some frequently used loanwords are regarded as *native* by speakers. It is generally believed that Sino-Korean words are regarded more as *native* words than *borrowings*. However, there are phonological differences to be observed:

(8)	Hangeul (native)	Sino-Korean
t-palatalization[6]	Yes	---
n-insertion in compounding[7] (when the second element is native)	Yes	---
vowel merger[8]	Yes	---
Minimality condition; Min(word) ≥ $[\sigma\sigma]_F$	---	Yes

As can be seen, although Sino-Korean is conceived of as native-like, there are clear differences between the Hangeul and Sino-Korean strata. This will be reviewed extensively in the later section, to see how phonology can be sensitive to morphological categories in the Korean language within the framework of OT. In order to investigate this lexical internal variation in languages, I shall discuss the theory of lexicon in the OT in the next section, as well as the motivation for lexical stratification in Korean.

[6] There is no *t* in the coda of Sino-Korean words.

[7] Han (1994) takes the position that *n* is not present underlyingly but inserted later. Her argument is against the *n*-deletion approach (see Ahn 1985, H-S Sohn 1987).

a. The second stem is native Korean
[[pat^h][il]] → pannil
'field' 'work' 'working in a field'
[[k'oc^h][ip^h]] → k'onnip
'flower' 'leaf' 'petal'

b. The second stem is Sino-Korean
[[kɨlim][ilki]] → kɨrimilgi (*kɨrimnilgi)
'picture' 'diary' 'pictorial diary'
[[simcaŋ][isik]] → simjaŋisik (*simjaŋnisik)
'heart' 'transplantation' 'heart transplantation'

[8] See Table 4 below.

3. The Theory of the Lexicon in OT

3.1 OT Grammar in the Lexicon

In this section, we consider the theory of the lexicon and how OT can project the structure of a language's grammar into the lexicon. First, I shall discuss the formal theory of the lexicon in OT, comparing it with the lexicon in derivational theory. Then, I shall investigate how the OT principles of *Richness of the Base* and *Lexicon Optimization* single out the best one from among the infinite number of possible candidates.

Prince and Smolensky (1993) state that the structure of the constraints in a language's grammar is reflected in the structure of its lexicon. Following this view, I also believe that the lexicon contains all the contrastive properties of a language's phonology, as well as the morphological, syntactic and semantic properties of the grammar. The Generator then provides all the possible combinations for the input. In other words, in OT, whatever is 'contrastive' depends on interactions of constraints at the surface level, eliminating any constraints on the lexical representations ('Richness of the Base'). The concept of *Richness of the Base* is defined in (9):

(9) Richness of the Base
No constraints hold at the level of underlying form.

The definition in (9) means that the set of possible inputs to the grammars of all languages is the same. According to McCarthy (2002:70), 'Richness of the Base says that there are no language-particular restrictions on the input, no linguistically significant generalizations about the lexicon, no principled lexical gaps, no lexical redundancy rules, morpheme structure constraints, or similar devices. All generalizations about the inventory of elements permitted in surface structure must be derived from markedness/faithfulness interaction, which controls the faithful and unfaithful mappings that preserve or merge the potential contrasts present in the rich base.'

The idea of *Richness of the Base* accords well with existing analyses of loanword phonology (see C. Rice 2000, Katayama 1998, 2000, Lee 2003). This work has suggested that a range of empirical generalizations concerning the phonology of loanwords can be modeled using constraint ranking.

Take a concrete example from English. English has no words beginning with the sound ŋ. The rich base provides both /ŋɑw/ and /nɑw/, but this distinction is neutralized to surface [nɑw]. In this case, the grammar asserts that there is no word-initial ŋ in the surface forms of English, and the actual underlying representation of

[nɑw] can be selected by *Lexicon Optimization*. In particular, *Lexicon Optimization* chooses as underlying form, output parse is the best well-formed structure chosen by the grammar.[9] Consider the following definition of *Lexicon Optimization*:

(10) Lexicon Optimization (Prince and Smolensky 1993)
'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.'

Lexicon Optimization (Prince and Smolensky 1993:192) is an elaboration of an idea of Stampe (1972), who suggested that underlying forms should always match surface forms in the absence of evidence to the contrary. Crucially, *Lexicon Optimization* does not contradict *Richness of the Base*.

In derivational theory rules are ordered in a step-by-step manner. Consider, then, the cases where input and output are not identical. The first rule in a series applies to the input form, then the second rules applies to the intermediate form derived from the application of the first rule and this process continues until the last rule produces the final output form. In this way, we cannot avoid having several processes during the course of a derivation and this gives rise to an economy problem. I repeat, therefore, that OT has a number of advantages over the derivational alternative since it does not involve steps or stages. In OT there is just one evaluation: it all happens in one fell swoop.

3.2 Motivation of the Phonological Lexicon and Lexical Stratification

In current research the integration of loan and native phonology has been discussed extensively. I also have to note that previous and ongoing work on lexical stratification and the phonology of loanwords (Silverman 1992, Yip 1993, Paradis

[9] Compares the mappings to [nɑw] from the two inputs, as shown below:

			*[ŋ	IDENT(velar)
a.	/ŋɑw/	☞ nɑw		*
		ŋɑw	*	
b.	/nɑw/	☞ nɑw		
		ŋɑw	*	*

1995a,b and 1996, Paradis and LaCharité 1997, Paradis and Lebel 1994, Paradis and Prunet 2000, Katayama 1998, and references therein) has raised great interest because of the differences in behaviour between native and loanword lexical items.

In this section, I shall provide a general outline of lexical stratification and the reasons for its necessity in some languages. I will then examine the case of Korean and attempt to show that lexical stratification is needed in order to achieve a unified account of the phonology in a single grammar, and to avoid conflicts in the constraint rankings relevant to the language.

As is widely known (McCarthy and Prince 1993, Prince and Smolensky 1993), OT defines a grammar by a single set of ranked constraints for each language, but a single ranking cannot account for those cases where there is conflicting behaviour in the same phonological process. Hence, some researchers have adopted a free re-ranking system which opposes *Ranking Invariance*. I shall argue that Itô and Mester's (1995b) use of re-ranking of faithfulness constraint resorts to brute force in order to keep their proposed Core-Periphery Structure in the Japanese Lexicon.

I shall propose that Korean native and loanword phonology can be explained in one grammar, and that the language also instantiates the necessity for lexical stratification. My analysis is couched in terms of Correspondence Theory, as proposed by McCarthy and Prince (1995). Specifically, it will build on the previous analyses of Urbanczyk (1995, 1996), Benua (1997, 1998), Fukazawa et al. (1998) and Fukazawa (1999), showing how different kinds of faithfulness relations coexist in a grammar.

Following this line of thought, an analysis of native and loanword phonology in one grammar with a single constraint ranking is shown to be possible by using *Indexed-IO* for each stratum not only in the Korean lexicon, but also in other languages. To explain this proposal, we shall first consider cross-linguistic evidence that some languages have stratified divisions which tell us how phonology can be sensitive to morphological category. We will first focus on the cases of Japanese .

3.2.1 Lexical Organization in Japanese

The division of the phonological lexicon into core and periphery was originally proposed by Itô and Mester (1995a), on the basis of segmental processes and distributional restrictions in modern Japanese for which they postulate four strata.[10] This work is crucially different from the sub-lexicon model of McCawley (1968), which needs specific rules and specific constraints in each sub-lexicon. Arguing

[10] Historically, four kinds of sub-lexicon exist in Japanese. McCawley (1968) and Itô and Mester (1995a) classify them as Yamato, Sino-Japanese, Mimetic and Foreign, the latter split by Itô and Mester (1995b) into Foreign (assimilated foreign) and Alien (unassimilated foreign), depending on the degree of assimilation.

against the sub-lexicon model, Itô and Mester (1995b) develop the idea of a core-periphery structure within OT in order to explain the properties of lexical stratification in Japanese.

According to Itô and Mester (1995b), the core is defined by the maximum set of lexical constraints, which constitute the unmarked situation. However, I shall argue that the real image is not one of core vs. periphery. Let us consider the following:

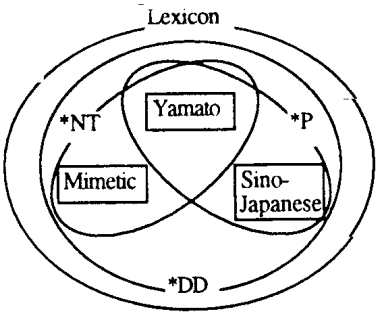


Figure 1. Non-subset relation between strata (Itô and Mester 1995a:823)

Figure 1 shows the non-subset relation between strata in Japanese. Contrary to Itô and Mester's (1995a) proposal, the image does not embody a core vs. periphery structure. Rather, certain parts overlap while other parts do not.

The suggestion of Itô and Mester (1995a, b) is that there are strict limits on lexicon-internal re-ranking: when it does occur, it is restricted to the re-ranking of Faithfulness constraints only. In other words, markedness rankings are fixed across all the strata in the Japanese lexicon, but faithfulness constraints can be moved, where all the facts make it necessary.

We illustrate this, in the tableau below, with hypothetical inputs, taken from Itô and Mester (1995b:188-9).

(11)

Yamato ranking:		SYLLSTRUC, NOVOIGEM, NO-[P], POSTNASVOI	FAITH
/kadda/	kadda	*! NOVOIGEM	
☞	katta		FAITH[voi]
/kanta/	kanta	*! POSTNASVOI	
☞	kanda		FAITH[voi]
/paka/	paka	* NO-[P]	
☞	haka		FAITH[lab]

As can be seen, in the Yamato ranking all four wellformedness constraints are fulfilled in the selected outputs. However, in other parts of the lexicon this does not always happen. Consider the following three tableaux to see the ranking differences between strata in (12)-(14):

(12)

Sino-Japanese ranking:		SYLLSTRUC, NOVOIGEM, NO-[P],	FAITH	POST NAS VOI
/kadda/	kadda	*! NOVOIGEM		
☞	katta		*FAITH[voi]	
/kanta/ ☞	kanta			*
	kanda		*FAITH[voi]	
/paka/	paka	*! NO-[P]		
☞	haka		*FAITH[lab]	

(13)

Foreign ranking:	SYLLSTRUC, NOVOIGEM	FAITH	NO-[P], POSTNASVOI
/kadda/ kadda	*! NOVOIGEM		
☞ katta		*FAITH [voi]	
/kanta/☞ kanta			*PNV
kanda		*!FAITH [voi]	
/paka/☞ paka			*NO-[P]
haka		*!FAITH [lab]	

(14)

Alien ranking:	SYLL-STRUC	FAITH	NOVOIGEM, NO-[P], POSTNASVOI
/kadda/☞ kadda			*NOVOIGEM
katta		*!FAITH[voi]	
/kanta/ ☞ kanta			*POSTNASVOI
kanda		*!FAITH[voi]	
/paka/ ☞ paka			* NO-[P]
haka		*!FAITH[lab]	

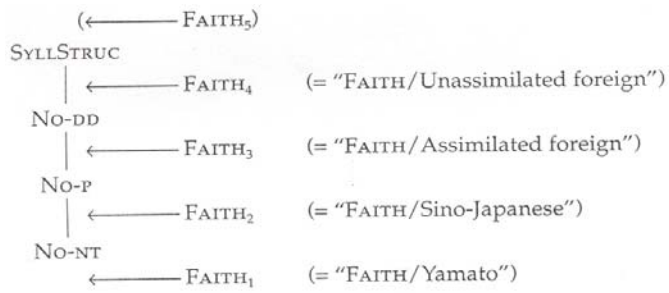
As we can see above, faithfulness constraints can be moved in the ranking[11]. In particular, Itô and Mester attempt to solve the conflict between language internal

[11] FAITH can in principle move, indicated by the position (a)-(e):
(e) >> SyllStruc >> (d) >> NoVoiGem >> (c) >> No-[p] >> (b) >>PostNasVoi >> (a)

variability and ranking invariance by allowing re-ranking of Faithfulness. Moreover, this introduces a modification of the OT principle of *ranking invariance*, which defines a single constraint hierarchy as constituting the entire grammar of a language. Thus, I contend that accepting the re-ranking of Faithfulness results in each stratum having a different grammar.[12] A similar argument has been made by researchers like Benua (1997) and Fukazawa et al. (1998).[13]

In Itô and Mester (1999), a slight modification is introduced to their previous proposal of re-ranking of Faithfulness. Because of the noted problems, they advance the theory of *Indexed-Faithfulness* (relativized/or split faithfulness), by which they attempt to eliminate differential ranking problems without using re-ranking. This relative ranking is displayed in (15) (Itô and Mester1999:72):

(15)



Itô and Mester's (1999) proposal serves to prevent conflicts within the grammar. In essence, their proposal consists of three elements. First, ranking consistency for IO-faithfulness constraints.[14] Second, a M >> F structure for the initial state of the grammar, as proposed by Smolensky (1996). Third, ranking conservatism as a

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[12] Though I do reject Itô and Mester's re-ranking of Faithfulness constraints in lexical stratification, it does not mean that I entirely disagree with their proposed model of core-periphery structure in the lexicon. In my view, core-periphery structure may or may not exist in the Japanese language in the sense of how it is strictly dominated, but it is clear that the degree of assimilation processes in relation to foreign words provides instantiation that such a structure can exist in a language.

[13] Benua (1997:90) claims that this is simply a stipulation that does not follow from anything else in the subgrammar theory. She strongly argues that it is unclear why Faithfulness constraints are mobile, while markedness constraints are not. On the re-ranking of Faithulness issue, Fukazawa (1999) rejects this system by adopting Correspondence Theory (McCarthy and Prince, 1995). She proposes that each sub-lexicon bears its own Input-Output (IO) Correspondence relation in Japanese.

[14] Ranking Consistency: (Itô and Mester 1999:82)

'Let F and G be two types of IO-faithfulness constraints (e.g. IDENT-PLACE and IDENT-μ). Then the relative rankings of the indexed versions of F and G are the same across all strata: $\forall AB\ (F/_A \gg G/_A) \Rightarrow (F/_B \gg G/_B)$.'

principle governing the successive stages of a developing grammar. With these principles they embed the core-periphery model in the context of learnability and grammar development.

However, I wish to question their assumptions about how children know what is a core item and what is a periphery item in the vocabulary. Are children really able to differentiate core and periphery items in the process of grammar development?

Fukazawa et al. (1998) follow Correspondence Theory (McCarthy and Prince 1995) and the notion of multiple sets of Faithfulness in a grammar, originally developed by Urbanczyk (1995, 1996) and Benua (1995, 1997), which shows that phonological patterns can vary in line with differences between morphological categories within a language: a pattern observed in one category may not occur in another. In this way, Fukazawa et al. suggest that it is possible for each correspondence relation, such as IO, OO, BR, TT etc., to bear multiple sets of Faithfulness constraints, one for each morphological class in a language.

Now the only real difference between Itô and Mester's (1999) later work and Fukazawa et al. (1998) concerns the construal of *Core* and *Periphery* in the Japanese lexicon. Differing from Itô and Mester, Fukazawa et al. deny that such a structure is part of the grammar in Japanese: for them, it is only a tendency.

To sum up, Itô and Mester (1999) and Fukazawa et al. (1998) independently propose relativized (split) Faithfulness constraints in different strata to overcome the problem of different rankings. By using relativized (split) Faithfulness constraints, a single set of constraint rankings within a language is possible. We shall now move on to discuss Korean.

3.2.2 Lexical Organization in Korean

As presented in an earlier section, a large body of work on the differences in morpho-phonological behaviour in a language points to the necessity of lexical stratification (see Itô and Mester 1999, and references therein). Morphologically speaking, the Korean language can be analysed as having mainly four domains, that is, native-Korean (Hangeul), Sino-Korean, loanwords, and ideophones. Class membership is determined by the etymological source, its period of adoption or particular function which delivers special semantic meaning such as sound, smell, colour, mood, and etc.

Needless to say, the Korean lexicon is characterized by numerous elements of foreign origin. H-M Sohn (1999) suggests that the Sino-Korean origin of more than half of the total foreign vocabulary can be attributed to two facts. Firstly, Chinese culture and learning deeply permeated all aspects of Korean life in the past, as historically Korea subordinated itself to the political and cultural influences of China. Secondly, due to the ideographic nature of the characters and the monosyllabic nature

of the morphemes, Chinese morphemes, rather than native morphemes, provided a much greater degree of facility for forming new words to represent the new concepts and products that appeared as civilization progressed. Hence, nearly all technical terms in academic fields, politics, economy, law, society and other cultural aspects of life as well as personal, place, and institutional names, are Sino-Korean words.

Song (1986) classifies the Korean lexicon into two main categories, namely, Sino-Korean and Non-Sino-Korean. On the other hand, O. Kang (1992) argues that there are three lexical sub-strata in the Korean lexicon, that is, native Korean (Hangeul), Sino-Korean and foreign words. Although O. Kang made useful observations on the Korean lexicon and its phonological characteristics she did not consider ideophones as an independent category. Note that some native phonological rules do not affect the ideophone vocabulary.

Although Kang made a good observation, she did not consider onomatopoeic and mimetic words or ideophones, which I believe that they should be treated as an independent lexical stratum because of their differences. For instance, umlaut, vowel merger and palatalization do not apply to ideophones whereas these phonological processes do apply in native Korean words. I suggest, therefore, that there are four strata in the Korean lexicon.

In the literature, Shin (1997) and Oum (1999), both of whom view the Korean lexicon as having four major domains. Both of their studies seem to support Itô and Mester's (1995a, 1995b and 1999) proposed Core-Periphery structure in the Japanese lexicon. Shin argues that umlaut in the *Kyungsang* dialect does not affect Sino-Korean, ideophones or loanwords, but it does affect Native-Korean (Hangeul) words. Because of disharmony in other types of Korean morpheme classes, Shin argues for a Korean lexicon model similar to Itô and Mester's (1995a, 1995b) proposal for Japanese grammar.

Although Shin suggests four morpheme classes in Korean based on the umlaut process which governs the morphological category, he did not consider whether or not the Korean lexicon could be organized into a core and periphery structure. Since he focused on the umlaut process, he does not adequately describe the specific lexical character of Korean. Nevertheless, Shin does provide material for discussion, arguing that the Korean lexicon is similar to that of Japanese, as mentioned above. Consider Table 1 (taken from Shin 1997:300):

As we can see from Table 1, some phonological processes do not apply to certain lexical strata. However, I should point out that umlaut may apply to Sino-Korean words as well as to Hangeul words. Note that Shin only considers the *Kyungsang* dialect of Korean in relation to the umlaut process. Umlaut does apply in other dialects, such as *Chungchung* and *Chella*[15], as Kang (1992) pointed out.

[15] It has very limited application: see data in (16).

Table 1. Phonological phenomena found in four different morpheme classes

Hangeul	Sino-Korean	Ideophones	Loanwords
Umlaut	*	*	*
Palatalization	Palatalization[16]	*	*
Verbal Morphology -Vowel harmony	Verbal Morphology -Vowel harmony	Vowel harmony	*
Vowel Merger	*	*	*

Following Kang (1992), I believe that umlaut does apply to the Sino-Korean stratum in dialects such as *Chungchung* and *Chell*a. Nevertheless, there are few examples, and this leads us to conclude that the umlaut process is very restricted and non-productive in the Sino-Korean stratum. Consider the examples in (16) (from Kang 1992), which show that umlaut can occur in the Sino-Korean stratum:

(16) /hakko/ [hɛkk'yo] or [hakk'yo] 'school'
/məsčaŋi/ [mətčɛŋɪ] or [mətčaŋi] 'fashion leader'

In this light, we need to revise Table 1. Importantly, I shall add Duɨm-Law, which states that phonological processes do not apply to ideophones and loanwords. Interestingly, vowel merger is only applicable in Hangeul. However, no stratum violates the syllable structure constraints. Consider the revised Table 2:

Hence, let us now take a close look at the lexical stratification of Korean presented in Table 2. To understand stratified phonological lexicon, I now illustrate each phonological process operating in the lexicon of Korean.

Table 2. Phonological behaviour for each morpheme class (Revised version)

HANGEUL	SINO-KOREAN	IDEOPHONE	LOANWORD
Vowel Merger (Coalescence)	N/A	N/A	N/A
Umlaut	Umlaut[17]	N/A	N/A
Palatalization	Palatalization	N/A	N/A
Duɨm-Law[18]	Duɨm-Law	Duɨm-Law	N/A
Vowel Harmony	Vowel Harmony	Vowel Harmony	N/A
Syllstruc	Syllstruc	Syllstruc	Syllstruc

[16] There is no t-palatalization in this stratum.
[17] Very limited as shown in (16).
[18] Duɨm-Law: *$_w$[ŋ, *$_w$[l , *$_w$[n/{i,y}
l-dropping is one of the characteristics of the Altaic languages: in all the languages considered to belong to this group, a liquid sound does not occur word-initially.

Table 3. Umlaut

HANGEUL	/koki/ [kegi] 'meat' /mək+hi+ta/ [mek^{h}ida] 'to be eaten' /cuk+i+ta/ [cigida] 'to kill' /api/ [æbi] 'father' /c^{h}aŋp^{h}i/ [c^{h}æŋp^{h}i] 'shame' /sum+ki+ta/ [ʃimgida] 'to hide' /kɨli+ta/ [kirida] 'to draw, paint' /salp^{h}+i+ta/ [sælp^{h}ida] 'to inspect closely' /təti+ta/ [tedida] 'moving slowly' /puti/ [pidi] 'by all means' /canti/ [cændi] 'lawn' (data from Hume 1990)
SINO-KOREAN	N/A
IDEOPHONES	N/A
LOANWORDS	N/A

Table 4. Vowel Merge (or Coalescence)

HANGEUL	/u + i/ [ü] /o+ i/ [ö] /ɨ + i/ [i] /ə+ i/ [e] /a + i/ [æ] /sanai/ [sanæ] 'man' /sai/ [sæ] 'gap' /əiko/ [ego] 'alas' /po+i+ta/ [p öda] 'to be seen' /ai/ [æ] 'child' /oi/ [ö] 'cucumber' (data from Ahn 1998)
SINO-KOREAN	N/A
IDEOPHONES	N/A
LOANWORDS	N/A

Table 5. Duɨm-Law: word level → *$_{w}$[l , *$_{w}$[n{i,y}

HANGEUL	No word starts underlyingly with a liquid in pure Korean.
SINO-KOREAN	/li+ca/ [ija] 'interest' /li+pal+so/ [ibalso] 'barber shop' /lo+in/ [noin] 'old man' /nyə+ca/ [yəja] 'woman'
IDEOPHONES	No word starts underlyingly with a liquid in ideophones.
LOANWORDS	N/A [radio] 'radio' [ramən] 'noodle' [rain] 'line'

Table 6. Palatalization

HANGEUL	/mati/ [maji] ‘the eldest’ /kat^{h}i/ [kac^{h}i] ‘together’ /maci/ [maji] ‘hempen paper’ /sikan/ [ʃigan] ‘time’ /muni/ [muñi] ‘door-subj’
SINO-KOREAN	/hwal-lyək/ [hwaɻɻək] ‘vital power’ /in-lyu/ [iɻɻu] ‘human race’ /hun-lyən/ [hyɻɻən] ‘training’ (data from Ahn 1998)
IDEOPHONES	N/A
LOANWORDS	N/A

Table 7. Vowel Harmony

HANGEUL (VERBAL MORPHOLOGY)	Stative	Past tense	Imperative	Gloss
	nah-a	nah-as’	nah-ala	‘to give birth’
	po-a	po-as’	po-ala	‘to see’
	se-ə	se-əs’	se-əla	‘to count’
	cu-ə	cu-əs’	cu-əla	‘to give’
	(data from M-H Cho 1994)			
SINO- KOREAN (VERBAL MORPHOLOGY)	nalah-ʌl ‘nation-accusative’ mazʌm-ʌl ‘mind-accusative’ cuh-um-ʌl ‘clean-nominalizer-accusative’ (more data in M-H Cho 1994)			
IDEOPHONES	k^{h}ollok ~ k^{h}ulluk ‘coughing’ p^{h}otoN ~ p^{h}utuN ‘plump’ sopok ~ supuk ‘heaping full’ (more data in J-S Lee 1992)			
LOANWORDS	N/A			

On the basis of these data, we are in a position to make a proposal about the stratified phonological lexicon in Korean. Oum (1999) also takes the view that the Korean lexicon can be described as having four main domains, following Itô and Mester’s (1995a) core-periphery lexicon model for Japanese. He argues that the Korean lexicon cannot be described as bifurcational (cf. McCawley 1968), as this cannot explain the gradual constraint domains in the lexicon. Accordingly, Oum contends that Korean is another language that has a core and periphery grammar in the lexicon, just like Japanese.

However, I believe that Oum (1999) does not provide a clear image of the core and

periphery structure. It looks like a Venn diagram, showing certain parts overlapping each other, but some parts do not overlap at all.[19] Consider his schematized Korean lexicon:

I have reported and discussed what Shin (1997) and Oum (1999) argue for in their papers. However, their case is weak in claiming a core-periphery structure for the Korean lexicon because it significantly lacks supporting data. They end up merely suggesting that there are four strata in the Korean lexicon and their model is similar to that proposed by Itô and Mester for Japanese.

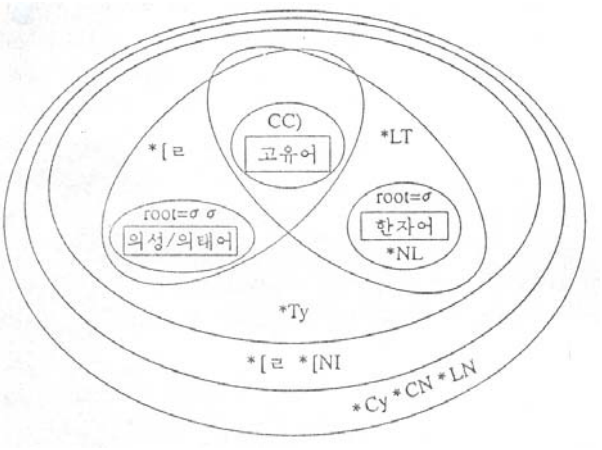

Figure 2. Korean Lexicon (Oum 1999)

I wish to cast doubt on a Core and Periphery structure in the Korean lexicon, even though I maintain that there are four strata in the Korean language. In the next section, I shall go through the exact nature of the core-periphery structure and show how it is encoded in the grammar. To begin with, I will elucidate what Chomsky (1986) says about core and periphery in a language. Then, I shall revisit Itô and Mester's (1995a, 1995b and 1999) core-periphery model in OT, comparing it with Fukazawa et al. (1998).

4. Can Core-Periphery Structure Be Maintained?

[19] In a similar vein, Fukazawa et al. (1998) view the Japanese Lexicon as not having a Core-Periphery structure. They argue that the model is not an inherent property of grammar but just a tendency of the Japanese language.

4.1 Markedness and Core Grammar

In this section, I shall focus on the research in generative grammar that has led to the adoption of a definition of markedness. Importantly, the research to be discussed in this section assumes a distinction between core grammar and peripheral phenomena. According to Chomsky (1981), the fixed principles and open parameters of UG constitute the L1 learner's initial state. As the open parameters are fixed by the child on the basis of input from the language being learned, a core grammar results. A core grammar, then, is a particular instantiation of those principles and parameters that are built-in. Thus, core grammars can vary from language to language since languages adopt different parameter settings. In general, the core grammar is regarded as unmarked because it is acquired with minimal evidence or triggering data.

By contrast, there are properties of language which are not direct reflections of the principles and parameters of UG. For example, linguistic phenomena that are idiosyncratic, language specific and exceptions are assumed to be outside the core grammar, making a marked periphery, which varies considerably from language to language.

To be specific, Chomsky (1986) distinguishes the core language from the periphery, where the core language is a system determined by fixing values for the parameters of UG, and the periphery is whatever is added on to the system actually represented in the mind/ brain of a speaker-hearer. He further states that the distinction between core and periphery leaves us with three notions of markedness:

(17) a. core versus periphery, internal to the core and internal to the periphery
b. the way parameters are set in the absence of evidence
c. significant regularities even in departures from the core principles (e.g. in irregular verb morphology in English)

According to Chomsky (1986), peripheral constructions are related to the core in systematic ways, by relaxing certain conditions of core grammar. The problem of formulating these notions precisely is an empirical one throughout, although not a simple one, and many kinds of evidence might be relevant in determining them. For example, we would expect phenomena that belong to the periphery to be supported by specific evidence of sufficient "density", to be variable among languages and dialects, and so on.

To sum up, Chomsky believes that a language is made up of two components, the core and the periphery. The most important issue, if we adopt the core and periphery approach, is how the core and the periphery arise in the human language faculty. To answer this question, I quote what Chomsky says about knowledge of language

(Chomsky 1986:221):

(18) "The state S_L is attained by setting parameters of S_0 in one of the permissible ways, yielding the core and adding a periphery of marked exceptions on the basis of specific experience, in accordance with the markedness principles of S_0. The core, then, consists of the set of values selected for parameters of the core system of S_0: this is the essential part of what is "learned," if that is the correct term for the process of fixing knowledge of a particular language. The grammar of the language L is the linguist's theory of L, consisting of a core grammar and an account of the periphery."

I would like to suggest that the relationship between core and periphery in phonology is not static. The lexicon cannot be partitioned into two distinct and separate parts, A and B. Consider Figure 3: (A=Core, B=Periphery):

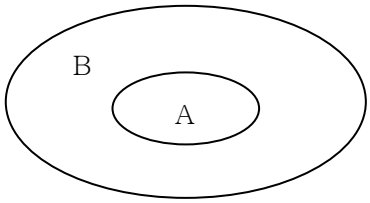

Figure 3. Wrong description of the lexicon

Let us say that A is the core grammar and that B is the periphery. In an ideal world it might be possible to partition the grammar into A and B. However, this is unlikely to be true for phonology. The phonological component of the grammar is rather fluid, which means that grammar moves into the core from outside the inner circle. This can probably be configured as in Figure 4:

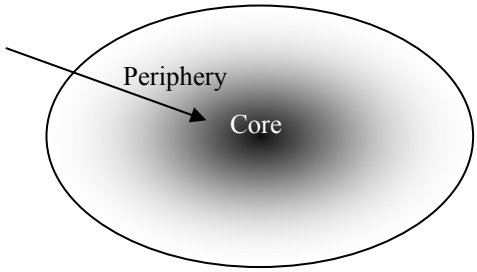

Figure 4. The abstract phonological component of grammar

If my prediction about the phonological lexicon is true, OT is a very precise way of explaining the grammar. With this tool, we can explain gradual phonological

movements in the lexicon, since this theory allows us to define the grammar by means of a set of constraint rankings. So, it is just a matter of getting the right constraints for the morphophonologically induced ranking. Let us see how this model can be encoded within an OT grammar.

4.2 Split Faithfulness Constraints vs. Co-Phonologies

In Optimality Theory, morphologically-conditioned phonology has been approached in two ways. One way is to posit *split faithfulness constraints* and the other is to posit a range of distinct *co-phonologies*.

McCarthy and Prince (1995) state that correspondence constraints are tied, not only to specific dimensions, e.g. B-R, I-O[20], but also, in some cases, to specific morphemes or morpheme classes. According to them, full schema for faithfulness constraints may include such parameters as these: the element preserved, the dimension of derivation along which the structures are related, the direction of inclusion along that dimension (as in the contrast between MAX and DEP), and the morphological domain (stem, affix, or even specific morpheme) to which the constraint is relevant.

Building on this idea, Urbanczyk (1995, 1996) uses MAX-DISTRIBUTIVE and MAX-DIMINUTIVE to show that two kinds of BR-Correspondence relation coexist in the grammar. She argues that, regardless of the morphological input, the constraint hierarchy, the grammar of Lushootseed selects the correct candidates for all patterns of reduplication. Benua (1997, 1998) proposes that relations between different kinds of strings can be further split into distinct types. Given the example of English, two OO-correspondence relations are instantiated, one proper to class 1 affixation and the other proper to class 2 affixation. Fukazawa et al. (1998) further exploits this idea in input-output relations, arguing that each stratum of the Japanese lexicon is associated with a distinct IO-correspondence relation. The recent version of Pater's (2000) work on English secondary stress also uses prosodic faithfulness constraints multiply instantiated in the constraints hierarchy, viz. in a lexically indexed version.

Following this line of analysis, I propose that Korean native and loanword

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[20] Input faithfulness constraints require that the stem's input specifications be preserved in the output, the 'base' of the base-reduplicant combination. Base-reduplicant identity constraints require that both parts of this output base-reduplicant combination be identical in some respect. This model can be depicted as follows:

Basic Model

Input: /Af_{RED} + Stem/

⇑⇓ **IO**-Faithfulness

Output: R ⇔ B

BR-Identity

phonology can be explained within one grammar by positing stratum specific IO-relations for the Korean lexicon, since Korean also instantiates the need for lexical stratification. My analysis will crucially depend on Correspondence Theory, as proposed by McCarthy and Prince (1995), who show that different kinds of faithfulness relation can coexist in a grammar. In a nutshell, faithfulness, markedness and alignment constraints are parameterized to apply to designated morphological categories, e.g., roots vs. affixes (McCarthy and Prince 1995; Urbanczyk 1996; Beckman 1998; Alderete 1999), nouns vs. other word classes (Smith 1997), head vs. dependents (Revithiadou 1999), lexical strata (Fukazawa et al. 1998), affix classes (Benua 1997, 1998), and even individual morpheme/lexemes (Hammond 1992; Russell 1995, 1999). Let us review one of these studies to see how phonological behaviour depends on lexical category.

Smith (2001) argues that the category 'noun' is in a special position, so the grammar contains special noun-specific faithfulness constraints, which, in a particular ranking, allow nouns to resist neutralization processes that affect words of other categories. In the Fukuoka dialects of Japanese there are differences in the phonology of pitch accent between nouns on the one hand, and verbs and adjectives, on the other. Consider the contrast between (19) and (20):

(19) Nouns have contrastive accent
- a. atama 'head' Unaccented
- b. inóti 'life' Accented; penultimate (peninitial) accent
- c. óokami 'wolf' Accented; initial accent

(20) Verbs and adjectives have an obligatory accent on the penultimate mora
- a. tabéta 'ate'
- b. tabén 'doesn't eat'
- c. akáka~akái 'red'
- d. akakaróo 'probably red'

As can be seen in (19) and (20), phonological contrasts in Fukuoka Japanese involving accent are permitted in nouns, but not in verbs or adjectives. To account for this, we can posit split faithfulness constraints for nouns vs. other word classes as shown in (21):

(21) F_{noun} (accent-location) >> M (accent-location) >> F (accent-location)

The ranking in (21) describes a language where accents shift to an unmarked position dictated by the markedness constraint M (accent-location), except in nouns where the accent remains faithful to its underlying position due to F_{noun} (accent-location).

On the other hand, co-phonologies have to keep phonological constraints purely phonological, by positing a range of distinct CO-PHONOLOGIES, that is, different constraint rankings for different morphological categories (McCarthy and Prince 1993; Itô and Mester 1995; cf. Inkelas et al. 1997[21]). Reverting to the example of Fukuoka Japanese, we could posit the two distinct constraint rankings in (22):

(22) F (accent-location) >> M (accent-location) (nouns)
M (accent-location) >> F (accent-location) (other words)

So, do we adopt the model in (21) or that in (22)? Which is the better way to constrain the grammar? This is an important question in OT, since this theory of grammar imposes an invariant ranking. This issue has been considered in the literature (Itô and Mester 1999, Fukazawa et al. 1998). In particular, the change in the direction of Itô and Mester's research shows up the problematic nature of co-phonologies: Itô and Mester (1999) adopt the theory of Indexed-Faithfulness (relativized/or split Faithfulness), in contrast with their earlier proposal of the Re-ranking of Faithfulness.

I shall endeavour to demonstrate that split Faithfulness constraints are a better way of dealing with lexical stratification than co-phonologies. I also believe that Itô and Mester's later work and Fukazawa et al. (1998) independently propose relativized (split) faithfulness constraints that apply to different strata in order to overcome the problem of the same faithfulness constraints in differential rankings. Although their work confirms that a single set of constraint rankings within a language is possible, the question of the core and periphery structure in the phonological lexicon in other languages remains.

5. Summary

I have discussed two OT approaches to phonological alternations, which are sensitive to morphological category as well as on the issue of the stratified phonological lexicon in languages within various frameworks in the past. In OT, the two approaches considered are conceptually quite distinct. However, it is often possible to analyze the same phenomenon either way. Few empirical arguments have been advanced for or against either of the theoretical options. Thus, we need further research into the empirical aspects of this issue. In the meantime, I have rejected the re-ranking of faithfulness, because OT assumes that a single constraint ranking defines

[21] This paper contains criticism of co-phonologies.

the entire grammar of a language. Instead, we have allowed each correspondence relation, such as IO, OO, BR, TT, etc., to bear multiple sets of faithfulness constraints, one for each morphological class, in languages such as Korean and Japanese.

On the other hand, this paper has presented an overview of the organization of the phonological lexicon in Korean, focusing on phonological differences between different vocabulary strata. As in earlier work on this topic, the traditional sub-divisions (Hangeul, Sino-Korean, ideophones, loanwords) are seen to play an important role.

In order to account for phonological differences that are sensitive to morphophonological category, i.e. loanword items vs. native items, I have given particular attention to the issue of whether loanword phonology is a separate component of the grammar. The finding has been that, within an OT framework, there is no separation between the grammar of loan and native lexical items.

Specifically, using Correspondence Theory (McCarthy and Prince 1995), the differential phonological behaviour of loanwords and native words has been shown to be accountable for by one and the same set of constraint rankings, provided that Split (Relative) Faithfulness constraints are adopted: e.g. MAX-IO-HANGEUL, MAX-IO-LOANWORD, DEP-IO-SINOKOREAN, DEP-IO-IDEOPHONE, etc. With stratum-specific input-output (IO) faithfulness constraints, the phonological differences among categories are adequately dealt with without sub-grammars. I argue, therefore, that there is no need for an input-specification approach to loanwords. Rather, stratally split IO faithfulness constraints systematically derive the phonological differences among the strata of the vocabulary.

It follows from this that the model of core vs. periphery structure proposed by Itô and Mester (1995a,b) is not sufficient to account for the entire stratified Korean phonological lexicon. Thus, the lexical stratification of Korean is solely explained by stratum-specific IO relations, not by core vs. periphery structure. In my view, core and periphery structure does not reflect the design of the grammatical system, but merely shows the existence of ongoing synchronic assimilation processes in languages. Therefore, my claim is that the core and periphery opposition is not a structural restriction built into the grammar of the language.

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