A Unified Harmonic Approach to Lenitions on Level Structures: Stress Shift and Vowel Shortening*

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Oh, Kwan-Young. (2014). A Unified Harmonic Approach to Lenitions on Level Structures: Stress Shift and Vowel Shortening. *The Linguistic Association of Korean Journal*, *22*(3), 19-41. This study accounts for the correlation between vowel shortening and stress shift triggered by suffixation through foot structures in level-structures. The reason we adopt this approach is that we assume the stress shift and vowel shortening are not separately implemented but they apply simultaneously. Furthermore, this method can give explanations to the phenomena without referring to intermediate derivations and the complexity of rule applications. First, we review a few analytical methods such as phonological rules-based, lexical, CV-level structure, and metrical approaches. Second, due to limitations of these approaches, this study focuses on level-structures to explain the examples discussed in previous studies by suggesting the new devices of a modified Prestress Destressing rule, Minor Weakening and Major Shortening rules, and their conditions for the rule application. Therefore, this study offers more simplified and clearer analytical methods to explain the stress shift and vowel shortening compositely in level-structures than the previous approaches.

Key Words: vowel laxing (shortening), stress shift, level-structure, Harmonic approach, foot structure, Prestress Distressing, trisyllabic laxing

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1. Introduction

In previous studies on Trisyllabic Laxing (TSL), we observe that stress shift and vowel shortening have been treated separately. In fact, when we reconsider a few examples related with TSL, they make us feel a need to devise other methods, since these examples contain subtle differences of vowel laxing from stress-sensitivity. First, we review the previous analytical methods such as phonological rules-based, lexical, CV-level structure, and metrical approaches. As an approach to them, we consider Durand (1990)'s explanation which relies on cyclic application of rules, but face shortcomings in explaining some other examples (*stability, vitality*, etc.). This is mainly due to some words that have similar contexts for vowel laxing but can't be explained by the cyclic rules. As a result, we consider two other approaches in which one depends on class I and II affixes and strata as their domains of application of rules (Mohanan 1982), and the other resorts to Resyllabification and Closed Syllable Shortening in CV-level structure (Myers 1987). However, these methods also have similar problems such as artificial underlying forms and unnatural syllable structure adjustments for explaining some other examples (*solidity, minority*, etc.).

As other approaches, we consider metrical analyses. These analyses are mainly performed by disjunctive views to stress shift and vowel laxing. Halle & Vergnaud (1987) (HV) rely on a hierarchical grid structure to explain vowel shortening, whereas the cases of vowel reduction are achieved by the application of two rules in sequence, in which HV considers the Stress Deletion rule to feed the Reduction rule. Giegerich (1992) posits foot structure in metrical version to explain TSL, but the cases of comprehensive vowel tense and lax shift depend on a series of applications of rules in a lexical framework. In this analytic method, an underlying form is significantly decided by a less abstract one. While Jensen (1993) explains vowel laxing through cyclic rules in a lexical framework, the stress shift by suffixation is explained on the foot structure. Though their analytic frameworks of vowel laxing are different, they agree in their views that Myers's Resyllabification is unnecessary.

On the other hand, there is an approach based on a composite view in analysis of stress shift and vowel laxing (Burzio 1993). This approach relies on well-formedness foot structure condition, which must meet requirements of

Generalized Shortening (GS) and Stress Preservation (SP). If GS and SP are simultaneously satisfied, this becomes a well-formed foot structure, so that systematic shortening occurs as in *serene→serenity*. However, when we adopt the analysis, we face limitations in explaining cases such as *nobility*, *locality* where vowel tensing occurs at the vowel to be laxed.

Kim (2013), on the other hand, gives a prosodic account of TSL without invoking Resyllabification. According to Kim, TSL is construed as bisyllabic laxing. The foot structure (L L) is the most harmonic trochaic foot (Prince 1990). Therefore, the foot structure (H L) reduces to a (L L) foot. Kim's account provides motivation for TSL. However, his account faces some limitations: the first is difficulty explaining why the foot structure (H) L as in *sa:nity* should be the base form, because there can be a monosyllabic foot type, (H) like *(sa:)nity* as a harmonic foot type (Prince 1990). The second is that the change from foot structure (H L) to (L L) can't be supported in other cases such as *finality, locality*, etc. In fact, the (L L) foot structure changes to (H L) in these examples.

In summary, when we consider several approaches to stress shift and vowel laxing, in spite of their reasoning in both stress shift and vowel laxing, actually, these analyses still have problems in explaining cases such as *stability*, *vitality, minority*, etc. Therefore, we need an alternative to give explanations to them as well as to be able to access stress shift and vowel laxing compositely. This is equivalent to HV's views of vowel laxing triggered by stress shift.

Now, this study analyzes the examples previously discussed compositely by using the foot structure under a phonological word in three-level structures of Harmonic approach (Goldsmith 1993, Lakoff 1993, Oh 2001). The reason we adopt this analysis method is that, firstly they (stress shift and vowel shortening) seem to be not disjunctively but rather closely related to each other. Secondly, it is possible to show the correlation between stress shift and vowel laxing in level structures without referring to intermediate derivations, complexity of rule applications, or artificiality of rules, as in Bosch's (1991) analysis. Therefore this study will analyze a few examples related with disharmonic interaction between vowel laxing and stress shift by suffixation compositely in cross-level structures.

In addition, this study suggests viable alternatives to the analyses of previous studies which couldn't explain a few examples of vowel laxing

associated with stress shift. One is to set a foot-structure extension in order to attach a final weak syllable, *-ty*, to an upper foot structure. The other is to come up with a modified Prestress Destressing rule because the first syllables in the second suffixed forms of *minor→minority* and *local→locality* are each differently realized. Another is about Minor Weakening and Major Shortening rules and their conditions for the applications of these rules, which should be required in the application of the modified Prestress Destressing rule. Thus, through the newly proposed devises, we expect to offer more simplified, direct explanations to stress shift and vowel laxing in level structures than the previous studies.

2. Previous Analyses

First, let us consider the cyclic rules-based approaches to TSL (SPE 1968, Mohanan 1982, Myers 1987, Durand 1990). For example, according to Durand's approach (1990), for the derivation of *serene-serenity*, the application of complex rules as in (1) is required.

(1)

	serene	serenity
Underlying form	/sVre:n/	/sVre:n+iti/
Stress assignment	sVré:n	sVré:n+iti
Shortening	_____	sVrén+iti
Vowel shift	sVrí:n	_____
Diphthongization	sVrí:jn	_____
Length adj.	sVríjn	_____
Other rules	[səríjn]	[səréniti]

However, this analysis has some drawbacks: firstly, this analysis has a set of complex rule applications and the setting of an abstract underlying form which are skeptical in the cognitive aspect. Secondly, this doesn't show an immediate correlation between vowel shortening and stress shift triggered by the presence of a suffix. Furthermore, there are some other words which have similar contexts for vowel laxing but such examples can't be explained by the rules referred to above (*solidity, vitality,* etc.).

In the case of lexical approaches, affixes are classified as class I and II affixes, and then strata are established as their domains of rule applications (Mohanan 1982, 1986; Kiparsky 1982b). Mohanan (1982) regards an affix *-ity* as class I and the domain of TSL as stratum I, respectively. Mohanan analyzes *vanity* as in (2) below. In this case, however, there are some problems. There is no motivation of vowel laxing and stress shift triggered by the suffix. In addition, a few other examples (*acídity, solémnity*, etc.) can't be accounted for by the approach as shown in (2), since the stressed vowels are not laxed but rather lengthened. Furthermore, the vowels followed by the stressed vowels are rather shortened.

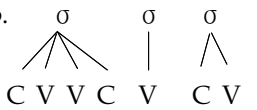
(2)

	vanity	
	[vein]	Underlying
Stratum 1	[[vein] iti]	*-ity* Suffixation
	[[væn] iti]	Laxing
Stratum 2	[væn iti]	Bracket Erasure
	[væniti]	

The approach in CV-level structure is that vowel shortening is conditioned by closed syllables which Resyllabification feeds (Borowsky 1986, Myers 1987, Bosch 1991). This analysis requires a series of applications of rules: Stress, Syllabification, and then Resyllabification. Especially, in this approach, the Resyllabification provides an important environment for vowel shortening. Through this rule, a stressed vowel is located in a closed syllable and subjected to Closed Syllable Shortening. In this case, the final syllable of a suffix is often treated as being extrametrical after suffixation. Thus, this approach can account for the vowel shortening in cases such as *sane-sanity*. The derivational process can be briefly shown as in (3).

As we see, (3a) is, as the output of the second cycle, the result of the application of Stress and Syllabification. Resyllabification produces (3b), in which Closed Syllable Shortening is applied to the syllable, yielding (3c).

(3) a. 

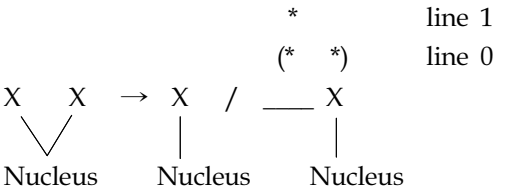
b. 

c. 

But this approach also has some shortcomings. First, if we apply this method to *final-finish*, Resyllabification in *finish* causes the stressed vowel to be shortened as in [ai]→[i]. However, in the case of *final-finálity*, we can't account for the reason why the first long vowel of *finality* isn't shortened even after stress shift by suffixation. Second, the Resyllabification seems to be an artificial operation for adjusting syllable structure. In other words, the process of the Resyllabification provides no independent motivation. Third is difficulty explaining cases such as *acidity*, *solidity*, in which the Resyllabification should be applied to *-ci-* and *-li-* by Stress and Syllabification as in *sanity* but they are already short vowels. Therefore, the Closed Syllable Shortening rule can't be applied to them. Ironically, their first vowels are shortened.

Metrical approaches are mainly performed on the basis of disjunctive views in stress shift and vowel shortening. Halle & Vergnaud (1987) have doubt about the necessity of Resyllabification and Closed Syllable Shortening Myers (1987) posits in explaining TSL. HV relies on a hierarchical grid structure, and proposes a shortening rule in metrical version as in (4). The rule conditions that the first stressed syllable is a nucleus to be shortened.

(4) Shortening

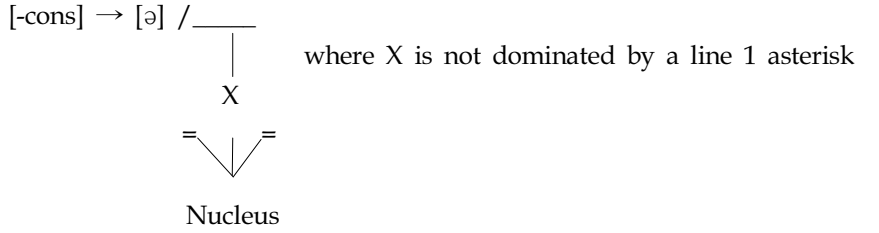


By depending on this rule, it is possible to explain the cases of *sanity, vanity*, only if the syllable *-ty* is treated as extrametrical. However, a few other examples (*acídity, fragílity,* etc.) can't be explained by the rule (4). The stressed vowels in these examples are not laxed but rather lengthened.[1)]

On the contrary, the vowels followed by the stressed vowel are shortened.

For these cases, HV posits Stress Deletion, and Reduction rules as in (5) below. The vowel shortening in the above-mentioned examples is accounted for by the application of these rules in sequence. That is, HV regards the Reduction rule as being fed by the Stress Deletion. As we see in the case of *fragility*, after the application of the Stress Deletion, the Reduction rule (5) is applied to the first unstressed syllable (*fra-*), so that the syllable is reduced to schwa.

(5) Reduction



where X is not dominated by a line 1 asterisk

However, these approaches can't account for cases such as *locality* because, unlike *fragility*, the first syllable still has a long vowel which is not reduced. Interestingly, HV modifies the Stress Deletion rule to explain the example like *locality* as in (6).

(6) Stress Deletion (modified)
Over a stress well, delete asterisks on line 1 and above, provided that the well is assigned to a syllable with nonbranching rime or to a Latinate prefix

According to one of the rule conditions, a syllable to be deleted should be a nonbranching rime. If the rule is applied to *locality*, the first syllable is a long vowel and this is inconsistent with the condition of the rule (6). Therefore, this analysis provides the reason why the first syllable can't be reduced to schwa in *locality*.

However, in the cases of *minority* and *nativity*, the first syllables are

1) In cases of *acidity*, etc., the reason the first vowel is regarded as shortened is that the vowel is reduced to schwa. Thus this paper considers cases like this to be shortened, and the vowel of *ci* is stressed. As a result, the vowel becomes lengthened.

shortened despite being long vowels in stems. Thus, these cases face illogicality in regard to HV method, since the Stress Deletion doesn't apply yet, but the Reduction rule has applied to them.

Giegerich (1992) and Jensen (1993) stand in a similar position with HV in a disjunctively analytic aspect of stress shift and vowel laxing. Giegerich explains TSL on the basis of foot structure in his metrical version, whereas the analyses of the cases in which comprehensive vowel tense or lax shift occurs are achieved by derivational process through application of rules in a lexical framework. In this case, an underlying form is significantly determined by a less abstract one.

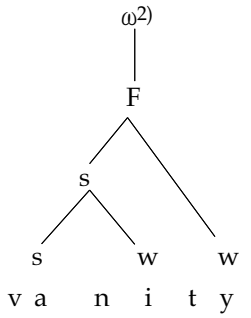
On the other hand, while Jensen explains vowel laxing on the basis of cyclic rules in a lexical framework, the stress shift from suffixation is explained by a foot structure, in which TSL laxes a stressed vowel that is followed by weak syllables in the same foot domain. Therefore, on account of their similar perspectives to these phenomena, we will consider a few examples on the basis of Jensen's approach. Though their analyses of vowel laxing are very different, they are identical in their views that Myers's Resyllabification is unnecessary. Especially, Jensen regards Resyllabification as being unnatural. Jensen proposes a Laxing rule instead of Resyllabification, which laxes a (stressed) vowel that is followed by another mora in the same foot. Thus, Jensen (1993:164) posits a Trisyllabic Laxing rule as follows:

(7) Trisyllabic Laxing

$$V \rightarrow [\text{-tense}] \; / \; \underset{\sigma \quad \sigma_w \quad \sigma}{\underline{\quad\quad}}$$

Let us now consider the case of *vane-vanity*. Jensen contends a series of applications of rules in order, such as Long Vowel Stressing, English Stress Rule, and TSL. Consequently, the application of these rules on the foot structure is illustrated as in (8).

(8)



As seen in (8), Jensen's approach provides explanations for the vowel laxing in the first stressed syllable of *vanity*, since, according to the rule (7), the syllable is followed by two (or more) syllables in the same domain, a foot.

In spite of his reasoning in both stress shift and vowel laxing, actually, his analysis has a limitation in explaining cases such as *solidity, vitality*, etc. Especially when we look into cases of *vítality, tónality, fínality, lócality*, etc., the target syllables remain tense without being laxed. In this instance, interestingly Jensen mentions that these examples violate the requirement that the following vowel of the target syllable not be stressed. Thus, the target syllables in these examples don't undergo vowel laxing. However, in fact, there are several other examples such as *nátivity, ábility*, etc., where the target syllables are laxed despite the similar contexts.

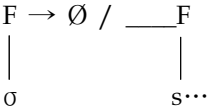
Next, apart from vowel laxing in the cases of *vitality* and *locality*, let us consider how Jensen deals with stress shift in these cases triggered by suffixation. According to Jensen, the domain of TSL is at stratum 1 because its environment is established by the addition of a stratum 1 suffix. The first syllable of *local* is stressed, and it is heavy by virtue of having a long (tense) vowel as well. However, stress shift occurs in *locálity* from *lócal* by *-ity* suffixation.

As an alternative, at stratum 2, Jensen posits a Prestress Destressing rule that a foot dominating a single mora is distressed when immediately followed by a stronger foot. The rule is shown as in (9). In addition, he mentions that the destressing takes place despite an underlying long vowel, such as *légal-legálity*,

2) This symbolizes a phonological word. The domain of ω consists of a stem and any linearly adjacent string of affixes (Jensen 1993:133).

bánal-banálity.

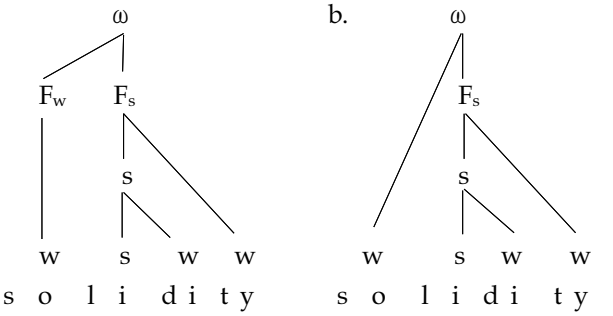
(9) Prestress Destressing (postcyclic)



where the syllable of the foot to be deleted dominates either a single mora or is open when medial.

Now, if we apply this rule to *solidity* in (10a) and adopt Hayes (1980)'s insistence that the defooted syllable is incorporated directly into the word tree, the application of the rule yields (10b).

(10) a. b.



However, this analysis has a restriction in the cases of *vitality, locality*. The first syllables of these examples are heavy by virtue of having long (tense) vowels despite similar context like *solidity*, even after suffixation. As a result, they can't meet the rule (9). Therefore we need to seek for another approach.

On the other hand, there is an approach based on a composite view in analysis of stress shift and vowel laxing (Burzio 1993). This approach relies on a well-formedness foot structure condition, which must meet requirements of Generalized Shortening (GS) and Stress Preservation (SP). GS and SP are shown as in (11a, b).

(11) a. Generalized Shortening
Vowels shorten in the environment: [. . . ___ . . .] affix (linear order irrelevant)

b. Stress Preservation
Stress is preserved in word-formation

According to Burzio (1993), if GS and SP are simultaneously satisfied, this is a well-formed foot structure, and in this case, systematic shortening occurs. For example, in *verbóse→verbósity*, we can see that the GS and SP both are observed. Thus, this is an ideal case of systematic shortening. However, if we comply with the analysis to account for cases such as *facility* and *locality*, we face shortcomings since tensing of vowel occurs at the vowel position to be laxed. Furthermore, the first syllable in *facility* is laxed, but not in *locality* disharmonically. The application of Burzio's approach to these examples is shown with a foot structure as in (12).

(12) Composite analyses of Burzio

Word types	GS	SP
a. (verbóse) → ver(bósity)	√	√
b. (fácile) → fa(cílity)	*	*
c. (lócal) → lo(cálity)	*	*

As seen in (12b, c), this composite approach has restrictions on explaining some examples in which vowel laxing occurs despite not preserving GS and SP. Though there are problems in this approach, the composite view to the stress shift and vowel laxing is greatly valued, and the attempt in this composite aspect has been considered in other approaches.

According to Kim (2013), the well-formedness of foot structure and the exhaustivity of foot formation trigger vowel shortening. That is, the motivation of trochaic shortening is the complete parsing of syllables into feet. Through vowel shortening, the trapped final syllable of stem, L, can form a harmonic trochaic foot like (**L** L), with the preceding syllable (**H**).[3] From his reasoning,

3) This is originally from Prince (1990)'s prosodic account of TSL. According to Prince, TSL is

the necessity of vowel shortening comes from the prohibition on the occurrence of illegal moraic trochees, such as (**H** L) or (L **H**). Kim's account is illustrated in (13) below. The extrametrical elements are shown by angled brackets.

(13) sane: (séj)<ne>
(**H**)
sane+ity: (séj) nə <ti> → (sǽ nə) <ti>
(**H**) L → (**L** L)

However, Kim's approach faces some problems: first, it has a difficulty explaining the reason why the foot type (H) L should be regarded as a basic foot form. According to Prince (1990) and Lee (1996), the monosyllabic foot (H) like *(sa:)nity* is also the most harmonic foot like (L L). Therefore, we have a doubt which is the suitable harmonic foot in these cases. Second, it has a difficulty explaining other examples such as *finality, locality* through this approach relying on the automatic change from foot structure (H L) to (L L). The first syllables of the words maintain the tenseness without being laxed even after suffixation. Thus, the foot structures in the case of these words become the illicit foot type as *(H (L L)) <ti>. Furthermore, this approach is against the view of the present study, in which vowel shortening is accounted for by TSL rule in the foot extension domain and the stress shift and vowel shortening are analyzed compositely in level-structures.

3. Level structure-based approach

The purpose of this study is to compositely analyze a few examples discussed in previous studies through the foot structure under a phonological word in the level structures of Harmonic approach (Goldsmith 1993, Lakoff 1993, Oh 2001). The reason why we adopt the level approach is that it makes it possible to show a correlation between stress shift and vowel laxing. Furthermore, this approach is able to explain the phenomena without referring

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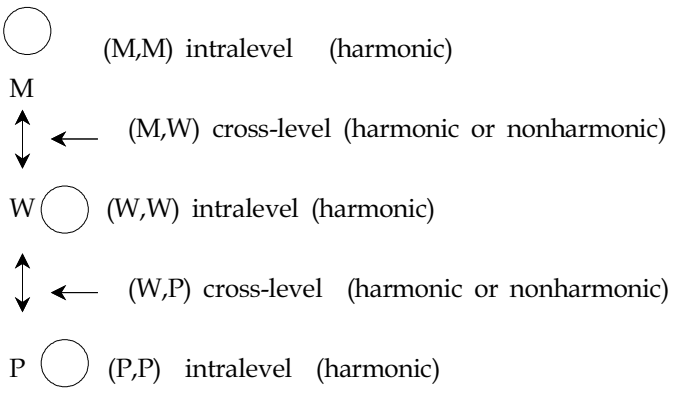
construed as a kind of bisyllabic laxing that is performed by the most harmonic trochaic foot.

to intermediate derivations, application of complex rules, or artificiality of rules. The framework of the approach consists of three levels, M-level, W-level, P-level. Phonotactic constraints are observed at each level. Goldsmith (1993) establishes three-levels, M-level, W-level, and P-level, and the hierarchical structure of these levels is as in (14).

(14)



In (14), *M-level* represents a morphophonemic level, at which morphemes are phonologically specified. *W-level* is regarded as a primary level related with syllables, feet, and phonological words because this level is stated by the bulk of significant well-formed conditions on syllables and words, and phonotactic constraints and prosodic structures as well. *P-level* involves a broad phonetic description that is contacted with the peripheral articulatory and acoustic devices, and at this stage, full well-formed phonetic representations are offered.

For example, Syllabification and Rounding is applied in (W,W) construction harmonically, and Epenthesis applies in (M,W) construction. In addition, rules such as Lowering, Flapping, Raising, Vowel Assimilation are applied in (W,P) construction (Goldsmith 1993:42, Lakoff 1993:128).

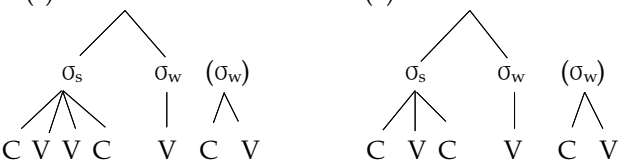
In general, the intralevels are more harmonious than the interlevels in terms of the application of rules. In the present study, the essential level is W-level, because stress shift, vowel laxing, syllabification, and Prestress Destressing rule are applied at this level structure (Oh 2001).

As an example, Bosch's (1991) analysis of TSL relies on a series of applications of rules in (W,W) level: Affixation, Extrametricality (final syllable),

English Stress Rule (ESR), Resyllabification, and Closed Syllable Shortening which is required by vowel shortening to observe CVX syllable template. The Resyllabification is motivated by the ESR and the Extrametricality Hayes (1982) contends. Consequently, the Resyllabification feeds the Closed Syllable Shortening. Considering her analysis, the examples such as *vanity* are well explained. In the case of *vanity*, Bosch regards the relation between root and suffix as close juncture. She also considers that the domain of affixation is W-level, and ESR and Syllabification are applied to (W,W) level. The output of *vanity* from the application of rules is seen at P-level, since it affords complete phonetic form. Thus, if we follow Bosch's approach, the process of application of rules in *vanity* is briefly shown as in (15).

(15) M-level: vane, ity

W-level: (a) P-word (b) P-word



P-level: [véniti]

Resyllabification produces (15a), in which Closed Syllable Shortening is applied to the syllable structure, resulting in (15b). However, this approach has drawbacks in explaining other similar examples, such as *acídity, solídity*, etc., in which the stressed syllables are not laxed but lengthened after suffixation. Furthermore, shortening occurs at the first syllables followed by the stressed syllables.

Thus, this study proposes viable alternatives to account for the examples for which previous studies didn't give satisfying explanations for the correlation between stress shift and vowel laxing. Before going on, we need to identify the suffix *-ity* because, from several examples to be considered, we observe the fact that whenever this suffix is added to a stem, the syllable preceding *-ity* is always stressed. Hogg & McCully (1987) regard the suffix as a typical stress-shifting affix and hold that it belongs to level 1. Burzio (1993) also

classifies the suffix *-ity* as a restressing suffix to preserve the metrical structure of a stem, and suffixes such as *ity), a)lø, icø)* follow LW (Light Weak) pattern in foot structure.

The stress in English is generally assigned from the right edge of words, but the additional stresses are assigned in a leftward direction, called retraction. LP (1977:280) classify types of retraction as Weak, Strong, and Long. According to LP, the Weak Retraction places stress on the syllable immediately before *-oid* if it is heavy (*ellípsoid*). Thus, we regard the suffix *-ity* as a Weak Retraction, since the stress mode of observed examples has the same pattern with *-oid*.

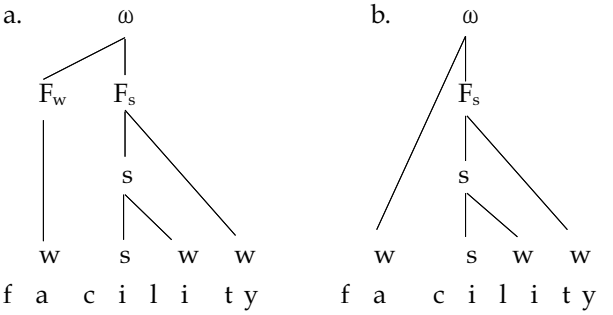
In this study, we propose a condition that TSL applies in (W,P) level provided that a target syllable to be shortened is within the same foot structure by the extension of foot domain, as seen in (8). This proposition is based on Prince (1980)'s view, in which if a mora is added to a given foot structure, this produces successive foot formation.

Now, we consider the examples referred to above on the basis of Jensen's approach, and suggest a few alternatives to be able to give explanations for them. We have already observed that Jensen's analysis on a foot structure is more proper in explaining cases such as *facility, solidity* than *tonality, minority*. Let us reanalyze *facility* on the grounds of Jensen's analysis in level-structures. The ESR and Syllabification is applied to *facility* in (W,W) level. The first stressed syllable of *facile* is heavy, and is able to compose one foot structure. By adding the suffix *-ity* to the stem, *facile*, stress is placed on the third syllable from the right edge of the word, *facility*. However, the target syllable being laxed is not the antipenultimate syllable, but rather the first one.

As we see in (16) below, (16a) shows the foot structure of *facility* after suffixation. Since stress shift occurs by suffixation to avoid stress clash, the Prestress Destressing rule (9) applies to (16a) in (W,P) level, yielding (16b).

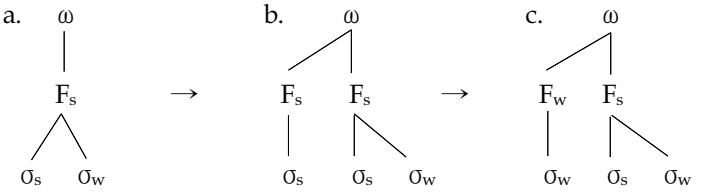
As seen in (16), *facility* is well explained by Jensen's analysis method. However, as in *facility*, in the case of *minor-minority*, the first syllable of *minority* is laxed, despite being heavy by virtue of having a long vowel in a stem. Therefore, it can't meet the rule (9). Consequently, we need to find a device so that it can offer explanations to cases like *minority*.

(16) (W,P) level:



When we consider the derivation of *minor-minority* in a foot structure, the syllable structure of *minor* can be briefly shown as in (17a). (17b) is a foot structure of *minority* after suffixation, and (17c) is one after the occurrence of stress shift.

(17)



Considering the structures of (17b) and (17c), we presume that these conform to the rule of LCPR (Lexical Category Prominence Rule), which is stated as follows (Hogg & McCully 1987:88):

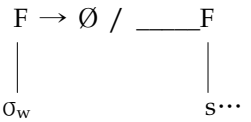
(18) LCPR

For any part of sister node $[N_1\ N_2]_L$, N_2 is strong iff it branches.

Conditions: L is a lexical category. N_1, N_2 are feet or dominate feet.

Apart from the foot structures of (17), however, we need to consider vowel reduction, since the first syllables of the stems in *tonality* and *minority* are heavy and so take strong metrical positions. For this reason, these examples can't meet the application of rule (9). As an alternative, we propose a modified version of the rule as in (19).

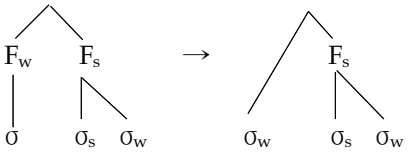
(19) Prestress Destressing (modified)



where the syllable of the foot to be deleted dominates either a single mora or a weak syllable with nonbranching rime.

As a way of illuminating the rule, it can be represented in a foot structure as in (20) below. In reference to destressing, Jensen (1993) states that the destressing takes place despite an underlying long vowel. Thus, once a long vowel undergoes vowel reduction, a weak syllable is undoubtedly applied to the foot-based rule (20).

(20) Prestress Destressing (foot-based)



A problem arises when we apply the modified Prestress Destressing rule to *tonality* and *minority*. The rule can explain only one of them, *minority*. First, in the case of *tónal+ity*, the first stressed syllable of the stem is still heavy, so the rule (19) can't be applied to the syllable (Hammond 1982:32). Second, after suffixation, however, the first syllables of *tonality* and *minority* each are differently realized. That is, *mi-* of *minórity* is laxed, but not in *to-* of *tonálity*. Thus, it is necessary to explore a new devise to be able to give consistent explanations for them.

At this point in time, we come up with the new rules and conditions of application of rules as in (21), since they give explanations for the phonological variations that result from the correlation between stress shift and vowel laxing. In fact, the proposed rules are closely associated with the Prestress Destressing rule, as we see in (21). The domain of the rules in level-structures is in (W,P) level, because the conditions of the rules are applied to in contexts after suffixation.

(21) (W,P)-level: Stress Shift-to-Vowel Laxing

When a stress-sensitive suffix is attached to a stem and stress shift occurs to avoid stress clash, (i) if the target vowel of the stem still is bimoraic,[4] the Prestress Destressing rule can't be applied to the vowel;[5] (ii) if the target vowel has undergone vowel laxing,[6] the Prestress Destressing rule must be applied to the vowel.

(i) The former case is defined as Minor Weakening Rule.
(ii) The latter case is defined as Major Shortening Rule.

The rules (21i) and (21ii) with their conditions are formalized as in (22a) and (22b) respectively.

(22) a. [$\bar{V}$ V]$_{stem}$+[∀CV]$_{suffix}$ → [[$\bar{V}$]$_F$ [∀ ∀CV]$_F$]$_{Pwrd}$

μ μ [-tense] μ μ [+tense]

b. [$\bar{V}$ V]$_{stem}$+[∀CV]$_{suffix}$ → [∀ [∀ ∀CV]$_F$]$_{Pwrd}$

μ μ [-tense] μ μ [+tense]

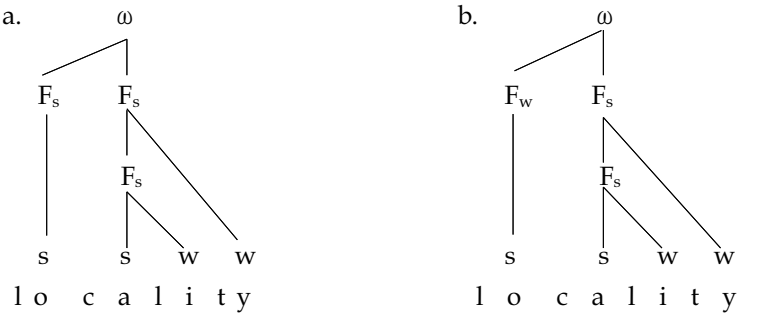
ø (mora deletion/vowel laxing)

Let us now consider how cases such as *locality, tonality* work under the conditions of the rules referred to above. For the output of *locality*, first

4) Lee (1996:75) refers Tense-to-Weight: if tense, then bimoraic.
5) LP (1977:284) mentions that cases of *lócal+ity→locálity* undergo a minor shortening rule which feeds initial destressing. This is based on the fact that the first stressed syllable of the word remains heavy even after suffixation.
6) Jensen (1993:191) mentions that laxing is automatically accompanied by elimination of the second mora of the vowel. Similarly, Lee (1996:77) insists that if the non-head syllable were bimoraic, vowel reduction would yield schwa for the vowel, and this is made provided that the vowel reduction deprives only one mora.

Suffixation and Stress rule are done at (W,W) level as in (23a). However, the first syllable of *locality* is heavy even after the occurrence of stress shift by suffixation and being placed in a strong position to compose a foot. When we consider *locality* on the basis of the rules and their conditions of (21), the case of *locality* belongs in (21i). Therefore, due to the application of the rule (22a), the Prestress Destressing of (20) can't apply to the word, yielding (23b) in (W,P) level, without being foot deletion (Hayes 1982:257).

(23) M-level: local, ity
W-level: $[[lo]_F[cálity]_F\ ]_{Pwrd}$

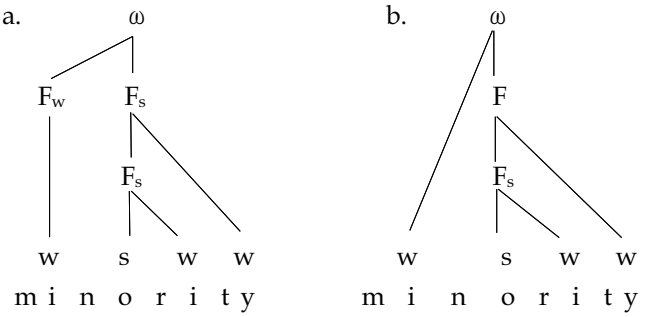


P-level: [loukǽliti]

Finally, let us consider the case of *minority*. The first syllable of *minority* is laxed despite being heavy by virtue of having a long vowel in a stem as in *locality*, as given in (24a). However, according to (21), the context of *minority* belongs in (21ii) and (22b).

Therefore, based on rule (21ii) and (22b), the Prestress Destressing is allowed to apply to the first syllable of *minority* in (W,P) level, the defooted syllable being incorporated directly to the phonological words (Hayes 1980), yielding (24b).

(24) M-level: minor, ity
W-level: [mi [nórity]$_F$]$_{Pwrd}$



P-level: [minɔ́:riti]

4. Conclusion

This study compositely accounted for a few examples in reference to TSL through the foot structures under phonological words in three-level structures. For theses purposes, we reviewed several analytical methods performed in phonological aspects such as phonological rules-based, lexical, CV-level structure, and metrical approaches. The common problem was that they didn't show the correlation between stress shift and vowel laxing triggered by suffixation. That is, in these analyses, stress shift and vowel shortening were treated separately.

First, we considered Durand (1990)'s approach, which relied on cyclic application of rules. Second, in a lexical framework, the examples discussed in Durand's analysis were treated by Mohanan (1982)'s analytical method. Third, we examined the analysis of Myers (1987), which resorted to Resyllabification and Closed Syllable Shortening in CV-level structure. However, these methods have shown problems such as the setting of artificial underlying forms and unnatural syllable structure adjustments in explaining some other examples (*solidity, minority*, etc.).

As an alternative, we considered metrical approaches such as Halle &

Vergnaud (1987), Giegerich (1992), and Jensen (1993). These analyses, which were based on a composite view in stress shift and vowel laxing, were also examined through the examples referred to in previous studies (Burzio 1993, Kim 2013). However, even in these explanations, there were difficulties explaining cases such as *nobility, finality, tonality, locality,* etc., where the vowels to be laxed maintained vowel tensing.

Consequently, this study has accounted for the examples to challenge previous studies by coming up with devices, which were operated on the foot structure under a phonological word in cross-level structures (Goldsmith 1993, Lakoff 1993, Oh 2001). As a solution, we proposed a few newly viable alternatives to account for the examples for which previous studies couldn't provide explanations satisfactorily: a foot-structure extension to attach to a final weak syllable, a modified Prestress Destressing rule to explain destressing and vowel laxing, and Minor Weakening and Major Shortening rules and their conditions required for the application of the modified Prestress Destressing rule. Thus, through the new propositions, this study offers more simplified, direct explanations for stress shift and vowel laxing in level structures than the previous studies. Especially, this present study has shown a possibility to explain the correlation between stress shift and vowel laxing simultaneously in level structures, without resorting to intermediate derivations, complexity of rule applications, or artificiality of rules. The approaches based on level-structures have some strength in the aspects which this paper has accounted for. In terms of the correlation between stress shift and its vowel laxing, however, there is the need for serious consideration and reevaluation of the notions of levels for a more generalized theoretical framework.

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