Prosodic buffers: A constraint-based account of English vowel laxing*

William Hart
(Hankuk University of Foreign Studies)

Hart, William. 2015. Prosodic buffers: A constraint-based account of English vowel laxing. *Studies in Phonetics, Phonology and Morphology* 21.2. 257-277. Using the tools of prosodic repulsion, this paper proposes a unified constraint-based account of vowel length alternation in sets of morphologically related English words such as *wise–wisdom*, *tone–tonic* and *sane–sanity*. These alternations, originally analyzed in SPE as resulting from rules of pre-cluster laxing, *-ic*/*-id*/*-ish* laxing and trisyllabic laxing, and in later work (e.g. Borowsky 1986, Myers 1987, Yip 1987) from shortening rules, are re-analyzed here as the result not of rule-based processes but of a parallel evaluation of ranked constraints. While the monomoraicity of words such as *wisdom* is determined by basic constraints regulating the maximum weight of a syllable, the moraicity of coda consonants, and moraic faithfulness, the short stressed vowel in words such as *tonic* and *sanity* emerges through the interaction not only of the three aforementioned constraints but also of two newly proposed ones. The first of these is a moraic resistance constraint that militates against the alignment of a strong mora with a syllable edge, and the second is a prosodic buffer constraint which formalizes a ban against vocalic buffers. As a result of this interaction of constraints, the intervocalic consonant in the optimal candidates of words like *tonic* and *sanity* is syllabified in the coda position of the stressed syllable, serving as a buffer between the strong mora and the syllable edge to quell the force of repulsion between them. **(Hankuk University of Foreign Studies)**

Keywords: English vowel shortening, pre-cluster laxing, closed syllable shortening, trisyllabic laxing, trisyllabic shortening, prosodic repulsion, moraic resistance, prosodic buffers, resyllabification

1. Introduction

The vowel alternations exemplified by the data in (1) below have been extensively discussed over the years from several different theoretical perspectives in phonology. In this paper, these alternations will be examined and reanalyzed using the tools of a concept called *prosodic repulsion* (Hart 2015).

(1) English vowel alternation
  a. [aɪ] ~ [ɪ] *w**i**se – w**i**sdom; w**i**de – w**i**dth*

* This article began life as the term paper for a seminar run by Professor Sung-Hoon Hong at the Graduate School of Hankuk University of Foreign Studies. I offer my heartfelt appreciation to him for suggesting many of the reference sources and for guiding me with invaluable questions and comments about the initial draft. Sincere thanks also go out to three anonymous reviewers for raising several stimulating questions about and challenges to the proposal, many of which will have to be addressed in future work.

b. [i:] ~ [ɛ] *conv**e**ne – conv**e**ntion; interv**e**ne – interv**e**ntion*
c. [eɪ] ~ [æ] *m**a**ge – m**a**gic; r**a**bies – r**a**bid; Sp**ai**n – Sp**a**nish*
d. [oʊ] ~ [a] ***to**ne – **to**nic; c**o**ne – c**o**nic*
e. [u:] ~ [ʌ] *prod**u**ce – prod**u**ction; pres**u**me – pres**u**mptive*
f. [aʊ] ~ [ʌ] *prof**ou**nd – prof**u**ndity; en**ou**nce – en**u**nciate*

In the first systematic treatment of this data, Chomsky and Halle (1968, hereafter SPE) proposed two rules. The first, covering the alterations presented in (1a), (1b), (1e) and (1f), results in the laxing of a vowel when it is followed by two consonants. The second is a disjunctive rule composed of two sub-rules. The first of these two sub-rules, which accounts for the alternations shown in (1c) and (1d), laxes a vowel when followed by a single consonant plus one of the three monosyllabic suffixes *-ic, -id* or *-ish.* The second of these two sub-rules, covering alternations such as *sane – sanity* and *serene – serenity*, laxes a vowel that is followed by two additional syllables. The formalizations of these three processes presented in SPE are provided in (2) below.

(2) SPE laxing rules

a. $$V \rightarrow [\text{-tense}] \ / \ \_\_\_\_\_ C_2$$

b. $$V \rightarrow [\text{-tense}] \ / \ \_\_\_\_\_ C_1 \quad + i \begin{Bmatrix} k \\ d \\ \check{s} \end{Bmatrix}$$

c. $$V \rightarrow [\text{-tense}] \ / \ \_\_\_\_\_ C_1 \ + \begin{bmatrix} \text{-stress} \\ V \end{bmatrix} C_0 V$$

As is evident from the formalizations of these rules, the SPE account relies on the distinction between tense and lax vowels, while the differences in length and vowel quality are held to be predictable based on the specification of the feature [tense] and are thus handled by separate rules.

In later work, the distinctions between such alternations as [aɪ] ~ [ɪ] have been analyzed instead as a matter of length or weight rather than tenseness, with representative examples being the proposals presented in Borowsky (1986), Yip (1987) and Myers (1987). From this perspective, the rules presented in (2a), (2b) and (2c) above can be described as closed syllable or pre-cluster shortening, -ic/-id/-ish shortening, and trisyllabic shortening, respectively.

Situated firmly in the cyclical rule-based theoretical framework of Lexical Phonology (Kiparsky 1982, Mohanan 1982), Yip's (1987) elegant account of English vowel alternation proposes that all of the suffixes that trigger alternation are underlyingly consonant initial, so that all three of the SPE laxing processes in (2) above can be seen to arise from a single rule that shortens long vowels before consonant clusters, analogous to the rule shown in (2a). The surface vowels that occur initially in suffixes such as *-ic, -ity* and *-itive*, and even those in such suffixes as *-atory, -ative* and *-able,* are claimed to result from a lexical fill-in rule of vowel epenthesis, by which /i/ is treated as a special vowel in English that is inserted into unspecified empty V-slots.

In an alternative account, published within the very same edition of the same journal, Myers (1987) acknowledges Yip's (1987) approach, yet points out that one of her major predictions is not empirically supported. Specifically, Yip's proposal predicts that vowel shortening will only occur before suffixes that begin with a consonant or the special vowel /i/, yet the alternations seen in word pairs such as *grade – gradual, patron – patronize,* and *recite – recitation*, among others, appear to falsify this prediction. Instead of shortening triggered by an /i/-initial suffix in these words, we find shortened vowels occurring before the /u/-initial suffix *-ual* in *gradual,* the /aɪ/-initial suffix *-ize* in *patronize*, and the /eɪ/-initial suffix *-ation* in *recitation.* While the latter two suffixes clearly begin with vowels other than the predicted /i/, it could be pointed out that the first of these three suffixes could also conceivably be interpreted as beginning with the diphthong /ju/ (or /ɪu/) and thus represents a case apparently analogous to the initial high front vowel of Yip's epenthetic vowel. However, Yip's proposal of pre-cluster shortening in fact requires that /i/ be the only vocalic element present at the beginning of the suffix, since the occurrence of any additional vocalic elements following it would prevent application of the pre-cluster shortening rule. What this means is that all cases of shortening triggered by suffixes such as *-ual,-ize* and *-ate/-ation*, which begin with vocalic elements other than /i/ alone, stand as counter evidence to Yip's predictions for the vowel epenthesis account.

In a similar approach, Myers (1987) also presents a unified view of all cases of vowel shortening in English as resulting from a single process, posited as a rule of closed syllable shortening. Yet rather than using the device of vowel epenthesis, he relies instead on the notion that consonants can be syllabified into the coda position of a preceding stressed syllable, whether through resyllabification (Selkirk 1982) or ambisyllabicity (Kahn 1976, Gussenhoven 1982). When a stressed syllable with a long vowel or diphthong in its nucleus is closed by a coda consonant, desyllabification of a vocalic timing slot is forced to arise in order to prevent violation of a constraint on the well-formedness of syllable structure. Since the syllable template for English roots C*V(X) (Borowsky 1986) does not allow more than two timing units in the rime, desyllabification is triggered when a long vowel or diphthong appears in a closed syllable, since otherwise this would result in an ill-formed CVVC syllable within the root. Because the delinking of timing units in English proceeds from left to right, the C*V(X) template is then satisfied as soon as the first V-slot is delinked from the syllable node, resulting in a short vowel. This process applies across the board, regardless of the featural make-up of the initial vowel of the suffix that triggers it. With this proposal, Myers (1987) not only unifies the three rules originally presented in SPE, but also provides a solid theoretical motivation for vowel alternation in terms of universal prosodic properties of language – the *why* in addition to the *what.*

The account of vowel alternation apparently triggered by C-initial, *-ic/ -id/-ish*-initial and minimally disyllabic suffixes proposed in this paper builds on that of Myers (1987). While his account is presented with the theoretical tools of metrical grids, autosegmental tiers and prosodic templates, the current proposal provides a constraint-based, output-only account that echoes the core of his proposal while additionally providing a theoretical motivation for the long-standing observation that stressed syllables appear to "attract" consonants (Hoard 1971). While Myers (1987) unifies all of the SPE laxing rules and provides the *why* behind them, this proposal goes further by explaining *how* the alternations between long and short vowels in corresponding roots occur where they do. That is to say, this paper will use the tools provided by the concept of prosodic repulsion to demonstrate precisely what it is about the structure and constraints of the phonological grammar of English that make the apparent process of shortening the optimal way to satisfy the well-formedness conditions of the language, rather than some other process. Specifically, the account presented herein is built upon the notions of *moraic resistance* (Hart 2015) and *prosodic buffers*.

The basic proposal is as follows. What has previously been viewed as a process of laxing or shortening is presented here as a case of length alternation between corresponding forms of roots within derivational paradigms. While previous accounts of the prosodic structure of the stressed syllables of words such as *wisdom, tonic* and *sanity* have essentially posited the monomoraicity of the nucleus vowel to be the result of a shortening rule, in the current account there is no process or rule involved, but only constraint interaction. This vowel is monomoraic because the syllable incorporates the post-vocalic consonant into coda position.[1] Since coda consonants in English are moraic, and because syllables are maximally bimoraic, the nucleus vowel cannot be associated to any more than a single mora, resulting in a short vowel in the surface form. One major question, of course, is why we should find the post-vocalic consonant in coda position at all, since this would appear to contravene the universal tendency for intervocalic consonants to be onsets. The answer to this question lies at the heart of the current proposal, and depends on two key points: first, that a strong mora resists the right edge of a syllable; and second, that consonantal segments inherently serve as better prosodic buffers than vocalic ones in counteracting the force of prosodic repulsion.

The proposal will be set forth in detail in Section 2 of this paper, which

---

[1] Although the account presented here assumes total resyllabification (Selkirk 1982), the basic idea works equally well for ambisyllabic interpretations (cf. Kahn 1976, Gussenhoven 1982). Although the formalizations of the constraints and the interaction between them would work a bit differently for the latter, the key point in both is that the stressed syllable is closed by a consonant.

includes detailed explanations and discussion of the set of constraints needed for this analysis as well as tableaux for three representative cases. Discussion of related points will be presented in Section 3, including the viability of what has traditionally been viewed as the resyllabification of coda consonants, as well as the psychological reality of vowel alternation. A summary of the main points of the paper will then be presented in Section 4, along with brief concluding remarks and suggestions for future related work.

2. The Analysis

The proposed analysis of vowel alternation utilizes the concept of prosodic repulsion, first introduced in Hart (2015) to account for English final tensing and aspects of the Cairene Arabic stress system. Prosodic repulsion rests on the simple idea that prosodic elements and structures resist each other, and although this force of resistance can be seen at work in several different areas of phonology and applied to various elements and structures, the particular instantiation of prosodic repulsion used in the present analysis applies specifically to the unit of weight called the mora, and can thus be referred to as moraic resistance. The particular moraic resistance constraint utilized in this account refers specifically to a segment associated with a *strong* mora.[2] It will be shown in the following analysis that moraic resistance is one of the crucial motivating factors involved in English vowel length alternation, since a strong mora resists the right edge of a syllable. To counteract this force of repulsion, the strong moraic segment requires some kind of buffer standing between it and the syllable edge that it resists, in essence shielding one from the other.

While Hart's (2015) account of final tensing in English demonstrates that a weak mora associated to a vocalic element can serve as a sufficient prosodic buffer word-finally, it will be shown here that, given the choice, a consonantal segment inherently serves as a better prosodic buffer than a vocalic one. Due to this preference for consonantal prosodic buffers in counteracting the force of moraic resistance, a consonant is incorporated into a preceding stressed syllable in coda position in order to shield its strong mora from the right edge of the syllable. Because coda consonants in English roots are always moraic, and since the weight of a syllable cannot exceed two morae, the vowel that emerges in the optimal form is thus short, or monomoraic. The constraints involved in the interaction are presented in (3) below, followed by more detailed explanations of each in turn.

[2] A strong mora is the leftmost (and sometimes the only) mora of a stressed syllable, while all other remaining morae in the foot are weak. The notion of strong mora is analogous to what Kager (1993, 1995) views as the strong micro-beat of a heavy syllable, but also includes the mora associated with the initial light syllable of (ˈLL) trochaic feet.

(3) Constraints involved in the interaction[3]

a. **WtMax** A syllable is maximally bimoraic.
b. **WBP** A consonant in coda position is moraic.
c. **$*\mu_S\,]_\sigma$** A strong moraic segment cannot be syllable-final.
d. ***V-Buff** Vowels cannot serve as prosodic buffers.
e. **Max-μ** A mora cannot be deleted.

The first constraint active in the analysis is **WtMax**,[4] which caps the maximum weight of a syllable at two morae, and is violated by any syllable heavier than a bimoraic one, such as so-called "superheavy" syllables. **WtMax** plays a key role in the analysis because it is the overwhelming demand for maximal bimoraicity that prevents long vowels and diphthongs from appearing in stressed syllables closed by moraic consonants. A consonant that occurs in the coda position of a stressed syllable, or in fact of any syllable, will be guaranteed moraicity by the highly ranked constraint **WBP**, either by association of a new mora, or through reassociation of a pre-existing mora from another segment. Any nonmoraic consonant in the coda position of a syllable will incur a violation mark for **WBP**.

The next constraint to be presented is the moraic resistance constraint **$*\mu_S]_\sigma$**, which prohibits a segment associated to a strong mora from being aligned with the right edge of a syllable. As such, it should be noted that the representation **$*\mu_S]_\sigma$** is merely a shorthand version of the constraint formally represented in (4) below.

(4) The moraic resistance constraint **$*\mu_S]_\sigma$**

$$* \left.\begin{array}{c}\mu_S\\ |\\ \mathrm{x}\end{array}\right]_{\sigma}$$

A strong moraic segment cannot be syllable-final.

It should be noted that the constraint shown in (4) bears striking similarity to **$*\mu_S]_{PW}$** and **$*\mu]_{FT\cap PW}$**, shorthand versions of two constraints proposed in Hart (2015) to account for the apparent word-final lengthening seen in some English words and aspects of the stress system of Cairene Arabic, respectively. This similarity is no accident, as all three are embodiments of moraic resistance, a particular instantiation of the concept of prosodic repulsion according to which moraic elements resist the edges of prosodic constituents. While **$*\mu_S]_{PW}$** militates against the alignment of a moraic segment with the right edge of a prosodic word and **$*\mu]_{FT\cap PW}$** disallows a

[3] The list presented in (3) includes only five constraints for the sake of simplicity, as these are the constraints used in representative tableaux (7), (8) and (9). It should perhaps be kept in mind, however, that there are other constraints involved "behind the scenes" in the interaction. These constraints will be discussed along the way.

[4] The name **WtMax** is an abbreviation of "weight maximum."

word-final moraic segment from being parsed into a foot, the key constraint $*\mu_S]_\sigma$ presented in (4) above is violated by any segment that is both associated to a strong mora and aligned with the right edge of the syllable. In other words, $*\mu_S]_\sigma$ formalizes the force of resistance between a strong mora and a right syllable edge.

A few points deserve to be made about the constraint $*\mu_S]_\sigma$ before continuing on to explanations of the remaining constraints shown in (3) above. The first point is that this constraint is, strictly speaking, a more specific version of the general constraint $*\mu]_\sigma$ which bans all moraic segments at the right edges of syllables, encompassing not only the strong moraic version $*\mu_S]_\sigma$ but also the weak moraic one $*\mu_W]_\sigma$, the latter of which happens to be ranked low enough in English to prevent any effects from being seen in the phenomenon at hand. The second point to be made is that, typologically speaking, if the concept of prosodic repulsion is to be applied to phonological structure as generally as possible, then we should also expect to see mirror-image versions of these right-edge constraints operating at the left edges of prosodic constituents, constraints that would in this case look something like $*_\sigma[\mu_S$ and $*_\sigma[\mu_W$ and formalize the force of resistance between morae and the left edges of syllables.

In fact, we do indeed find the predicted constraints $*_\sigma[\mu_S$ and $*_\sigma[\mu_W$ active in phonology, but they are usually unified as a single constraint and presented in a different form. These two constraints are actually alternative formalizations of the classic constraint **ONSET**, but split into two separate moraic resistance constraints – one for strong morae and another for weak ones. Formal representations of these two constraints are shown below in (5).

(5) Moraic resistance representations of **ONSET**

a.

$$* \; {}_{\sigma}\left[\begin{array}{c} \mu_S \\ | \\ X \end{array} \right. \qquad \textit{A strong moraic segment cannot be syllable-initial.}$$

b.

$$* \; {}_{\sigma}\left[\begin{array}{c} \mu_W \\ | \\ X \end{array} \right. \qquad \textit{A weak moraic segment cannot be syllable-initial.}$$

Viewed through the lens of prosodic repulsion, the representations shown in (5a) and (5b) recast **ONSET** as a pair of markedness constraints that militate against the alignment of left syllable edges with strong and weak morae, respectively. Though at first glance these two constraints might seem like substantively identical restatements of **ONSET**, there is an important difference involved. While **ONSET** is typically stated as a positive structural requirement demanding that syllables begin with consonantal segments, the negatively framed moraic resistance constraints $*_\sigma[\mu_S$ and $*_\sigma[\mu_W$ simply formalize bans on marked structures without stating specifically how these marked structures are to be avoided. These two constraints then confine themselves to a single job each, and it is the interaction of other constraints that determines whether and how they are satisfied.

As to the question why separate onset constraints for strong and weak morae are proposed, the phenomenon currently under investigation provides a prime example of why both of the two are needed. While high-ranking **$*_{\sigma}[\mu_S$** provides pressure for stressed syllables to have onsets, it is the low ranking of **$*_{\sigma}[\mu_W$** that allows for the syllabification of intervocalic consonants in the coda position of preceding stressed syllables, and it is this syllabification that effectually "squeezes" a mora out of the stressed syllable to result in short vowels in optimal forms. It is thus the bifurcation of **ONSET** into two separate left-edge resistance constraints and the dominance of the strong moraic version over the weak moraic one that makes the structures ˈCVC.V and CV.ˈCV more well-formed than ˈCV.CV and CVC.ˈV in English. Although these **ONSET** constraints have been omitted from the representative tableaux presented below in (7), (8) and (9), the basic interaction between them and the right-edge resistance constraints plays a key role in determining the predicted syllabifications that affect vowel length alternation in English and is therefore demonstrated below in (6). In this tableau, syllable boundaries are marked with periods (i.e. full stops), while stressed and unstressed monomoraic vowels are represented as μ_S and μ_W, respectively, in order to more clearly demonstrate violation and satisfaction of the relevant constraints.

(6) Interaction of left and right edge moraic resistance constraints

CV́CV[5]	$*_{\sigma}[\mu_S$	$*\mu_S]_{\sigma}$	$*_{\sigma}[\mu_W$	$*\mu_W]_{\sigma}$
a. $C\mu_S.C\mu_W$		*!		*
☞ b. $C\mu_SC.\mu_W$			*	*
CVCV́				
☞ c. $C\mu_W.C\mu_S$		*		*
d. $C\mu_WC.\mu_S$	*!	*		

As evidenced by the victory of candidate (6b) over (6a), CV́C.V syllabifications are optimal for strong-weak trochaic patterns. This is because the alternative form CV́.CV leaves a segment associated with a strong mora nakedly exposed to a right syllable edge, thus incurring a fatal violation of the highly ranked moraic resistance constraint **$*\mu_S]_{\sigma}$**. Though this pattern of

5 Note that the representations CV́CV and CVCV́, presented in the first and fourth lines of tableau (6), do not necessarily represent inputs in the classic OT sense, as stress is arguably absent from input forms. Rather, these representations are provided simply to demonstrate the contrast in constraint interaction between trochaic and moraic feet. Much thanks go to an anonymous reviewer for raising this point. See also footnote 10 below.

syllabification leaves the second syllable without an onset, CV́C.V is still the optimal form because the weak left-edge onset constraint $*_{\sigma}[\mu_W$ is dominated. In contrast, for weak-strong iambs the optimal syllabification is the CV.CV́ pattern of candidate (6c) because the strong onset constraint $*_{\sigma}[\mu_S$ outranks the weak right-edge constraint $*\mu_W]_{\sigma}$. Through this simple interaction of moraic resistance constraints, the apparent phenomenon of resyllabification of onset consonants to preceding stressed syllables, originally proposed by Selkirk (1982), is captured through a single parallel evaluation of candidates. Since these syllabification forms are by no means uncontroversial, empirical evidence in support of them is presented in the discussion of related issues in Section 3.

Turning back to the list presented in (3) above, the next constraint to be introduced is *V-BUFF, a markedness constraint prohibiting the occurrence of vocalic segments serving as buffers against the force of moraic resistance. Specifically, a violation mark is incurred for *V-BUFF when and only when segmental material associated to a V-slot lies directly adjacent to a syllable boundary on one side and to segmental material associated with a strong mora on the other, with the intervening vocalic element hence serving as a buffer between the strong mora and the syllable edge, mitigating the force of resistance between them. By such means, the underlined element in ˈCV$\underline{\text{V}}$.CV[6] incurs a violation of *V-BUFF, while those in ˈCV$\underline{\text{V}}$C.V and ˈCV$\underline{\text{C}}$.CV do not. In ˈCV$\underline{\text{V}}$C.V no violation of *V-BUFF occurs because the vocalic element is not directly adjacent to the right syllable edge, while in ˈCV$\underline{\text{C}}$.CV it is a consonantal rather than a vocalic element that intervenes between the strong mora and the right syllable edge. This particular buffer constraint is thus inherently connected to $*\mu_S]_{\sigma}$, the moraic resistance constraint that is satisfied by means of minimal violation of *V-BUFF, which is a point of no small significance. Before the question of why this constraint should be negatively stated is dealt with and the specific details of how it interacts with other constraints are laid out, it is worth taking a moment to consider the concept of prosodic buffers in general, to look at the various forms that they can take and the essential function that they fulfill in various phonological phenomena.

Prosodic buffers are an important correlate to the concept of prosodic repulsion, for they are the entities that serve as “shields” between the phonological elements and structures that resist each other, providing the means for repulsion constraints to be satisfied. All kinds of elements and constituents can serve as prosodic buffers. In the treatment of English final tensing presented in Hart (2015), it is a single weak mora that satisfies the

---

[6] For the sake of simplicity, the representation VV covers both long vowels and diphthongs in the case that the two vocalic elements occur tautosyllabically. While the assumption of VG representations for diphthongs (e.g. [ej] and [aw] rather than [eɪ] and [aʊ]) would not require any alteration of the essence of the proposed analysis, it would necessitate further extension of the series of prosodic buffer constraints to a ban against glides serving as buffers (i.e. *G-BUFF) in addition to the proposed bans on vowels and consonants.

right-edge resistance constraint ***μ**$_{\mathbf{S}}$**]**$_{\mathbf{PW}}$, serving as a buffer to hold a strong mora away from a right constituent edge and resulting in bimoraic yet unstressed final vowels in the optimal forms of words such as *kangaroo, buffalo* and *monkey*.

The same type of resistance can be seen at work in shaping the structures seen in universal foot typology, in which the constraint that plays a vital role is ***μ**$_{\mathbf{S}}$**]**$_{\mathbf{Ft}}$, a ban against the alignment of a strong mora with the edge of a prosodic foot. In this case, the right-edge strong moraic resistance constraint appears to be the motivating force behind the asymmetry between canonical trochaic (ˈLL) and iambic (LˈH) feet, and two separate types of buffers intervening between the strong mora and the foot edge are needed in order to satisfy it. While the strong mora of an (ˈLL) trochee resists the right edge of the foot with a light syllabic buffer, the strong mora of an (LˈH) iamb is situated within a syllable aligned with the right edge of the foot, and would thus be directly exposed to that edge if it occurred in a light syllable. The buffer in an iambic foot is thus a weak foot-final mora which intervenes between the strong mora and the right foot edge, resulting in stressed syllables that are heavy in (LˈH) iambs but light in (ˈLL) trochees.

In addition to syllables and morae serving as prosodic buffers, segmental ones can also be found. In looking at the universal tendency for the occurrence of onsets in syllable structure, it is shown in (6) above that a single consonant can satisfy the left-edge moraic constituent ***$_{\boldsymbol{\sigma}}$[μ**$_{\mathbf{S}}$, serving as a buffer to shield the strong mora from the left edge of the syllable. Consonantal buffers are also seen at work at the right edge of constituents, resulting for example in the satisfaction of ***μ**$_{\mathbf{S}}$**]**$_{\mathbf{PW}}$ in the analysis of English final tensing mentioned above. In these cases, a consonant can serve as a buffer to hold a strong mora away from a right constituent edge and obviate the need for final lengthening in words ending in closed syllables. It is for this reason that a much greater range of vocalic contrasts are seen in final closed syllables in English than in final open ones.

Besides elemental buffers such as morae and consonants, full prosodic constituents can serve as buffers as well. While the well-known pattern of stress in English nouns and suffixed adjectives has often been presented using the theoretical devices of extrametricality or nonfinality, this pattern can be viewed alternatively as a matter of prosodic repulsion, with the rightmost foot resisting the right edge of the word, and a single syllable serving as a buffer to hold them apart. In the same way, the phenomenon known as primary stress retraction can also be seen as the result of prosodic repulsion. In monomorphemic words such as *ánecdòte, állibì* and *árchìve*, as well as morphologically complex words such as *íncubàte, clárify* and *réalìze*, the head foot of the prosodic word is not the rightmost one, as it is in most other words of the language, but rather the next foot over to the left. While this pattern has previously been viewed a kind of retraction in process-based approaches, it can instead be understood in the light of prosodic repulsion as the resistance of the head foot to the right edge of the prosodic word, with an entire foot serving as a buffer to hold them apart.

From this brief introductory look at prosodic buffers, it can be seen that several types of phonological entities can serve to satisfy repulsion constraints by holding various elements and structures apart, including segments, morae, syllables and feet, and that different types of marked structures require different types of buffers. The question that must then be faced is this: how can buffers be formalized in a constraint-based framework? One possibility would be to merely stipulate for each resistance constraint the particular type of minimal buffer that is required in order to satisfy it. In this way, resistance constraints could basically be formalized as negatively framed or "asterisked" versions of Generalized Alignment constraints (McCarthy and Prince 1993), with the addition of an appendix specifying the buffer. However, this stipulative operation would ignore the significant observation that the type of buffer that serves as a shield against any particular instance of repulsion appears to be linked systematically to the form and substance of the constraint that embodies the force of resistance that it serves to mitigate. While basic moraic resistance constraints such as **$*_{\sigma}[\mu_S$** are satisfied by lower level elements at the CV-tier, higher level foot constraints such as those responsible for nonfinality in English and other languages are satisfied by higher level syllabic buffers, and going even further up the prosodic hierarchy, word-level constraints such as those active in primary stress retraction in English are satisfied by constituents at the foot level. Based on this observation, a basic generalization regarding the connections between resistance constraints and the buffers that satisfy them can be offered. The prediction is that, the more prominent or further up the prosodic hierarchy an element is that repels the edge of a constituent, the more prominent or further up the hierarchy will be the minimal buffer that is required to intervene between them in order to quell this force of repulsion.

Using this basic generalization as a starting point, constraints have been crafted in order to model the interactions responsible for alternations in English vowel length in morphologically related forms, the phenomenon currently under investigation. Inspired by Gouskova's (2004) discussion of harmonic alignment, relational hierarchies, and the inherent connections between moraicity, sonority and prominence, the buffer constraints ***V-BUFF** and ***C-BUFF**[7] proposed here have been fashioned as two schematized parts of a harmonically aligned series of constraints (Prince and Smolensky 1993/2004) reflecting the inverse relationship between prominence and goodness as prosodic buffers. This scale is based on the generalization that the more prominent or the further up in the prosodic hierarchy an element or structure is, the better it can serve as a buffer to counteract the force of prosodic repulsion by intervening between increasingly more prominent

---

[7] The reader may note that ***C-BUFF** is absent from the original list of constraints shown in (3). This is because, being ranked lower than ***V-BUFF** and not high enough to play any other role in the interaction at hand, ***C-BUFF** has been omitted from the representative tableaux presented in (7), (8) and (9).

elements and structures.

The full range of elements and structures in this harmonic series extends beyond this simple division into vocalic and consonantal buffers to include structures further up the prosodic hierarchy, as well as within these two classes to include more finely grained distinctions in sonority and prominence between different types of vocalic and consonantal segments. However, for the analysis at hand only condensed versions of this series are needed, since in the case of vowel length alternation there are only two viable types of candidates for the buffer needed to satisfy the right-edge moraic resistance constraint **$*\mu_S]_\sigma$**. In all of the cases relevant to vowel length alternation examined here, these two candidate buffers are the vocalic element associated to a weak mora as the second part of a long vowel or diphthong (i.e. CV́V̲CV), and the consonantal segment that follows a stressed vowel (i.e. CV́C̲V). The ranking of ***V-BUFF** over ***C-BUFF**, the constraints that respectively militate against these two candidate buffers, formally reflects the fact that consonants, being less sonorous and hence less prominent than vowels, inherently make better buffers against the force of moraic resistance. Thus, a candidate with a consonantal buffer situated between a strong mora and a right syllable edge will, *ceteris paribus*, be more optimal than a candidate with a vocalic one, making the form CV́C.V[8], whose stressed syllable contains a short vowel and is closed by a consonant, more optimal than CV́V.CV, whose stressed syllable is bimoraic. Note that it is specifically sonority, and not just moraicity itself, which determines the goodness of the buffer, since the consonant that syllabifies into the coda position of the stressed syllable is also moraic, being associated to a mora under pressure from **WBP**.

Finally, the fact that the optimal form of a suffixed word appears with a monomoraic stressed vowel rather than a fully faithful bimoraic one necessitates mention of the last constraint listed in (3). This is of course the faithfulness constraint **MAX-μ**, which protects a mora from deletion, and is violated by any output candidate lacking an association to a mora that is present in its corresponding base or input form. If this constraint were more highly ranked in English there would be no apparent process of "shortening" and indeed, no vowel alternation at all. This means that **MAX-μ** must be dominated by the resistance constraint **$*\mu_S]_\sigma$**, since it is the avoidance of violating this markedness constraint that makes a moraically deficient candidate more optimal than one which retains all of it its original moraic associations.

With all of the key constraints having been introduced and the relevant discussions pursued, a few representative tableaux will now be presented in order to demonstrate the constraint interaction proposed to account for vowel

[8] The form CV́C.V is shown here with a monomoraic stressed vowel rather than CV́VC.V with a bimoraic one because it is only in the former that the consonant actually serves as a buffer against **$*\mu_S]_\sigma$**. In the latter, the consonant stands directly adjacent to the syllable edge to the right but not to the strong mora to the left, and thus incurs no violation of ***C-BUFF**.

length alternation in English. The analysis for *wisdom* is shown in (7) below as an example of what has traditionally been covered by a rule of closed syllable shortening, while the tableau for *tonic* is provided in (8) to demonstrate the interaction accounting for *-ic*/*-id*/*-ish* shortening, and the tableau for *sanity* is shown in (9) to account for what has previously been viewed as a process of trisyllabic shortening. It can be noted that the interactions shown to account for *-ic*/*-id*/*-ish* and trisyllabic shortening are in fact identical, but both have been provided to parallel the original division of the SPE account into three rules. The only significant difference between words displaying these two patterns (e.g. *tonic* vs. *sanity*) is in their overall stress patterns, with the former but not the latter type exhibiting an apparent "immunity" to the phenomenon of syllabic nonfinality. Though this apparent anomaly lies outside the purview of the current investigation, it is intimately connected with the full applications of the concept of prosodic repulsion and remains to be tackled in future work.

In the representations shown in tableaux (7), (8) and (9), periods (full stops) indicate syllable boundaries, while underlining is used to indicate the moraicity of consonantal segments, with an underlined segment being moraic and one without underlining nonmoraic. In order to show the effects of the resistance and buffer constraints on vocalic morae more perspicuously, the traditional symbol µ is used in place of vowels in stressed syllables, with strong and weak morae labeled as μ_s and μ_w, respectively. It should be kept in mind that this analysis deals solely with the weight and thus the length of stressed vowels; while the concomitant qualitative changes in their feature specifications are well worthy of discussion, they will not be addressed here.

(7) Tableau for *wisdom*[9]

ˈwµµz-dəm[10]	**WtMax**	**WBP**	**$*\mu_S\,]_\sigma$**	***V-Buff**	**Max-µ**
a. ˈw$\mu_s\mu_w$z.dəm		*!			
b. ˈw$\mu_s\mu_w\underline{z}$.dəm	*!				
☞ c. ˈw$\mu_s\underline{z}$.dəm					*

Originally described in SPE as instances of pre-cluster laxing, cases such as those demonstrated in tableau (7) are the most straightforward to handle, since the optimal form is determined entirely by the basic moraic

9 Given the constraint interaction demonstrated in tableau (7), it might be wondered how a final consonant is allowed to appear in monomorphemic base forms such as *wise*. Though it is likely that word-final coronal elements in such forms, traditionally handled by the device of syllable appendices, can best be accounted for in a constraint-based approach with the use of positional faithfulness constraints (cf. Beckman 1998) specific to word edges, this prediction remains to be explored.

10 As in tableau (6), the forms provided in the upper left corners of tableaux (7), (8) and (9) do not represent input forms *per se*, for one because stress is usually assumed to be absent from input representations in OT. The important question of how the constraints currently under discussion interact with those that determine the placement of primary and secondary stress will be dealt with in future work.

markedness constraints **WtMax**, **WBP** and **Max-μ**, without any viable candidates violating the proposed moraic resistance constraint **$*\mu_{S}]_{\sigma}$** or the prosodic buffer constraint ***V-Buff**. While candidate (7a) suffers a fatal violation of **WBP** due to the nonmoraic consonantal segment in the coda position of the stressed syllable, (7b) satisfies the moraic coda constraint **WBP** yet in so doing crucially violates the maximal weight constraint **WtMax** with three morae in the initial syllable. Candidate (7c) thus stands as the optimal form, minimally violating **Max-μ** to emerge with a single monomoraic vowel and a moraic consonant in the stressed syllable. From this interaction, it can be seen that not all of the data in (1) require reference to the concepts of moraic resistance and prosodic buffers; as pointed out above and demonstrated in (7), for the simpler cases more highly ranked constraints do all the work.

It is worth noting at this point that, although constraints related to the sonority cycle (Clements 1990) are presumably needed to account for the phonotactic restrictions of syllabic constituents in general, they are not necessary here at all. This is because the constraints at hand do all the work that is required, ruling out phonotactically anomalous candidates such as ˈwaɪ.zdəm and ˈwɪzd.əm (not shown in tableau (7)) without recourse for other, separately stated constraints regulating phonotactic restrictions. For intervocalic clusters such as /zd/ that follow stressed vowels, the ranking of ***V-Buff** over ***C-Buff** effectively locates the fricative /z/ in coda position of the preceding stressed syllable rather than in onset position of the following unstressed one, while the onset constraint for weak morae **$*_{\sigma}[\mu_{W}$** ensures that the stop /d/ is syllabified in onset position of the following unstressed syllable. Any candidate in which these two segments are syllabified together on one or the other side of the syllabic boundary is intrinsically suboptimal due to the working of these buffer and resistance constraints. However, the extent to which "brute force" phonotactic restrictions can be superceded by prosodic markedness constraints remains to be explored in detail, and this is beside the point that the moraic markedness constraints **WtMax** and **WBP** also prevent overcrowding of consonants in the coda, as demonstrated above in the violation profiles for candidates (7a) and (7b).

The constraint interactions demonstrated in tableaux (8) and (9) serve as representative cases, respectively, for the analysis of words suffixed with *-ic, -id* or *-ish* such as *tonic*[11] as well as for words such as *sanity*, in which the stressed syllable is followed by two or more unstressed ones, and the vowel of the stressed syllable precedes a single consonant. Words such as *profundity* from the initial set of data provided above in (1) also have a stressed syllable followed by two unstressed ones, and might thus be assumed to pattern together with words such as *sanity* in terms of their

---

[11] As noted in SPE, the suffix *–ish* here refers to the verbal affix found in words such as *abolish*, not the adjective-forming affix found in words such as *roundish.*

constraint violations. However, since such words contain a stressed vowel followed by a consonant cluster, they can best be accounted for by the same interaction shown in tableau (7) for *wisdom*.

As noted above, the only difference between words such *conic* and *sanity* is in their overall stress pattern, with penultimate stress on the former type and antepenultimate on the latter. This difference is due to the working of the constraint that regulates the phenomenon of syllabic nonfinality in English stress. This constraint, itself an instantiation of prosodic repulsion, exhibits both variation and regularity, apparently applying to some forms (i.e. nouns and suffixed adjectives) but not others (i.e. verbs, unsuffixed adjectives, derived words ending in -*ic*/-*id*/ -*ish*, and some nouns). This intriguing issue will be taken up in later work, but as it does not affect the analysis at hand, cases exemplified by the interactions presented in (8) and (9) will here be treated as equivalent.

(8) Tableau for *tonic*

ˈtµµn-ɪk	**WtMax**	**WBP**	**$*\mu_S]_\sigma$**	***V-Buff**	**Max-µ**
a. ˈt$\mu_s\mu_w$.nɪk				*!	
b. ˈt$\mu_s\mu_w\underline{n}$.ɪk	*!				
c. ˈt$\mu_s\mu_w$n.ɪk		*!			
d. ˈtμ_s.nɪk			*!		*
☞ e. ˈt$\mu_s\underline{n}$.ɪk					*

(9) Tableau for *sanity*[12]

ˈsµµn-ɪti	**WtMax**	**WBP**	**$*\mu_S]_\sigma$**	***V-Buff**	**Max-µ**
a. ˈs$\mu_s\mu_w$.nɪti:				*!	
b. ˈs$\mu_s\mu_w\underline{n}$.ti:	*!				
c. ˈs$\mu_s\mu_w$n.ɪti:		*!			
d. ˈsμ_s.nɪti:			*!		*
☞ e. ˈs$\mu_s\underline{n}$.ɪti:					*

The cases presented in (8) and (9) were originally described in SPE as examples of -*ic*/-*id*/-*ish* and trisyllabic laxing, respectively. These two tableaux lie at the heart of the current analysis, serving as showcases for the moraic resistance constraint **$*\mu_S]_\sigma$** and the prosodic buffer constraint ***V-Buff** that are proposed in this paper. Candidates (8c) and (9c), in which the root and the suffix are parsed as separate syllables, each incur a fatal violation of **WBP** due to a nonmoraic coda consonant. Candidates (8b) and (9b), with a syllabic structure identical to that of (8c) and (9c), satisfy **WBP** through association of a mora to the coda consonant of the initial syllable, but in so doing sign their own death sentence by exceeding the maximal bimoraic weight limit set by **WtMax**. Forms (8d) and (9d), substantively equivalent to the optimal candidates yet formally distinct, are the worst

[12] For an analysis of the final unstressed bimoraic vowels seen here, see Hart (2015).

options available from the perspective of moraic resistance; besides incurring an utterly useless violation of **MAX-μ**, the stressed syllable of each of these two candidates contains a strong mora that is directly exposed to the right edge of the syllable, violating the key resistance constraint **$*\mu_S]_\sigma$** that is essential to this proposal[13].

We are then left with two remaining pairs of forms which satisfy the key moraic resistance constraint in two different ways. Candidates (8a) and (9a) satisfy **$*\mu_S]_\sigma$** with a vocalic buffer intervening between the strong mora and the right syllable edge, while candidates (8e) and (9e) satisfy it with a consonantal buffer. In so doing, the former pair violate the vocalic buffer constraint ***V-BUFF** while the latter pair violate its consonantal counterpart ***C-BUFF**, which has been omitted from these tableaux but remains dominated by the vocalic buffer constraint. Note that (8a) and (9a) are in fact the only candidates in tableaux (8) and (9) that violate the buffer constraint ***V-BUFF**, since they are the only representations in which a vocalic element lies directly adjacent to a strong mora to its left and a syllable edge to its right. Candidates (8b), (9b), (8c) and (9c) do not violate ***V-BUFF** since the weak mora is not directly adjacent to the syllable edge.

It is in this final comparison of the pair (8a) and (9a) to the pair (8e) and (9e) that the crucial role of the prosodic buffer constraint ***V-BUFF** can be seen. Since consonantal segments are less sonorous than vocalic ones, they inherently make better prosodic buffers to shield against the force of repulsion exerted between moraic elements and constituent edges. It is therefore candidates (8e) and (9e) that win out, minimally violating **MAX-μ** in order to satisfy both ***V-BUFF** and **$*\mu_S]_\sigma$**, and emerging as the victorious output forms with a monomoraic nucleus instead of a bimoraic one. It is important to note that the optimal candidates ˈtμ_a<u>n</u>.ɪk and ˈsμ_s<u>n</u>.ɪti: also violate the low ranking constraint **$*_\sigma[\mu_W$**, leaving their unstressed syllables "naked" without onsets, just as originally proposed by Selkirk (1982). This not uncontroversial point is the first to be taken up in the discussion of Section 3 below.

3. Related Issues

In this section a few points relevant to the main proposal will be discussed, starting with the question of resyllabification mentioned in Section 2. In this account, no process of resyllabification is recognized as such, since alternations in vowel length are analyzed by means of "one shot" evaluations rather than rule-based derivations. The key issue here is rather the question of whether intervocalic consonants can be syllabified together with a previous stressed vowel instead of, or even in addition to, a latter unstressed one. In Selkirk's (1982) account of total resyllabification, this kind of

[13] It should also be noted that the form of syllabification of candidates (8d) and (9d) is the representation typically assumed by phonologists who deny or minimize the roles played by ambisyllabicity and resyllabification to stressed syllable codas.

representation would run counter to the widely recognized cross-typological tendency for consonants in this environment to syllabify as the onset to the following syllable rather than as the coda of the preceding one, resulting in a marked CVC.V syllabification instead of the universally favored CV.CV structure. On the other hand, in the case of ambisyllabification accounts (Kahn 1976), this would require the acceptance of a situation in which a single segment could by parsed into two separate syllables at the same time. Both of these proposals have their advocates and opponents, and while no side will be taken here in favor of either of these two alternative proposals, a few pieces of evidence will be laid down in defense of intervocalic coda syllabification, since the main proposal of this paper clearly hinges upon recognition of this structure.

Although the points to be mentioned here refer specifically to the total resyllabification view, since that is the account upon which the proposed analysis is based, the same arguments can be extended to the ambisyllabification view as well. First, Hoard (1971) and many others since have pointed to the phenomenon of flapping in American English as evidence for resyllabification, arguing that the particular distribution of this allophone can best be understood in reference to the coda environment. Specifically, coronal stops are flapped when they occur in coda position as in *butter*, yet aspirated in onset position as in *between.* This makes perfect sense if the initial stressed syllable of words like *butter* "attract" the onset consonant of the second syllable, pulling it into coda position. In contrast, the initial syllable in words such as *between* is unstressed, so the stop is syllabified into the onset position of the following syllable and is aspirated rather than flapped.

Further phonotactic evidence is offered by Borowsky (1986), who accounts for the [h]~Ø alternation of the voiceless glottal fricative in English in terms of syllabic position. In this account, the fricative emerges only when it occurs in onset position, as in *prohibit*, but not when it is in the coda, as in *prohibition.* Once again, these alternations can be understood in terms of differences in syllabification. When /h/ precedes a stressed vowel it syllabifies in onset position and is fully realized, yet when it follows a stressed vowel it is effectually pulled into the coda position and left phonetically unrealized. Parallel arguments are also offered for the [y]~Ø alternations seen in word pairs such as *vo*[lju]*me* and *vo*[lú]*minous*, as well as for the affricate~stop alternations found in such pairs as *consti*[tʃu]*ent* and *consti*[tú]*tional.* In these cases, it is the syllabic position of the palatal glide that determines the final surface form. When it occurs before a stressed vowel as in *voluminous* and *constitutional*, the glide is deleted, but when it follows a stressed vowel it is once again drawn into the coda position of the preceding syllable where it can be phonetically realized. The glide then appears in unaltered form in words such as *volume*, and triggers palatalization in words such as *constituent.*

Though the preceding phonotactic evidence was first offered before the dawn of Optimality Theory (Prince and Smolensky 1993/2004), the points are still valid, and can easily be remodeled using phonotactic constraints. In more recent work, Eddington et al. (2013a, b) use a quantitative approach to demonstrate that consonants tend to be attracted toward stressed syllables that precede them. In these two metalinguistic mega-studies conducted online, native speakers were presented with alternative syllabifications of thousands of multisyllabic words, and the results indicate a strong tendency for participants to prefer consonants syllabified in the coda position of stressed syllables rather than the onset position of following unstressed ones. The findings of these two studies thus present additional empirical support for the structure in question.

The second point to be discussed in this section concerns what has been dubbed the *psychological reality* of vowel alternation in English. The distinct possibility exists that the type of alternation typified by the examples in (1) above is not an active part of the phonological grammar of native speakers, but rather merely a dead relic of historical change. According to this view, no phonological account of laxing or shortening is necessary, since speakers simply learn forms such as *tone* and *tonic* as separate lexical items. In the light of this claim, the results of Cena's (1978) classic study should not be forgotten. Redefining the concept of psychological reality as the degree to which a phonological generalization serves as a variable in cognitive processing, Cena conducted a metalinguistic experiment in which native speakers of English learned pairs of nonce words, some of which showed the familiar vowel alternations presented in (1), and others featuring vowel alternations not found in English. He found that the pairs of nonce words with familiar vowel alternations were learned more quickly and effectively than those with unfamiliar ones, and that learning of the pairs with unfamiliar alternations was hindered by interference from the familiar ones. Based on these results, this study provides empirical evidence that knowledge of the alternation patterns of English vowels does indeed go beyond the items stored in the lexicon, and that native speakers call upon this knowledge in the course of learning.

Cena (1978) additionally argues that psychological reality is not absolute or categorical, but rather exists on a gradient continuum that reflects the relevant salience of phonological patterns, predisposing speakers towards particular generalizations to different degrees rather than setting these patterns in stone categorically as being grammatical or not. Within this continuum, Cena puts the pattern of vowel length alternation dealt with in this paper at a position lower in salience than exceptionless surface phonotactic knowledge such as the assimilative voicing pattern seen with the plural marker *-s*, the genitive case marker *-'s*, and the reduced forms of *is* and *has* found in *it's* and *she's.* Although far from clearing up the matter of variation, this view of a gradient salience for phonological generalizations helps provide a better understanding for the fact that native English of speakers can hold knowledge of these vowel alternations as part of their phonological grammar yet at the same time maintain so many exceptions to these alternations (cf. SPE; the appendix in Myers 1987) in their mental lexicons, without anything seeming strange about it. Precisely how these exceptions are to be formally represented however, is a matter to be examined in future work.

4. Conclusion

This paper provides a unified view of what were originally presented in SPE as three separate rules needed to account for English vowel alternation, rules which result in the laxing of vowels that precede consonant clusters, or are followed by particular monosyllabic suffixes, or are positioned at least three syllables from the right edge of a word. The basic proposal, analogous to Myers' (1987) grid and template-based account, is that consonants following stressed syllables are syllabified as codas, and since the resulting VVC structure that would occur if the vowel remained long violates a bimoraic maximum on syllable weight, the vowel that actually occurs in optimal output forms is short. The motivation for syllabification of the postvocalic consonant in coda position is a specific form of prosodic repulsion called moraic resistance. A strong mora resists the right edge of a syllable, and since consonantal segments inherently make better prosodic buffers than vocalic ones, the post-vocalic consonant is in effect "stolen" from the following syllable to serve as a shield against the force of repulsion between the strong mora and the syllable edge.

The advantage this proposal has over Myers (1987) is that it accounts for the *how* as well as the *why* of the phenomenon. While Myers briefly mentions the possibility of a phonetic motivation, explaining that since stressed syllables are longer in duration than unstressed ones they can therefore hold more material, he does not offer any specific predictions as to how this is instantiated in the grammar, or to exactly how much more material stressed syllables can hold than unstressed ones. In the present account, these issues are precisely resolved in a strictly formal manner by means of a constraint interaction that utilizes the key concepts of moraic resistance and prosodic buffers. These concepts will be further explored and developed in future work in the investigation of such phonological phenomena in English as name truncation (cf. Lappe 2003), primary stress retraction, compound stress, stress clash, prevocalic tensing, and extrametricality of consonants and syllables.

References

BECKMAN, JILL. 1998. *Positional Faithfulness.* PhD Dissertation. University of Massachusetts Amherst.

BOROWSKY, TONI. 1986. *Topics in the Lexical Phonology of English.* PhD Dissertation. University of Massachusetts Amherst.

CENA, RICHARD M. 1978. *When is a Phonological Generalization Psychologically Real?* Bloomington, Indiana: Indiana University Linguistics Club.

CHOMSKY, NOAM and MORRIS HALLE. 1968. *The Sound Pattern of English.* New York: Harper and Row.

CLEMENTS, GEORGE NICK. 1990. The role of the sonority cycle in core syllabification. *Papers in Laboratory Phonology* I, 283-333.

EDDINGTON, DAVID, REBECCA TREIMAN and DIRK ELZINGA. 2013a. Syllabification of American English: Evidence from a large-scale experiment, Part I. *Journal of Quantitative Linguistics* 20, 45-67.

_____________. 2013b. Syllabification of American English: Evidence from a large-scale experiment, Part II. *Journal of Quantitative Linguistics* 20, 75-93.

GOUSKOVA, MARIA. 2004. Relational hierarchies in OT: The case of syllable contact. *Phonology* 21, 201-250.

GUSSENHOVEN, CARLOS. 1982. English plosive allophones and ambisyllabicity. *Gramma* 10, 119-141.

HART, WILLIAM. 2015. Prosodic repulsion in English and Cairene Arabic. *Studies in Phonetics, Phonology and Morphology* 21.1, 143-168. The Phonology-Morphology Circle of Korea.

HOARD, JAMES E. 1971. Aspiration, tenseness, and syllabification in English. *Language* 47, 133-140.

KAGER, RENÉ. 1993. Alternatives to the iambic-trochaic law. *Natural Language and Linguistic Theory* 11, 381-432.

____________.1995. Review of Hayes 1995. *Phonology* 112, 437-464.

KAHN, DANIEL. 1976. *Syllable-Based Generalizations in English Phonology.* PhD Dissertation. MIT.

KIPARSKY, PAUL. 1982. Lexical phonology and morphology. In In-Seok Yang (ed.), *Linguistics in the Morning Calm,* 3-91. Seoul: Hanshin.

LAPPE, SABINE. 2003. Monosyllabicity in prosodic morphology: The case of truncated personal names in English. *Yearbook of Morphology 2002*, 135-186.

MCCARTHY, JOHN J. and ALAN PRINCE. 1993. Generalized alignment. In G. E. Booij and J. van Marle (eds.). *Yearbook of Morphology 1993,* 79-153 Dordrecht: Kluwer.

MOHANAN, K. P. 1982. *Lexical Phonology*. Bloomington, Indiana: Indiana University Linguistics Club.

MYERS, SCOTT. 1987. Vowel shortening in English. *Natural Language and Linguistic Theory* 5, 485-518.

PRINCE, ALAN and PAUL SMOLENSKY. 1993/2004. *Optimality Theory: Constraint Interaction in Generative Grammar.* Malden, MA and Oxford: Blackwell. [Revision of 1993 technical report, Rutgers University Center for Cognitive Science.]

SELKIRK, ELISABETH. 1982. The syllable. In Harry van der Hulst and Norval Smith (eds.). *The Structure of Phonological Representations Part 2,*

337-383. Dordrecht: Foris.
YIP, MOIRA. 1987. English vowel epenthesis. *Natural Language and Linguistic Theory* 5, 463-484.

William Hart
Department of English Linguistics
Hankuk University of Foreign Studies
107 Imun-ro Dongdaemun-gu, Seoul 130-791, Korea
e-mail: williamhart.korea@gmail.com

received: July 7, 2015
revised: August 19, 2015
accepted: August 20, 2015