The Eurhythmics of Segmental Melody: Some Underlying Parallels between Prominence and Markedness

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1. Introduction: Rhythm involves segmental melody as well as prosody

It is a well-known fact that stress-timed languages like English exhibit rhythmic alternation at the word, phrase, and sentence levels. Rhythmic alternation aims at implementing the so-called isochronism (at least ideally), or repetition of the same elements in the same cycle. In phonetic terms, isochronism is defined as a configuration in which some elements are aligned equally in duration or occurring at equal intervals of time, but phonologically, it can be defined as one in which some feet are aligned regularly in the same cycle. In (1), for example, isochronism is carried out by vowel reduction and contraction, and as a consequence, the 'ideal' sentence comes to form a repetition of the same feet, which are units of strong and weak syllables.

(1) Isochronism by reduction and contraction
a. Jóhn is the gréat.est schól.ar in the wórld.
   ○ • ○ ○ • • • ○
b. Jóhn’s the gréat.est schól.ar in the wórld.
   ○ • ○ • • • • • ○

The same principle holds true for the case of inserting expletives, especially regarding what words or phrases to insert in what position in a sentence. This point is shown in sentences (2a–e), which are also meant to be 'ideal' situations.

(2) Isochronism by inserting expletives
a. Whát the fück are you dôing héré?
   ○ • ○ • • • • • ○
b. Why thèll díd yóu dô thís?
   ○ • • • • ○
c. Hè's a fücking génius.
   • • • • •
d. Jóhn is gôddamn rightr!
   ○ • • • • •
e. Thàt's a môtér-fücking bâd idêá!
   ○ • • • • • • • • • ○
Again, the repetition of trochaic feet is observed here, and violations of this principle such as "*What fücking" and "*fück genius" are avoided in this linguistic environment, because they cause stress clash (aside from other grammatical reasons).

So rhythmic alternation can be characterized by repetition of prosodic categories such as mora, syllable, and foot, and actually rhythmic typology in language corresponds to these types of prosodic categories: mora-timed rhythm, syllable-timed rhythm, and stress-timed (or strictly, foot-timed) rhythm. But when looked at from a different angle, repetition of prosodic categories comes to have another meaning: what cycles are hidden at each level of prosodic categories. To show this clearly, let us look at (3), which is organized in terms of categories and cycles. Repetition of feet involves cycles of strong/weak in stress, repetition of syllables involves cycles of high/low in sonority, and repetition of moras involves cycles of heavy/light in quantity. All of these three categories have the contrast of heads and non-heads, and the heads are ‘prominent’ or ‘salient’ in some phonetic and phonological respects.

(3) Rhythmic Typology

<table>
<thead>
<tr>
<th>Type of rhythm</th>
<th>Repeated category</th>
<th>Cycle (contrasted elements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Stress-timed</td>
<td>foot</td>
<td>stress (strong and weak)</td>
</tr>
<tr>
<td>b. Syllable-timed</td>
<td>syllable</td>
<td>sonority (high and low)</td>
</tr>
<tr>
<td>c. Mora-timed</td>
<td>mora</td>
<td>quantity (heavy and light)</td>
</tr>
<tr>
<td>d. Segmental melody</td>
<td>features</td>
<td>markedness (marked and unmarked)</td>
</tr>
</tbody>
</table>

Now what I focus on in this paper is the existence of the rhythm of segmental melody given in (1d); that is, marked segments or features necessarily participate in rhythmic alternation just as prosodic categories for prominence do. This claim is not so unnatural, because marked segments or features count as ‘salient’ elements in some sense just as usual prominence does. Thus, it happens that marked elements and prominent elements do not co-occur, because they are both ‘salient’ elements. Relative salience necessarily decreases when there is more than one salience. The following cases in (4) and (5), for example, show the cooccurrence restriction of accent (a prominent element) and voicing (a marked element).

(4) Names of islands with sima ‘island’ (Tanaka 2005a, 2005b)

<table>
<thead>
<tr>
<th></th>
<th>Repeated category</th>
<th>Cycle (contrasted elements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Rendaku voicing without accent</td>
<td>sakura-zima, miyako-zima, isigaki-zima, iriomote-zima, iou-zima</td>
<td></td>
</tr>
<tr>
<td>b. Accent without Rendaku voicing</td>
<td>itukü-sima, syoudó-sima, awazi-sima, tanegá-sima, okinó-sima</td>
<td></td>
</tr>
</tbody>
</table>

(5) Person names with saburou ‘the third son’ (Haraguchi 2002)

<table>
<thead>
<tr>
<th></th>
<th>Repeated category</th>
<th>Cycle (contrasted elements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Rendaku voicing without accent</td>
<td>nin-zaburou, ken-zaburou, dai-zaburou, tyou-zaburou</td>
<td></td>
</tr>
<tr>
<td>b. Accent without Rendaku voicing</td>
<td>yo-saburou, ki-sáburou, tama-sáburou, tomi-sáburou</td>
<td></td>
</tr>
</tbody>
</table>

Here, a single ‘salient’ element is enough to mark the word boundary of a compound; in other words, accent and voicing are in complementary distribution and have some functional unity or conspiracy in marking morphological boundaries.

This is just to offer an idea, as a first approximation, of how accent and voicing can share the same nature and function, and might not be generalized to a common characteristic in rhythmic alternation between prominence and markedness. But if it is true that markedness is pertinent to ‘salient’ elements as I mean them, it may well exhibit some melodic rhythm just like the prosodic rhythm in (1) and (2).

To verify this, I first define the fundamental properties of rhythm as ‘monophilia,’ ‘anti-adjacency,’ and ‘emergence of isochronism’ and demonstrate the parallel nature of prominence and markedness based on these three criteria (sections 2.1–2.3). I also show that prominence and markedness undergo the same types of phonological processes when they try to respect these three criteria (section 2.2). Then, I examine a case study from Japanese obstruent voicing and claim that, contrary to the common assumption, Lyman’s Law holds true for loanwords and that ‘anti-adjacency’ is as crucial for the effects of Lyman’s Law as ‘monophilia’ is (section 3).

In what follows, I am concerned mainly with stress accent and pitch accent as examples of prominence, because they are typical in talking about prominence. In contrast, the case of markedness involves various types of features or segments.
2. The parallel nature of prominence and markedness

2.1 Monophilia or the OCP in prominence and markedness

One of the fundamental properties of prominence, including stress accent and pitch accent, is ‘monophilia,’ which means that only one ‘salient’ element is licensed in a domain. This is also known as ‘culminativity,’ meaning only one accent per word. Although subsidiary accents may be found in a word, there is only one main accent there. In English and Japanese, for example, words like football and huttobooru have one and only one accent, and the same is true even if they form compounds like American otba1 1 and amerikanhuttobooru. This is due to the fact that there is only one head licensed in the domain of a prosodic word and that accent itself is the head of a prosodic word.

This property is not only observed in word accent but also in certain types of syllables. For example, the following shows the cases where only one CVV or CVC is licensed within the domain of a word.

(6) Monophillia of marked syllable structures

a. CVV in Oromo allomorphy (Alderete 1997)
   nama ‘man’ / nam-oota ‘men’
   harree ‘donkey’ / harr-oota ‘donkeys’
   gaala ‘camel’ / *gaal-oota → gaal-ota ‘camels’
   loomi ‘lemon tree’ / *loom-oota
   → loom-ota ‘farmers’

b. CVC in Japanese loanwords (Tanaka 2007)
   pikku-appu ‘pick up’
   wossyu-kitto ‘kit for washing’
   *pikkunikku → pikunikku ‘picnic’
   *wosyuretto → wosyuretto ‘washlet’

   In (6a) the plural allomorph -ota is used, instead of the default counterpart -ota, when there is a long vowel in the preceding stem, while in (6b) two geminate consonants are usually allowed across the word boundary but they do not occur in a single word. In either case, note here that heavy syllables such as CVV and CVC have relatively more prominent or marked structures than the simple light syllable CV, which matches up with Gordon’s (2002, 2004) claim that CVV and CVC are perceptually more salient than CV. Also, any language with CVV and/or CVC always has CV, as Jakobsonian typology observes, which means the fact that the heavy syllables are more marked than the common light syllable.

This observation tempts us to suppose that a single marked structure is enough within a certain domain and that this is the case with marked segments as well as prosodic structures. In the segmental field, such a domain-bound co-occurrence restriction has been well known as the Obligatory Contour Principle (OCP) ever since the works of Odden (1980), McCarthy (1986), Yip (1988), Suzuki (1998), and Fukazawa (1999), saying that two identical elements are prohibited at the melodic level. If so, it is quite natural that, as Alderete (1997) and Ito and Mester (2003) argue, the same two elements, especially two marked ones, do not stand in the same domain.

Specifically, the following examples show the OCP effects in some languages where two marked segments do not co-occur within the domain of a morpheme or a word and, when they do, certain types of repair strategies apply to avoid the repetition of marked structures: for instance, movement (7), blocking of vowel deletion (8), dissimilation (9), and blocking of voicing by Lyman’s Law (10).

(7) Grassmann’s Law and movement of [Ch] in Ancient Greek (Sag 1974): [Ch] = marked
   a. *tʰapʰ-os → tapʰ-os ‘grave’
   *tʰapʰ-ee → tapʰ-ee ‘burial’
   *tʰrikʰ-es → trikʰ-es ‘hairs’
   *tʰapʰ-ein → tapʰ-ein ‘to bury (present)’
   b. *tʰrikʰ-s → *trikʰ-s → tʰrikʰ-s ‘hair’
   *tʰapʰ-sai → *tapʰ-sai → tʰapʰ-sai ‘to bury (aorist)’

(8) Blocking of vowel deletion in the context #CVC_CV in Afar, a Lowland East Cushitic language spoken in Ethiopia, Eritrea and Djibouti (McCarthy 1986): sonorants = marked
   a. wager-e → wagr-e ‘I/he reconciled’
   digib-e → digb-e ‘I/he married’
   b. danan-e (→ *dann-e) ‘I/he was hurt’
   walal-e (→ *wall-e) ‘I/he conversed’

(9) Dissimilation of [r] in Ainu allomorphy (Shibatani 1990): [r] = marked
   a. kor-mat ‘his wife’
   kukor-kur ‘my husband’
   b. *kor-rametok → kon-rametok ‘his bravery’
   *kukor-rusuy → kukon-rusuy ‘I want to have (something)’

(10) Blocking of voicing by Lyman’s Law in Japanese
   (Ito and Mester 2003, Tanaka to appear): voiced obstruents = marked
   a. kusi ‘hair’ / mi-gusi ‘your hair’
huta ‘lid’ / kana-buta ‘metal lid’
suki ‘likely’ / home-zuki ‘likely to praise’
b kuzi ‘lottery’ / *mi-guzi ‘fortune slip’
huda ‘card’ / *kana-buta ‘metal card’
sugi ‘too much’ / *home-sugi ‘praise too much’

(7) illustrates the case of Grassmann’s Law that deaspirates the first of two consecutive aspirated consonants, but in (7b) the second one cannot bear an aspiration because of the following [s] and so the aspiration is thrown back, docking onto the first consonant; (8) and (9) are cases of anti-gemination and show what happens when vowel deletion and prefixation apply, respectively and then geminate consonants would appear ((8) might not seem to be a case of ‘monophilia’ but of ‘anti-adjacency’ discussed below because two sonorants are actually licensed if separated by a vowel, but it does involve ‘monophilia’ as well because only a single sonorant can occur at the locus of syllable contact); and finally, (10) shows the blocking of Rendaku voicing due to Lyman’s Law. All of the above cases involve the ‘monophilia’ of certain marked elements. It is clear that markedness would necessarily increase if identical segments appeared consecutively.

Note in passing that such examples as nin-zaburo and dai-zaburou in (5a) are not subject to the effects of Lyman’s Law. This may be because the requirement of marking head-initial consonants by voicing happens to override Lyman’s Law in these cases. See also Haraguchi (2002) and Tanaka (to appear) for other related reasons why two voiced obstruents are licensed in such cases as in (5a).

2.2 Anti-adjacency in prominence and markedness

Another fundamental property underlying both prominence and markedness is ‘anti-adjacency’: that two salient elements are licensed conditionally, i.e., only when they are apart from each other by some distance. It might at first appear that ‘monophilia’ and ‘anti-adjacency’ are incompatible with each other, but this is not at all true: ‘monophilia’ is just a tendency and holds true in principle, but it may be violated only when ‘anti-adjacency’ is guaranteed.

In fact, both ‘monophilia’ and ‘anti-adjacency’ work together to implement the eurhythmics of speech. From a functional perspective, it is true that a single prominent or marked element is enough to implement salience or culminativity and that the existence of two adjacent prominent or marked elements spoils their relative salience or culminativity as a whole. This is the story of ‘monophilia.’ However, if the two prominent or marked elements are separated from each other by a moderate distance, which means the effect of ‘anti-adjacency,’ then they do not spoil each other but instead cooperate to implement eurhythmics or ‘isochronism.’ I am claiming that this is precisely the truth of the rhythmic principles of prominence and markedness (and the exact relationship among ‘monophilia,’ ‘anti-adjacency,’ and ‘isochronism’). (11) illustrates how ‘monophilia’ and ‘anti-adjacency’ make harmony to create ‘isochronism’.

(11) Relative salience in rhythmic alternation

\[
\begin{array}{c|c|c}
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
 x & x & x \\
\end{array}
\]

Here, the entire configuration consists of the same unit \([x, x, x, x]^{-}\) in columns and rows, where \(x\) is a prominent or marked feature in the domain of \([\_\_\_\_\_\_\_]\), which defines ‘monophilia,’ and \(x\) and \(x\) necessarily take some distance according to the level concerned, which defines ‘anti-adjacency.’ In other words, a higher beat \(x\) exists only in some domain while a lower beat \(x\) relatively makes the higher beat salient at some distance. In this way, rhythmic alternation is exclusively ‘relative’ as Liberman and Prince (1977) define it, and the phonological mechanism of ‘isochronism’ follows from both ‘monophilia’ and ‘anti-adjacency.’

Then, the next question is this: what is the “moderate” distance for two identical elements? It turns out that there is a critical distance or ‘threshold’ at which two identical elements are either prohibited or tolerated.

Let us make this point clear by using specific examples. As far as English stress is concerned, two main stresses are prohibited when they are separated by none or one weak syllable at the phrase or inter-word level as in (12a). In this case, stress movement applies. But when they are separated by two weak syllables, stress movement does not occur as in (12b).


a. bambū pole → bámboo pôle
   Tennessee Wältz → Ténnessee Wältz
   Salvation Army → Sálvation Army
Mississippi River → Mississipi River
b. sensációnal claim → *sensational claim
Minneapolis Mike → *Minneapolis Mike

At the word-internal level, however, the situation is somewhat different. Vowel deletion can apply so as to form an ideal trochaic foot, aiming at the regular alternation of S(trong) and W(awk) syllables as in (13a), but this does not occur when the result of vowel deletion would cause stress clash (i.e., zero distance) as in (13b). At the intra-word level, stringent adjacency is prohibited, and two stresses are tolerated when separated by at least one weak syllable.

a. Toronto (WSW) → T’ronto (SW)
   potato (WSW) → p’tato (SW)
   opera (SWW) → op’ra (SW)
   general (SWW) → génral (SW)
b. operatic (SWSW) → *op’ratic (SSW)
   generality (SWSWW) → *gener’ality (SSWW)
   glórífy (SWS) → *glór’fy (SS)
   respiráte (SWS) → *resp’ráte (SS)

The same is true for the following case; that is, the suffixes -ary and -ory usually bear stress as in (14a), but they lose it when immediately preceded by another stress as in (14b).

(14) Stress subordination in English
a. planét-ary       fragment-ary
   cremat-ory       audit-ory
b. rót-ary          element-ary
   diréct-ory       satisf-a-ory

These examples lead us to conclude that, word-internally, stresses do not co-occur in stringently-adjacent relation, but they do when separated by one weak syllable.

Incidentally but importantly, the three patterns in (12)–(14) remind us of the fact that similar repair strategies are used to amend ill-formed structures in both segmental markedness and prosodic prominence as we have seen in (7)–(9): movement, blocking of deletion, and subordination. It can safely be said that the similarity of repair strategies means the equivalency of the principles that work for markedness and prominence.

Now, such a conditional tolerance of identical elements as observed in (12)–(14) is found in marked segments as well. (15) illustrates dissimilation of [a] in Kera, where two [a]’s do not stand when separated by one consonant but can co-occur when separated by two consonants. The Yimans case in (16), just like the allomorphy of Ainu in (9), shows that two [r]’s are allowed when separated by two vowels but not when separated by only a single vowel. The final English allomorphy in (17) can be accounted for by saying that two [l]’s are allowed when separated by three vowels but not when there are at most two vowels between them.

(15) Dissimilation of [a] in Kera, an East Chadic language spoken in Southwest Chad and North Cameroon (Kenstowicz and Kisseberth 1979, Suzuki 1998)
a. *ba-pa → ba-pa ‘no more’
   *koroń-da-fadi → koroń-da-fadi
   ‘came here quickly’
b. ṅafna-n ‘wanted me’
   ṅafna-n ‘met me’

a. *apr-afa → apr-ata ‘open, spread’
b. wurpi-ara ‘slacken’
   kkrak-ara ‘loosen’
   araŋ-ara ‘tear into pieces’

a. *simi1-a1 → simi1-ar *vulg-al → vulg-ar
   *famili-al → famili-ar *lun-al → lun-ar
b. logic-al labi-al classic-al element-al

But for a more detailed and accurate account of the case in (17) referring to a wide range of data, see Tanaka (2007).

In either case, there is a critical distance or threshold by which two identical elements can stand in the domain of a whole word. Here we realize that ‘anti-adjacency’ is a key notion for the OCP and that it holds well for segmental melody as in (15)–(17) as well as for prosodic prominence as in (12)–(14).

2.3 Emergence of isochronism in prominence and markedness

The third crucial property for rhythmic alternation is ‘emergence of isochronism.’ By this notion is meant the fact that some ‘salient’ elements emerge alternately from where there are none and that flat or monotonous structure is avoided in spontaneous speech.

In terms of stress-accent, main stress only is actually
not enough for English speakers to utter speech in natural rhythm. They articulate speech rhythm by using subsidiary stresses just like in (18).

(18) Emergence of subsidiary stresses
*onomatopoeia → onomatopoeia
*hamamelidanthemum → hamamelidanthemum

This kind of ‘emergence of isochronism’ is also observed in syllable quantity. In Choctaw, the heavy syllable CVV, which is a prominent element, emerges to alternate in articulating speech, except for the final syllable. This is the so-called ‘rhythmic lengthening,’ which applies to words, phrases, and sentences with three syllables or more.

(19) Emergence of heavy syllables in Choctaw, a Muskogean language spoken in Oklahoma and Mississippi (Hayes 1995, Haag and Willis 2001)
itī ‘tree’ + aʃəffa ‘one’ → iti-aʃəffa ‘one tree’
nąjooba ‘wolf’ + losa ‘black’
→ nąjooba-loosa ‘black wolf’
sa ‘I’ + litiīha ‘dirty’ + tok ‘was’
→ sa-liitiīhaa-tok ‘I was dirty’
ʧi ‘you’ + habiīna ‘have a present’ + ʧi ‘let’ + li ‘I’
→ ʧi-haabinaa-ʧi-li ‘I let you have a present’

A closed syllable CVC never lengthens because it is already heavy. This phenomenon shows that for Choctaw speakers, alternating CV with CVV or CVC is better in terms of rhythm than a simple repetition of CV in segmenting speech.

In addition to such prosodic aspects, markedness also enters into ‘emergence of isochronism’ as is predicted if both prominence and markedness concern salience in speech at all. For example, it has been said in the literature of Japanese phonology that high vowel devoicing occurs when high vowels are preceded by a voiceless consonant and followed by another voiceless consonant or a word boundary (Haraguchi 1991, 2002 and Tsujimura 1996/2007 among many others). However, this is not always true as shown by the following examples, which are meant to be nonsense words without any accent or pitch fall (those with the tone patterns of LH and LHHH).

(20) Emergence of voiced vowels

a. LH
*kiki → kiki
*kuku → kuku
*ʧiʧi → ʧiʧi
*tsutsu → tsutsu
*ʧiʧi → ʧiʧi
*susu → susu

b. LHHH
*kikikiki → kikikiki
*kukukuku → kukukuku
*ʧʧʧʧ → ʧʧʧʧ
*tsutsutsutsu → tsutsutsutsu
*ʧiʧiʧiʧi → ʧiʧiʧiʧi
*sususu → sususu

All the words are supposed to be pronounced as voiceless by rule, but actually voiced vowels do emerge alternately. This means that voicing forms rhythmic alternation just like prosodic rhythm.

3. The OCP and anti-adjacency of voicing in Japanese -su/zu allomorphy

The final case we focus on is Lyman’s Law on loanwords in Japanese and its ‘anti-adjacency’ effect, which has not been realized in the literature concerning the OCP or in Japanese phonology. Through this case study, we will look at more evidence showing that the OCP effects or ‘monophilia’ cannot be separated from ‘anti-adjacency.’

As we discussed in (10), Lyman’s Law has long been known as a dissimilatory condition on Rendaku voicing in the native vocabulary of Japanese since Otsu’s (1980) and Ito and Mester’s (1986) pioneering works introduced it to generative phonology. It is also known widely that the condition holds regardless of the distance between two voiced obstruents, as in denki-kurage / *denki-gurage ‘electric jellyfish,’ kaki-kotoba / *kaki-gotoba ‘written language,’ yama-tutuzi / *yama-dutuzi ‘mountain azalea,’ and so on, where the two obstruents are two syllables apart.

Loanwords are said to be apparently exempt from this condition: there can be two or more voiced obstruents in their domain, as in bebii ‘baby,’ dakyuru ‘double,’ zvogüzi ‘Jacuzzi,’ abogado ‘avocado,’ and so on. As Nishimura (2006) first noticed, however, this is not the case when there is a voiced geminate there; such examples as beddo ‘bed’ and bæggu ‘bag’ can undergo devoicing to avoid duplicate voicing, turning into betto and bakkku, respectively, which contrast well with those non-devoiced counterparts like eggu / *ekku ‘egg’ and wuddo / *wutto ‘wood’.

In the same way, the following case in (21) is significant as well in that Lyman’s Law applies to loanwords, and, crucially, in that it is sensitive to the distance between the two voiced obstruents. The examples are taken from the names of companies, products, baseball teams, and singer groups. Those forms suffixed with
-su/zu in Japanese loanwords have been taken up by Fukazawa, Kitahara, and Ota (2002), Tateishi (2003), and Ito and Mester (2006) concerning their lexical stratification or by Kawahara and Wolf (2009) concerning their accentual behavior. Yet their OCP effects, especially their ‘anti-adjacency’ effects, have never been focused on in the literature.

Basically, the underlying form of the plural suffix /su/ seems to assimilate to the voicedness of the stem-final segment. In the former two examples of (21a), where the stem-final syllable contains a voiceless obstruent and a devoiced vowel, it remains unchanged without any voicing assimilation (recall that, as stated in (20), a single high vowel interleaved by voiceless consonants is generally devoiced and also that the high vowel [u] here is epenthetic). But as seen in the latter two examples of (21a), where the stem ends in underlying undevoiced vowels, it surfaces as [zu] by rule. This is the basic pattern showing that the underlying /su/ agrees and assimilates to the voicing value of the preceding vowel.

However, our interest here is in examples (21b-d), in which the stem-final syllable contains a voiced obstruent and a certain number of vowels. All of these cases would undergo voicing assimilation and surface as [zu], due to the preceding undevoiced vowels, but the truth is not so transparent. Obviously, the application of voicing assimilation is blocked by Lyman’s Law in some cases.

(21) ‘Anti-adjacency’ in Lyman’s Law effects on loanwords

a. hooku-su ‘Hawks’
   reddosokku-su ‘Red Socks or Red Sox’
   beisutaa-zu ‘Bay Stars’
   ruukii-zu ‘Rookies’

b. bureebu-su ‘Braves’
   fooriibu-su ‘Four Leaves’
   hoorudingu-su ‘Holdings’
   bozusukyaggu-su ‘Boz Scaggs’

c. taigaa-su ‘Tigers’
   dodjaa-su ‘Dodgers’
   rendjaa-su / rendjaa-zu ‘Rangers’
   windoo-su / windoo-zu ‘Windows’
   kyandii-zu ‘Candies’
   bizii-zu ‘Bee Gees’

d. biitibooi-zu ‘Beach Boys’
   beaa-zu ‘Bears’

(21b) tells us that when the stem ends in a single epenthetic vowel, [zu] surprisingly does not surface. Examples like *bureebu-zu and *hoorudingu-zu are prohibited because of Lyman’s Law or the OCP effects on loanwords. In contrast, when there are three vowels in stem-final position as in (21d), [zu] can safely appear because the two voiced obstruents are far enough apart to liberate themselves from the OCP. This is exactly the case for ‘anti-adjacency’. Interestingly, the examples in (21c) support this account by exhibiting some variation; that is, when the two obstruents are separated by two vowels, either [su] or [zu] is licensed depending on specific examples. In addition to such ‘inter-lexical’ variations, there are even ‘intra-lexical’ variations observed, such as rendjaa-su / rendjaa-zu and windoo-su / windoo-zu. This tendency strongly suggests that the separation by two vowels is ambiguous with respect to the licensing of two voiced obstruents within the domain of a word.

In Optimality Theory, the OCP effects have been accounted for by the operation of combining a certain constraint recursively, called local self-conjunction, and the notion of adjacency has been abolished in formulating the OCP effects as in the way of Alderete’s (1997) and Ito and Mester’s (2003). However, Suzuki (1998) and Tanaka (2007) have argued against this stance and gathered various pieces of evidence for incorporating adjacency into the formulation of the OCP. The above case for ‘anti-adjacency’ counts as another piece of evidence showing that the notion of adjacency is indispensable to account for dissimilatory processes in language.

4. Conclusion: Why prominence and markedness are on the same scale

In this article, we have argued for some underlying parallels between prominence and markedness in rhythmic alternation by referring to the key notions of ‘monophilia,’ ‘anti-adjacency,’ and ‘emergence of isochronism’. Both of them concern ‘salience’ in speech and this is why they share some rhythmic properties.

Our findings and their theoretical implications can be summarized as follows. First, the discovery of the parallel nature of rhythm between prosody (prominence) and melody (markedness) has some impact on phonology in general, if the arguments presented in this article are valid and convincing at all. Second, I have adduced much evidence that the notion of adjacency is crucial for the formulation of the OCP. This has no less implication for phonological theory. And finally, we have witnessed another case for the Lyman’s Law effects on loanwords, which lead to a linguistically-significant generalization in Japanese phonology.
As for the first theoretical implication, Alderete (1997) and Ito and Mester (2003) actually realized that certain prosodic features somehow have the OCP effects just like marked segmental features; however, they do not address the issue of why they have such properties. This is because they were pursuing the OCP effects in terms of markedness, even though prominence does not seem marked at all in itself. Instead, our findings offer a clear and principled answer to the question of why markedness and prominence share the same fundamental properties; that is, the parallel nature stems from the fact that both marked segmental features and prosodic features are ‘salient’ in some phonetic or phonological terms, and this is why they both exhibit the three properties as I argued in section 2. This elucidation was made possible precisely because we looked at markedness from the viewpoint of prominence or, more strictly, ‘salience’ and did not look at prominence from the viewpoint of markedness. Our viewpoint is entirely the opposite to Alderete’s and Ito and Mester’s.

The OCP effects have been surveyed in the literature mainly in terms of segmental features such as place, manner and voice, but originally the principle was discovered with respect to tone by Leben (1973) as its name clearly shows: the Obligatory Contour Principle. That is, tones obligatorily exhibit contour, and two consecutive high tones are banned as seen in the following example.

(22) The OCP of high tones in Shona (Odden 1986)
mbwa ‘dog’ / ne-mbwa ‘with dog’
H H L
hove ‘fish’ / ne-hove ‘with fish’
H H L
mbundudzi ‘army worms’ /
H
ne-mbundudzi ‘with army worms’
H L

But note here that a high tone is a ‘salient’ element just like accent. Moreover, in general terms, accent implies tone (accent is always high-pitched); tone implies sonority (accent or tone always falls on sonorants); and sonority implies voicing (accent, tone, and sonorants are always voiced); in other words, accent, tone, sonority, and voicing are all governed on some implicational scale, as schematized in (23).

(23) Implicational scale of ‘salient’ elements (Tanaka 2005b)

<table>
<thead>
<tr>
<th>FIELD</th>
<th>prosody</th>
<th>melody</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPICATIONAL RELATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>accent</td>
<td>⊃ tone</td>
<td>⊃ sonority</td>
</tr>
<tr>
<td>PHONETIC RESOURCES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vibration</td>
<td>vibration</td>
<td>vibration</td>
</tr>
<tr>
<td>aperture</td>
<td>aperture</td>
<td>aperture</td>
</tr>
<tr>
<td>pitch</td>
<td>pitch</td>
<td></td>
</tr>
<tr>
<td>duration</td>
<td>intensity</td>
<td></td>
</tr>
<tr>
<td>SALIENCE</td>
<td>prominence</td>
<td>markedness</td>
</tr>
</tbody>
</table>

On this implicational scale of ‘salience,’ leftward elements are more likely to concern prominence in prosody and rightward elements are more likely to concern markedness in melody. In either way, they stand in implicational relation and are governed by the same principles of ‘monophillia,’ ‘anti-adjacency,’ and ‘emergence of isochronism.’ That is why we can talk about prominence and markedness on an equal footing, and also about their common nature that involves obligatory contour—their eurhythmics.

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