

Phonetic Evidence for Silent Beats in English *

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Kim, Hyo-Young. 2003. **Phonetic Evidence for Silent Beats in English.** *Korean Journal of English Language and Linguistics* 3-1, 1-14. This paper proposes an empty constituent, a silent beat, to express long duration of stressed syllable in the word final position and rhythmic correspondence in English. This empty constituent has an important consequence. It helps reveal one of the characteristics English feet have: they must be non-final in nouns as well as in verbs. In addition, the silent beats overcome the shortcomings of empty constituents proposed previously, namely null vowels (Burzio 1994) and invisible suffixes (Hammond 1999).

Key Words: English, stress, silent beat, Nonfinality, OT

1. Introduction

This paper proposes an abstract and empty constituent, a silent beat, to represent long duration of stressed word-final syllable in English. The proposal is based on the results of some phonetic experiments (Barnwell 1971; Lehiste 1975; Oller 1972; Klatt 1973, 1975, 1976; Goldsmith 1981) and rhyming phenomenon in English. The silent beat shows that an OT constraint used to deal with English stress, NONFINALITY, is satisfied in a more general way than it is thought to be.

The paper is organized in the following way. The first section reviews proposals for empty constituents by Burzio (1994) and Hammond (1999). The second section presents the phonetic findings and rhyming phenomenon which motivate silent beats and proposes the silent beats, showing the usefulness of them.

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The third section discusses the advantages of assuming silent beats. The final section closes the paper with brief concluding remarks.

2. Previous Empty Constituents

In the literature, empty constituents have been proposed for English under various names, including null vowels, silent syllables, empty syllables, invisible suffixes, and catalexis for various purposes (Abercrombie 1965; Chomsky and Halle 1968; Ross 1972; Selkirk 1984; Rubach 1984; Giegerich 1981, 1992; Kaye 1990; Iverson 1990; Kiparsky 1991; Harris 1994; Hammond 1999). The concept has been employed in the analysis of languages other than English, including German (Giegerich 1981, 1985), Moroccan Arabic (Kaye 1990), French (Charette 1991), and Italian (Burzio 1994).

This section reviews empty constituents proposed by Burzio (1994) and Hammond (1999), among others, to account for word stress in English.

Consider, first, Burzio's (1994) null vowels. Burzio adopts the assumption about null vowels and gemination proposed in SPE. Examples are given in (1). Null vowels are marked by \emptyset and syllable boundaries are indicated with dots.

- (1) Null vowels and geminates
 vanilla: va.[nil.la], giraffe: gi.[raf.fe \emptyset]

Without geminates *vanilla* would be stressed on a light syllable: *va[ni.lla]*. Likewise, a unary foot would be formed over *giraffe* or stress would fall on a light syllable: *gi[raffe]* or *[gi.raffe]*. However, neither unary feet nor feet with light syllables as heads are good in Burzio (1994) since the only good feet are binary feet with a heavy syllable as its head and

ternary feet with a light syllable in the middle: [H s] or [s L s]. In other words, the primary function of null vowels is to adapt foot structures of some exceptional words into the good feet.

(2) shows how the words with final stress are analysed by Burzio (1994).

- (2) a. monosyllabic words: [cat.t Φ], [bee. Φ], [sen.t Φ]
 b. disyllabic words: pre[ven.t Φ], po[li.ce Φ], gi[raf.fe Φ], Ju[ly. Φ]

It should be noted that the syllable structure of superheavy syllables is shown as *cent.t Φ* , not *cent. Φ* (Burzio 1994: 46). In other words, the so-called superheavy syllables are not allowed in Burzio (1994: 63-4). Instead, superheavy syllables are analyzed as a combination of a heavy syllable and a null vowel. In addition, a word composed of a single CVC syllable such as *cat* is syllabified with a final null vowel and gemination, as in *cat.t Φ* (Burzio 1994: 55) since the Onset Rule is obligatory in Burzio and stressed syllables must be heavy in binary feet.

These null vowels are not free from some limitations. The main problem with null vowels is their unrestricted distribution. As can be seen in (3), a null vowel can occur anywhere: word internally, morpheme internally, and word finally.

- (3) Distribution of null vowels (Burzio 1994: 55, 64, 324)
 a. word internally, morpheme finally: *sik.s Φ . th Φ .s Φ* .
 b. morpheme internal null vowel: *a.par.t Φ .men.t Φ*
 c. word initially: *Φ .re.fu.te Φ*
 d. word-finally: *gi.raffe Φ*

Another problem is to posit the null vowel even after a vowel. Since null vowels are motivated by the assumption that all words end in a vowel according to Burzio (1994: 46), it is not clear why a null vowel is added to words which comply

with the assumption already by ending in a vowel, as in *bee* ($[bee.\Phi]$). Except for the assumption, no evidence for existence of null vowels is provided in Burzio.

Secondly, consider Hammond's (1999: 278-283) invisible suffixes. Hammond (1999: 278) assumes that verbs and adjectives are followed by an invisible suffix. The major reason to postulate the invisible suffix seems to capture a generalization between nouns and verbs/adjectives. Consider the syllable structures in (4).

(4)	Nouns	Verbs
Stress	penultimate syllable	final syllable
When	(C)VC	(C)VCC
	a.gen.da	a.dept
	A.mer.i.ca	de.vel.op ¹⁾

As can be seen in (4), without invisible suffixes, it is not easy to make a general statement about stress placement; windows for stress of nouns are the last three syllables while those for stress of verbs and adjectives are the last two syllables. That is, stress is on the 'penultimate' syllable in nouns when the penultimate syllable contains 'a' coda consonant; otherwise stress falls on the 'antepenultimate' syllable. In verbs and unsuffixed adjectives, stress is on the 'final' syllable when it contains 'two' coda consonants; otherwise stress falls on the 'penultimate' syllable.

¹⁾It would be worth mentioning that Hammond (1999: 246) assumes that syllabification and stress assignment affect each other so that every stressed syllables are heavy and stressless syllables may not have an onset.

(i) Syllabification (Hammond 1999: 279)

de.vel.o.p Φ	A.mer.i.ca
a.dep.t Φ	a.gen.da

In contrast, with invisible suffixes, the window for stress is last three syllables for verbs and adjectives as well as for nouns, as is seen in (5).

(5)	Nouns	Verbs
Stress	penultimate syllable	penultimate syllable
When	(C)VC	(C)VC
	a.gen.da	a.dep.t \emptyset
	A.mer.i.ca	de.vel.o.p \emptyset

In other words, the invisible suffixes enable us to catch the generalization between nouns and verbs/adjectives as illustrated by the parallel foot structures of *agenda/adept* and *America/develop*. Both *a.gen.da* and *a.dep.t \emptyset* are stressed on their 'penultimate' syllable since they contain 'a' coda consonant.

Moreover, it follows from the invisible suffix proposal that the overt word-final syllable in verbs and adjectives are not in the word-final position but in the penultimate position and can be closed with one consonant like the penultimate syllable in nouns.

Furthermore, the invisible suffix makes NONFINALITY general; verbs and adjectives can avoid violation of NONFINALITY due to the invisible suffix.

To show the effect of invisible suffixes on NONFINALITY, some examples will be given shortly. Before presenting the examples, constraints and the ranking of them are presented in (6) and (7). Only the relevant parts are mentioned here.

(6) Constraints (Hammond 1999: 261–269)

ROOTING (R): all words are stressed.

WSP VV (VV): stress syllables with long vowels.

WSP VCC (VCC): stress syllables with consonant clusters as

the coda.

WSP VC (VC): stress syllables with a consonant as the coda.

NONFINALITY (NF): the final syllable is not footed.

FOOTBINARITY (FB): feet are binary.

(7) Constraint ranking for English stress

(Hammond 1999: 262, 265, 274)

R >> VV, VCC >> NONFIN >> VC >> FTBIN

With the constraints and their ranking in mind, consider the tableaux in (8).

(8)

	R	NF	VC	FB
▶ a[dep].t \emptyset				*
[ad.ed]t \emptyset			*!	
a[dep.t \emptyset]		*!		

	R	NF	VC	FB
▶ a[gen]da				*
agenda	*!			
[ag.en]da			*!	

	R	NF	VC	FB
ca.na.[da]		*!		*
ca[nad.a]		*!		
▶ [can.a]da				

	R	NF	VC	FB
▶ de[vel.o]p \emptyset				
[dev.e]lop			*!	
de[vel.op]		*!		

With the help of invisible suffixes, NONFINALITY gets more general, being satisfied in *tell*, *adept* and *polite*. Otherwise, the

foot structure would be *a[dept]* and *de[vel.op]*.

Now, a problem of the invisible suffix should be pointed out. Even with these invisible syllables, Hammond cannot explain final stress either in nouns or in verbs. Thus, for these words, Hammond (1999: 170) depends on an extremely powerful constraint, FAITH (v'),²⁾

- (9) FAITH(v'): accented (lexically marked) syllables must be stressed.

The constraint guarantees that lexically marked syllables get stressed. v' indicates vowels with lexically marked stress. The power of the constraint is shown in (10).

(10)

gira'ffe	FAITH (v')	NF	VC	FB
[gir.affe]	*!	*	*	
▶gir[affe]		*		*
[gir]affe	*!		*	*

The outranking of NF over WSP (VC) incorrectly predict *[gir]affe* as an optimal output without FAITH (v'). Only the high ranking FAITH (v') can select *gir[affe]* under the assumption that *a'* is marked to bear accent in the lexicon.

It has been shown that two major roles of invisible suffixes are 1) to catch generalization between nouns and verbs/adjectives with respect to stress placement and closedness of syllables, and 2) consequently to make NONFINALITY generally satisfied in verbs and adjectives.

To summarize this section, neither Burzio's null vowels nor Hammond's invisible suffixes are not phonetically grounded and

²FAITH (v') is a device which is so powerful that it can derive any stress pattern.

have some limitations. To overcome the limitations and substitute phonetically supported empty constituents, phonetic findings in relation to stressed syllables will be presented in the next section.

3. Motivations and Proposal

What numerous phonetic studies have proposed concerning stress is 1) stressed syllables are longer than stressless syllables, (11a), and 2) stressed syllables in the word final positions are longer than stressed syllables in word initial or word medial positions, (11b), (Barnwell 1971; Lehiste 1975; Oller 1972; Klatt 1973, 1975, 1976; Goldsmith 1981).

- (11) a. stressed syllable > stressless syllable
 insu'lt > i'nsult
 b. word final position > other position
 ke'ep > ke'eper

The same segmental sequence, *sult* is longer when it is stressed than it is not. *keep* is longer when it is in the word final position, monosyllabic word in this case than *keep* when it is not in the word final position. According to Klatt's (1973) finding, summarized in (12), if the duration of *keep* when it is monosyllabic word is set as 100, the duration of *keep* in *keeper* is 66.

- (12) Vowel duration in stressed syllables (Klatt 1973: 1102)

	monosyllable	disyllable
mean duration (msec.)	198	131
mean duration (percent)	100	66

In spite of the fact that the stressed syllables in the word

final position are longer than stressed syllables in other position and stressless syllables in the same position, the fact can not be expressed with any of the current empty constituents.³⁾

Next, consider a nursery rhyme which contains two lines.

(13) Rhyming

ding dong bell
kitty's in the well

Each monosyllabic word in the first line counts for two beats, as can be seen by matching the first line with the second. For example, *ding* corresponds rhythmically to *kitty's*, a word that obviously counts for two beats. The rhythmic correspondence cannot be reflected in the current phonological representation.

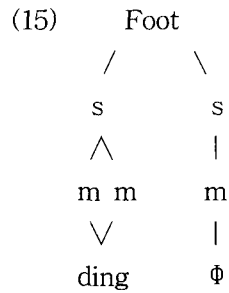
To express the long duration of stressed syllables in the word final position and the rhythmic correspondence, I propose to use an abstract constituent, a silent beat at the end of those words. Then, the rhythmic correspondence in (13) can be directly displayed as in (14) using the silent beats. The silent beat is expressed with Φ and feet with square brackets.

(14) Phonological representation of rhythm

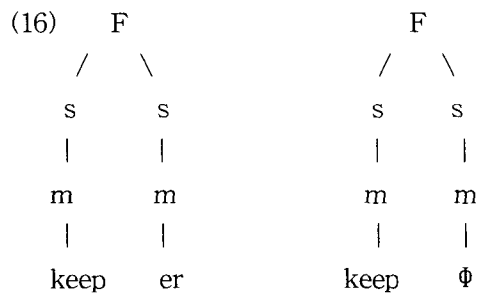
[ding Φ] [dong Φ] [bell Φ]
[kitty's] [in the] [well Φ]

A silent beat is assumed to be crucially assigned a moraic and syllabic status, as in (15), since it has some duration. Here, m's stand for moras and s's indicate syllables.

³An anonymous reviewer points out that word final lengthening is not limited to stressed syllables. Rather, the lengthening is a general property of final syllables. Thus, it could not reflect phonetic facts appropriately to postulate silent beats only after the stressed syllables in the word final position.



Turn to durational difference of stressed syllables depending on their positions in words.



The fact that duration of *keep* is longer than that of *keep* in *keeper* is lucidly represented when the silent beat is adopted in the phonological representation under the assumption that the mora of the silent beat is realized on the preceding syllable since the syllable dominating the silent beat does not have segmental content.⁴⁾

4. General NONFINALITY

⁴⁾I am grateful to an anonymous reviewer for calling my attention into this matter.

In addition, the reviewer addressed a concern that beats of rhyming should be differentiated from word stress. The reasons are twofold: 1) rhythmic correspondence is usually represented with grids and 2) the beats of a particular syllable are determined depending on the position of the word in P-structure (Hayes & Kaun 1996) as well as the presence of stress on the syllable.

In the previous section, I have shown that the advantage of assuming silent beats is to replace previous empty constituents with phonetically grounded ones. In this section, I show that the other advantageous characteristic of silent beats is to reveal that feet in English satisfy NONFINALITY more generally than they have been thought to be.

Consider (17) which displays foot structures when invisible suffixes are assumed.

(17) Feet with invisible suffixes

nouns	verbs/Adjectives
[cat].	[tell]. Φ
a. [gen]. da	a. [dep]. t Φ
A[mer. i]. ca	de. [vel. o]. p Φ
po. [lice]	po. [li]. te Φ

Words which violate NONFINALITY are nouns with final stress such as *police* and *cat*. However, unlike nouns, verbs or adjectives such as *tell* and *polite* do not violate NONFINALITY due to the invisible suffixes though they have final stress.

A question arises from the apparently same segmental configurations of *cat/police* and *tell/polite*. The question is this: Is there any way to achieve the same foot structures for *cat/police* as those for *tell/polite*? The answer to the question can be found in the use of the silent beats.

The silent beats are a step further towards more general NONFINALITY. Compare foot structures adopting silent beats in (18) with those in (17).

(18) Feet with silent beats

nouns	verbs/Adjectives
[cat]. Φ	[tell]. Φ
a. [gen]. da	a. [dep]. t Φ

A.[mer. i].ca ⁵⁾	de. [vel]. op
po. [li]. ce \emptyset	po. [li]. te \emptyset

As a result of adopting silent beats, no foot violates NONFINALITY; all feet must be non-final in English. Once phonological representation mirrors phonetic facts, it becomes clear that NONFINALITY is more generally satisfied. In other words, if phonetically significant duration/length is recognized and given a place in phonological representation, a characteristic of a phonological constraint is revealed more clearly; NONFINALITY is a more general requirement on feet in English.

5. Conclusion

I have proposed to postulate an empty constituent, a silent beat, to express long duration of stressed syllable in the word final position and rhythmic correspondence. This empty constituent has important consequence: it helps reveal that feet in English must be non-final.

To postulate silent beats after the stressed syllables in the word final positions seems to cause a circularity problem. That is, the silent beats should know where stress is located and foot parsing should know where the silent beats are posited. This apparent problem can disappear under the OT (Hammond 1999: 246) assumption that syllabification and foot parsing are done simultaneously using information from each other.

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⁵The foot structures of *America* and *develop* are not parallel with the proposed silent beats. This could be a problem for the proposal.

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