An Optimality Theoretic Account of the Influence of Catalexis in English Stress*

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Chang, Mi. 2002. An Analysis of Using Catalexis in English Stress. *SNU Working Papers in English Language and Linguistics* 1, 161-174 . This paper deals with English stress patterns for verbs and unsuffixed adjectives within the framework of Optimality Theory (Prince and Smolensky (1993)) by drawing on the notion of catalexis which is also adopted by Hammond (1999). Introduction of a null vowel to verbs and unsuffixed adjectives as a catalectic suffix makes a single mechanism explain English stress patterns for nouns, verbs, and adjectives. The only difference in those morphological categories is that unsuffixed adjectives and verbs have catalectic suffix but nouns does not have catalexis. This paper claims that English stress patterns in unsuffixed verbs and adjectives can be dealt with by such constraints as FT-BIN , NONFINALITY, WSP, Align(PrWd, R; Ft(Head), R), FINAL-STR and DEP, and that the constraint ranking, FtBin >> Nonfinality >> WSP >> Align(PrWd, R; Ft(Head), R) 》 》 EP, is responsible for English stress patterns for nouns, verbs, and adjectives. **(Seoul National University)**

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1. Introduction

The aim of this paper is to show that English stress patterns for nouns, verbs and unsuffixed adjectives can be explained in a single mechanism by drawing on the notion of catalexis which is also adopted by Hammond(1999). Introduction of a null vowel to verbs and unsuffixed adjectives as a catalectic suffix can derive the same syllabic patterns as nouns in English stress.

In this paper, I will analyse and compare the stress patterns of nouns with those of verbs and unsuffixed adjectives within the framework of Optimality Theory(Prince and Smolensky(1993)). I am not concerned with all the distribution of the primary stress. The patterns of English primary

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and nonprimary stress are more complex than the patterns presented here. I just focus on the stress patterns in verbs and unsuffixed adjectives with antepenultimate stress and penultimate stress.

The paper is organized as follows. In section 2, I review the previous analysis in English stress. In addition, this paper discuss the notion of catalexis which is adopted by Hammond(1999). In section 3, it will be shown that Optimality Theory successfully accounts for the catalectic suffix to verbs and unsuffixed adjectives. Last, section 4 will offer conclusion of this paper.

2. Previous Analysis

Kager(1989) proposes derivational English stress placement. He presents three main groups of multi-syllabic, non-retracted simple words. This classification is based on two factors: the relationship between stress and syllable weight and the degree of extrametricality present in the word.

His first two groups are said to be common and are associated with lexical categories, while the third is labeled "idiosyncratic" and may contain words from any grammatical category. His groups differ in terms of the type of extrametricality effects seen at the right edge of the word. His first group shows final syllable extrametricality and his second group shows final consonant extrametricality as seen in (2), (4).

(1) Stress placement I (underived nouns, suffixed nouns and adjectives)
  a. ignore the final syllable
  b. stress the antepenult (if present) provided the penult is light.
  c. otherwise stress the penult.

(2) Group I

Light penult	Long vowel penult	Heavy penult	Light ultima
a(m e ri)<ca>	a(r o)<ma>	a(g e n)<da>	(v´)<lla>
(c i nna)<mon>	ho(r i)<zon>	as(b e s)<tos>	(v´)<nom>
(l a by)<rinth>	massa(ch ı´)<setts>	ap(p e n)<dix>	(h´)<rald>

The examples with antepenultimate stress are said to have light penults. Those with penultimate stress have heavy penults, containing either a long vowel or a syllabic-closing consonant.

(3) Stress placement II (verbs and unsuffixed adjectives)
  a. ignore the final consonant
  b. stress the penult (if present) provided the final syllable is light.
  c. otherwise, stress the final syllable.

(4) Group II

de(v e lo)<p>	mani(t a i)<n>	tor(m e n)<t>
as(t o ni)<sh>	su<pr e)<m>e	ex(p e c)<t>
il(l i ci)<t>	al(l o w)	o(v e r)<t>

For words like *om i t*, the extrametricality can't be applied. So Kager devises another group. His third, "idiosyncratic" group, shows no extrametricality(e.g. gui(t a r), acqui(e sce)).

Kager tries to broadly connect these groups with syntactic categories(although there are cleary many exceptions to this generalization), linking the first group to nouns and the second to verbs and adjectives. His analysis conforms generally to the view that English displays the bimoraic trochaic foot(Hayes(1981)). But the group III is small and lacking extrameticality(or, alternatively, fails to meet expectations about foot structure) and violate generalizations about the syntactic categories covered in group I and II. The words in group III may simply be seen as exceptions that fail to fit into the two major groupings, apparently lexically unpredictable in their stress.

In Lee(1996), English words can be divided into two groups with respect to their stress patterns. One is related to nouns, class 1 suffixed forms and Type N(oun) adjectives. The other group includes verbs and Type V(erb) adjectives. The division of adjectives into two groups comes from the stress distribution and theoretical considerations.

English nouns show that primary stress falls on penultimate syllables if they are heavy(e.g. *ag e nda, Totr o nto*) and otherwise on antepenultimate syllables(e.g. *c ά mera, m e dicine*). The normal stress pattern of nouns does not permit the final syllable to have stress. In word final position, closed syllables like those in *syn o psis, p ý ramid, hor i zon* do not attract stress, nor do final open syllables. Even superheavy final syllables of nouns have no primary stress. Thus we can say that the stress pattern of nouns is sensitive to syllable weight in word medial position and final syllables do not have stress regardless of syllable weight, lexical exception aside.

The basic stress pattern of verbs is that final syllables have stress if they are superheavy, while they do not attract stress if they are heavy as seen in (5). In (5a), stress falls on final superheavy syllables, while it falls on the penultimate syllables if final syllables are not superheavy as seen in (5b).

(5) a. Superheavy final syllable
CVCC#: con v i nce, prev e nt, re c a nt, re sp o nd
C(C)VVC#: de c i de, inter v e ne, per v a de, pro m o te
b. Heavy final syllable
CVC#: ast o nish, dev e lop, inha ´ ;, so l i cit
CVV#: c o py, e n vy, m a rry, v a ry
a r gue, cont i nue, r e s cue

Unsuffixed adjectives follow either the noun stress pattern or the verb stress pattern. This view is shared with Burzio(1994), and differs from the claim in previous works like SPE, Hayes(1981), Halle and Vergnaud(1987) and Sainz(1992). The previously held view is that adjectives follow the verb stress pattern. Lee(1996) suggests that two types of adjectives be lexically differentiated with respect to their stress pattern. One class of adjectives, like (6), follows the noun stress pattern, and the other class, like those in (7), patterns with verbs with regard to stress. He terms the former class Type N adjectives and the latter class Type V adjectives.

(6) a. Superheavy final syllable
´ dject, ´ uburn, ´ wkward, b´ stard, c´ ward,
´ arnest, ´ legant, ´ loquent,
´ xpert, f´ rward, h´ nest, m´ dern, m´ dest, r´ levant,
st´ lwart, st´ bborn
b. Heavy final syllable
´ dequate, cons´ derate, f´ minine, ´ ntimate, l´ teral,
l´ terate, m´ sculine,
m´ derate, ´ bstinate, p´ pular, t´ mperate
(7) a. compl´ te, contr´ te, discr´ et, div´ ne, extr´ me,
obsc´ ne, pol´ te, sec´ re,
ser´ ne, sinc´ re
b. abs´ rd, ad´ pt, aug´ st, corr´ ct, dir´ ct, dist´ nct,
ex´ ct, imm´ nse, inf´ rm, int´ nse, occ´ lt

In an attempt to analyze English metrical structure for the segmental phonology, Lee(1996) follows Hayes(1995) in assuming that ternary feet are excluded, and metrification is nonexhaustive. He makes an assumption that English stress is sensitive to syllable weight both in word final position and word medial position, like Prince(1983), Selkirk(1984), and Halle and Vergnaud(1987).

Hammond (1999) says that verbs and adjectives exhibit final stress if the final syllable contains a long vowel or it is closed by two consonants, penultimate stress if the final syllable does not contain a long vowel or two coda consonants, and antepenultimate stress(and the penult and ultima unstressed) if the final syllable is a syllabic sonorant and the penult is light. If the antepenult is stressed then the penult cannot contain a bimoraic syllable except under two circumstances. First, the penult may contain a [i, u, e, o] if it is prevocalic(not followed by a consonant), e.g. alien[́ liə |. Second, the penult can be closed if the ultima contains [r̩, i], e.g. cylinder[sɪ n̩dr̩]. If the antepenult is stressed and the word is a verb or adjective, then the ultima must be [n̩,r̩], e.g. *jettison*.

To capture the general restriction against antepenultimate stress with adjectives and verbs, Hammond proposes that adjectives and verbs are followed by an invisible or catalectic suffix. Nouns do not have the option of catalexis. From this assumption, both the distance from the right edge and the number of consonants are necessary to close a syllable follow.

Hammond suggests that the only reason for adopting the catalectic suffix for English is that it allows us to generalize NONFINALITY. Nouns do not have the option of catalexis. The final syllable can be skipped by NONFINALITY, and antepenult stress is possible. Verbs and adjectives have catalectic suffixes which are skipped by NONFINALITY: allowing overt penultimate stress as in (8). There are several additional arguments for this proposal. Specifically, the cataletic suffix is subject to the usual principles of syllabification, including ONSET as in (9). Under the notion of catalexis, superficially word-final syllable preceding a catalexis suffix is only going to count as heavy if there are at least two word-final consonants. By adopting the notion of catalexis, the syllable patterns of verbs and adjectives are the same as that of nouns.

(8)

N	V	A
(σσ σ	(σσ ·[σ	(σσ ·[σ

(9)

	Catalexis	No catalexis
C	de.vɛ́.lo.p[/]	A.me.ri.ca
CC	a.dǽp.t[/]	a.gen.da

He suggests that verbs and adjectives can be treated with the same machinery proposed for nouns. The only difference is that unsuffixed verbs and adjectives undergo catalectic suffixation.

However, there are some problems of Hammond's account of English stress and the notion of catalexis. First, his approach of catalexis is not consistent. As in (8) and (9), he confused null vowel with catalectic syllable. He doesn't completely define the notation of catalexis. Second, he just introduces cataletic suffix and doesn't show his proposal with Optimality Theory.

Burzio's(1994) approach to English stress is nonderivational in the sense that metrical feet are employed to check surface stress, not to derive stress from underlying forms to surface forms through derivations. The minimal foot is disyllabic feet in Burzio's foot inventory. He excludes monosyllables, regardless of whether they are heavy or light. He considers ternary feet to be normal. In Burzio's stress system, the inclusion of ternary feet in and the exclusion of monosyllabic feet from the foot inventory crucially rely on the assumption that all words end in a overt or null vowel as in (10). But his approach lacks of predictive power. The null vowel does not have a predictable distribution. Some words ending in an overt vowel have an additional abstract vowel to satisfy the requirements of legitimate foot parsing, as seen in (11a). Others with a final overt vowel have no null vowel in metrification, as seen in (11b).

(10) a. inhɪ́bit: in(hɪ́.bi.t/)
b. prevɛ́nt: pre(vɛ́n.t/)

(11) a. (law/) vs. *(law)
b. A(merica) vs. *Ame(rica/)

Even though there are some problems in Burzio's approach, I adopt the notion of null vowel in English stress and I regard the null vowel as a catalectic suffix. In the next section, I will formally analyze the stress pattern with catalectic suffix within Optimality Theory framework.

3. An Optimality-theoretic Account of Catalexis

In this section, I will explain English stress patterns for nouns, verbs and unsuffixed adjectives under the notion of cataletic suffix within the framework of Optimality Theory(Prince and Smolensky(1993)).

In section 2, I mentioned the proposal of Hammond which presents the terms of catalectic suffix. However, there are some problems in his notion of catalexis as presented in section 2. By drawing on the notion of null vowel which is also adopted in Burzio(1994), we can have the same stress pattern in the first and the second group of Kager. As shown in (9), the verb with penultimate stress changes into the form with antepenultimate stress. It has the same syllabic structure with the noun *América.* The verbs and adjectives with final stress turns into the forms with penultimate stress by the appearance of invisible vowel. If they have two final consonants, they have the same syllabic patterns with the noun, *agénda.* So in this section, I will suggest the need of catalexis in analyzing the stress patterns in final two syllables with Optimality Theory.

Optimality Theory, as proposed by Prince and Smolensky(1993), is a theory of how the input-output relation is governed by well-formedness constraints. The general architecture of Optimality Theory is composed of Input, Output, the function Gen(generator) and the function Eval(evaluator). For a given input, Gen generates an infinite set of output candidates and then the candidates are evaluated by Eval. Evaluation operates by a set of ranked constraints, each of which may eliminate some candidate outputs, until a point is reached at which only one output candidate survives.

Constraints are intrinsically in conflict, hence every locally possible output of any grammar will necessarily violate at least some constraints. The output candidate is the one that is the most congruous with respect to the set of ranked constraints. Violation of a higher-ranked constraint brings about a greater cost than the violation of a lower-ranked constraint. Accordingly, a lower-ranked constraint can be violated to avoid the violation of a higher-ranked one, but violation is always kept to a minimum, given the requirement of maximal harmony.

In OT, Gen, Eval and the set of constraints are a fixed set of Universal Grammar. Individual grammar are constructed by imposing a ranking on the Universal constraint set, with some setting of parameters and fixing of arguments with constraints. (Prince & Smolensky(1993), McCarthy & Prince(1993a, b, 1995)).

From now on, I will present the stress patterns by drawing on the notion of catalexis. In this paper, I focus on the final stress in verbs and unsuffixed adjectives and I will show that the stress patterns of the examples in (12) and (13) behave the same as those of nouns with antepenultmate or penultimate stress by the appearance of abstract vowel. The examples in (12) show that verbs exhibit final stress. I classify final syllable as heavy or superheavy whether it has one consonant or two consonants. If the final syllable contains one consonant, the words have penultimate stress and if the final syllable contains two consonants, they have final stress. But the unsuffixed adjectives in (13) show final stress like the stress pattern in (12b). The examples in (13a) contain long vowel or diphthong and those in (13b) contain two consonants in final syllables. As shown in (8), the syllabic patterns in verbs and unsuffixed adjectives followed by cataletic suffix are the same as those in nouns. The examples in (11a) present the same syllabic patterns like *A.mé.ri.ca.* If the words contain two consonant in the final syllable followed by catalexis, the syllabic pattern of the words coincides with *a.gén.da.*

(12) a. verbs with penultimate stress
devélop embárrass inhíbit solícit prohíbit
b. verbs with final stress
torment prevént usúrp respónd expéct smírch
collápse clénch decíde cléanse

(13) a. adjectives with long vowel or diphthong in final syllable
políte discréet remóte compléte contríte
b. adjectives with two consonants in final syllable
adépt inténse absúrd exáct abjéct
ovért distínct expért robúst corréct

I will illustrate what I claim in this paper by considering the words in (12) and (13). I will show that the verbs and adjectives in (12) and (13) can be explained by the appearance of null vowel as *de.vé.lo.p/* and *o.vér.t/*. Introduction of a null vowel to verbs and unsuffixed adjectives as a catalectic suffix makes a single mechanism for nouns, verbs and unsuffixed adjectives in English stress.

Now, I show constraints relevant for English stress and catalectic suffix, as follows.

(14) NONFINALITY: No prosodic head of PrWd is final in PrWd.

In other words, the head syllable does not stand at the right edge of a prosodic word(Prince and Smolensky(1993)).

The presence of the main-stressed foot at the right edge of the word (as in Hayes(1995) End Rule:Right) can be enforced by an alignment constraint.

(15) Align(PrWd, R; Ft(Head), R) (McCarthy & Prince(1993a))

This states that the head foot coincides with right edge of the prosodic word. The combination of the preceding two constraints yields the extrametricality effects seen in English, so long as NONFINALITY is ranked above Align(PrWd, R; Ft(Head), R).

On the other hand, there are several ways to generate word final stress and virtually all of them have been proposed in the literature.

(16) Some ways to generate final stress:

a. Right-headed unbounded iambic foot(Kaisse(1986), Halle and Vergnaud (1987))
b. Final binary iambic foot
c. Final grid mark(no foot) (Barker(1989), Hayes(1991))
d. Final binary trochee + catalexis (Kiparsky(1991), Kager (1992b))

Of these analysis, I choose (d) because English displays the bimoraic trochaic foot(Hayes(1995)). The analysis of final stress shows that an alignment constraint, FINAL-STR, requires the word-final syllable to be stressed.

(17) FINAL-STR Align(PrWd, R, $\acute{\sigma}$, R)

This constraint, when combined with the inviolable TROCHAIC and FT-BIN constraints, requires catalexis, the existence of a phonetically null vowel. Catalexis has been proposed for Turkish and other languages, by Kiparsky(1991) and Kager(1992a, b, 1993). It permits a disyllabic trochee to be headed by the word-final syllable. In order to achieve catalexis, DEP, the constraint against null syllables, must be ranked below

FINAL-STR.

To enforce proper foot-formation for the words showing the general stress pattern, it is necessary to identify the type of foot used by the grammar. The data suggest that Hayesian bimoraic trochaic feet are the canonical foot-type in English. These can be enforced by a constraint FtBin, which requires the presence of exactly two moras in the foot. Stated in terms of the mora, a foot with a heavy syllable is represented as consisting of two moras, which satisfies the constraint termed Ft-Bin in (18).

(18) FT-BIN: Feet are binary.

A trochaic foot marks the left member as its head, which means that the left member will bear stress. Trochaic foot structure, thus, can be governed by an Alignment constraint in (19) which states that the left edge a foot aligns with the left edge of the foot head.

(19) Foot-Form(trochaic): Align(Ft,L ; Hd(Ft), L)

The quantity-sensitivity, the matching of syllable weight and prominence can be covered by following constraint proposed by Prince and Smolensky(1993). WSP states that stress falls on a heavy syllable,

(20) Weight to Stress Principle(WSP) :
Heavy syllables are stressed.

The following constraint ranking in (21) is employed in the analysis of English metrical structure.

(21) FT-BIN >> NONFINALITY >> WSP >>
Align(PrWd, R; Ft(Head), R) 》 》 EP

Justification for the constraint ranking in (21) is confirmed by the tableaux below. First, the adjective in tableau (22) shows penultimate stress by the appearance of catalectic suffix. Candidate, a(d(´p)t[/] is chosen as optimal from the input /adept/. Candidates (22c) violates the undominated constraint, Ft-Bin and (22a) and (22d) violate NONFINALITY constraint. Although candidate (22b) violates ALIGN(PrWd, R; Ft(Head), R), FINAL-STR, and DEP constraints, it just violates the lower ranked constraints. So the candidate (22b) is selected as the optimal output.

(22)

/adept/	FT-BIN	NONFINALITY	WSP	ALIGN (FT,R)	FINAL -STR	DEP
a.a(dέp.t[/])		*!			*	*
☞ .a(dέp)t[/]				*	*	*
c.(a.dέp)t[/]	*!			*	*	*
d.a(dέpt)		*!				

Since the candidates in (23c) and (23d) have diphthong in the foot, they disobey FT-BIN constraint which requires the presence of exactly two moras in the foot. Candidates (23a) and (23d) dissatisfy NONFINALITY and are ruled out of the competition. The remaining candidate (23b) incurs lesser violations of Align(PrWd, R; Ft(Head), R), FINAL-STR and DEP and is selected as optimal.

(23)

/polite/	FT-BIN	NONFINALITY	WSP	ALIGN (FT,R)	FINAL -STR	DEP
a.po(l´.t[/])		*!			*	*
☞ .po(l´)t[/]				*	*	*
c.(po.l´)t[/]	*!			*	*	*
d.po(l´t)	*!	*				

The same constraint hierarchy is responsible for the correct selection of the surface form of verbs with penultimate stress. The verb in (24) shows antepenultimate stress when it is followed by catalexis. Candidates (24b) and (24c) violate the high-ranking constraints FT-BIN and NONFINALITY. So the candidate (24a) is selected as optimal.

(24)

/develop/	FT-BIN	NONFINALITY	WSP	ALIGN (Ft, R)	FINAL -STR	DEP
☞ de(v´.lo)p[/]				*	*	*
b.de(v´l.op)	*!	*			*	
c.(de.ve)(l´.p[/])	*!	*			*	*

The verb in (25) shows penultimate stress by the appearance of abstract vowel. The candidate (25c) violates the high-ranking constraint FT-BIN and the candidates (25a) and (25b) dissatisfy NONFINALITY. So they are ruled out of the competition. The optimal candidate (25b) satisfies FT-BIN, NONFINALITY and WSP.

(25)

/prevent/	FT-BIN	NONFINALITY	WSP	ALIGN (Ft, R)	FINAL -STR	DEP
a.pre(v´nt)		*!				
☞ .pre(v´n)t[/]				*	*	*
c.(pre.v´n)t[/]	*!			*	*	*
d.pre(v´n.t[/])		*!			*	*

From above analysis, the stress patterns in verbs and unsuffixed adjectives can be explained within Optimality-theoretic analysis by the appearance of catalectic suffix. And they show the same syllabic structures as those of nouns which have antepunultimate stress or penultimate stress.

4. Conclusion

In this paper, I focused on verbs and unsuffixed adjectives with final stress. English stress patterns for nouns, verbs and unsuffixed adjectives can be explained in a single mechanism by drawing on the notion of catalexis. The introduction of a null vowel which is adopted by Burzio(1994) to verbs and unsuffixed adjectives as a catalectic suffix can derive the same syllabic patterns as nouns in English stress. I present the appearance of catalexis in analyzing the stress patterns for nouns, verbs and unsuffixed adjectives within the framework of Optimality Theory. The only difference in those morphological categories is that unsuffixed adjectives and verbs have catalectic suffix but nouns does not have catalexis.

I have argued that the stress patterns in unsuffixed verbs and adjectives can be dealt with the constraints as FT-BIN, NONFINALITY, WSP, Align(PrWd, R; Ft(Head), R), FINAL-STR, DEP. And their hierarchy is as following: FT-BIN >> NONFINALITY >> WSP >> Align(PrWd, R; Ft(Head), R) 》 》 'EP. However, this paper is insufficient to generalize English stress patterns and needs further study as to explain the asymmetry in nouns and verbs.

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