Stress Retraction in English*
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1. Introduction

In the literature on English stress, it is widely assumed that primary stress falls on one of the last three syllables, depending on its weight and on whether the word undergoes extrametricality. Under such an assumption, no secondary stress is expected to be assigned word-finally because the theory predicts that the final stress should be primary. However, a large number of words show that the last syllable can bear secondary stress. Here are examples:[1]

(1)	ánecdòte	páradìse	hóminòid
	récognìze	désigàte	sátisfỳ
	sécretàry	inhíbitòry	ábsolùte

Since Chomsky and Halle (1968), this phenomenon has been called *stress retraction*; that is, the primary stress assigned on the last syllable is retracted leftward, making the original stress secondary. Various kinds of rules are employed for stress retraction in different frameworks (cf. Liberman and Prince (1977), Hayes (1981), etc.), but they are essentially the same in that they retract primary stress.

However, a closer investigation reveals that not all words with final stress are subsumed under the retraction rule. For example, the following words do not undergo the retraction rule, although words with the suffix -*ate* generally do (e.g. *invéstigàte*):

(2) abáte, debáte, donáte, infláte, transláte, etc.

In the recent metrical theory, Halle and Vergnaud (1987) (henceforth H & V) propose a rule called *the Rhythm Rule* for stress retraction. Yet their analysis is incomplete in that it must regard the words in (2) just as exceptions to the Rhythm Rule.[2]

In this paper, therefore, we will refine stress assignment rules in English so that the Rhythm Rule can work more adequately. Specifically, we will propose that foot construction at level 2 is quantity-insensitive and requires bisyllabicity. When a foot is not constructed before

primary stress because of this bisyllabicity requirement, the stress cannot be retracted because a foot on which the stress is expected to be retracted is not available. In other words, the Rhythm Rule cannot apply to the words in (2) because the first syllables do not constitute a foot.

Moreover, we will abolish the special treatment that regards some suffixes (e.g. -ory) as constituting a stress domain in and of themselves. Stresses in words with such suffixes are accounted for by adopting the assumption made in Halle and Idsardi (1992) and Idsardi (1992) that some suffixes have lexical boundaries.

This paper is organized as follows. We will first review stress assignment rules proposed in recent analyses in section 2. In section 3, we will refine the Rhythm Rule and stress assignment rules at level 2. In section 4, we will propose an alternative to the "stress domain" analysis, which will be called the "lexical bracket" analysis. Concluding remarks are made in section 5.

2.   Stress Assignment Rules

Before we start discussion on stress retraction, let us review stress assignment rules in recent analyses. In particular, we will assume most of the rules in H & V and Halle and Kenstowicz (1991) (henceforth H & K). However, we will modify some of the rules as the discussion proceeds.

2.1. General Assumptions

In this subsection we will review some general assumptions introduced in H & V ans H & K.

An Assumption proposed in Lexical Phonology (cf. Kiparsky (1982)) is introduced. That is, there are two levels in the lexicon; one is cyclic and the other non-cyclic.[3] If a suffix belongs to the cyclic level, primary stress is assigned in a calculation of the whole string /stem + suffix/; whereas a suffix is attached after primary stress assignment if it is non-cyclic. This is because the cyclic level (level 1) precedes the non-cyclic one (level 2) and rules that assign primary stress lie in level 1.

It is also assumed that a stem can have several metrical planes, extending the work of McCarthy (1986). A new plane is constructed when a cyclic suffix is attached, with metrical structures in previous cycles erased. Only the primary stress is maintained by a rule called *Stress Copy*. For example:

```
(3)      *
        (*)
        (*      *)<*>                      instru mental
         instru ment al                   (*      *)(*)<*>
         *     *   *   *                   (*           *)
         *                     -->                      *
```

In (3), the structure above is constructed on the plane of *instrument*. When the cyclic suffix *-al* is attached to the stem *instrument*, the sequence *instrumental* constitutes a distinct plane, as the lower structure in (3) shows. Only the primary stress is copied on that plane. Stress assignment rules also apply in this plane, yielding a new structure.

2.2. Rules in H & V

H & V provide the following rules for stress assignment in English.[4]

```
(4)      level 1 (cyclic)            level 2 (non-cyclic)
         Extrametricality            Stress Copy
         Accent Rule                 Binary Constituent
         Binary Constituent              Construction
             Construction            Rhythm Rule
         Unbounded Constituent       Stress Deletion
             Construction
         Stress Conflation
```

Let us briefly explain each of the rules. When Extrametricality applies to a word, the last syllable of the word is skipped in metrical constituent construction. The Accent Rule places stress on every heavy syllable. Respecting the stress assigned by the Accent Rule, Binary Constituent Construction produces left-headed binary constituents (i.e. trochaic feet)

from right to left at level 1. Unbounded Constituent Construction makes the last stress which is assigned by Binary Constituent Construction primary, because the foot constructed by this rule is right-headed. At the end of level 1, Stress Conflation eliminates all stresses other than primary. At level 2 Stress Copy places a stress on the same syllable that have primary stress in previous cycles (cf. (3)). Binary constituents are constructed again in right-to-left direction[5]. The Rhythm Rule, which we discuss in this paper, retracts final primary stress leftward. Stress Deletion deletes a weaker stress when it is adjacent to a stronger one.

Let us illustrate how these rules work in the sample derivation in (5):

```
(5)  a.                   b.                   c.
                                               *           *
     *    * *   *         *    * * <*>         *    * * <*>
     instrumental         instrumental         instrumental

     d.                   e.        *          f.        *
      *         *         (*        *)                  (*)
     (*    *)(*)<*>       (*    *)(*)<*>        *    *(*)<*>
      instru mental        instru mental        instrumental

     g.        *          h.        *
      *        (*)        (*        *)
      *    * [*]<*>       (*    *)[*]<*>
      instru mental        instru mental
```

The structure in (5a) is the input. A grid is assigned to every rime in a word. Extrametricality makes the last syllable invisible to constituent construction as in (5b) (angled brackets are employed to show this effect). The Accent Rule places stress on heavy syllables (5c). Trochaic feet are constructed from right to left by Binary Constituent Construction (5d). To respect the stress assigned by the Accent Rule, the heavy syllable *ment* constitute a foot. Unbounded Constituent Construction places primary stress on the last stress-bearing syllable (5e). All stresses but the primary are eliminated by Stress Conflation, and the structure in (5f) becomes the input to level 2. Stress Copy places the stress on the first syllable (5g) since its original word *instrument* has primary stress on that syllable (Following Halle (1990), square brackets are used to indicate the constituent made at level 1.).

Binary Constituent Construction applies again to place secondary stress, respecting the stress assigned by Stress Copy (5h).

Two remaining rules, namely the Rhythm Rule and Stress Deletion, do not apply here because the primary stress is not on the final syllable and there are no adjacent stresses (as for the Rhythm Rule, see 3.1.).

2.3. *H & K's Free Element Condition*

H & K propose that "reapplication of the stress rules respects previously established structure (H & K: 458)"; in other words, foot construction at level 2 cannot destroy a foot constructed at level 1. This condition involves the following three effects:

(6)　a. opacity effect
　　　　A dependent of a foot is inaccessible to foot
　　　　construction.
　　　b. closure effect
　　　　A degenerate foot cannot incorporate post- or
　　　　pretonic grid.
　　　c. crossover effect
　　　　Line 0 metrification may not cross over a
　　　　previously established foot.

In order to illustrate these effects in a more concrete way, we will consider the following structures as examples:

```
(7)   a. *                b.*               c.            *
         (* *)  *  *         (*)  *  *          *  *  *  (* *)  *  *
          1 2   3  4          1   2  3          1  2  3   4 5   6  7
```

The opacity effect prevents the grid on syllable 2 in (7a) from being metrified in another foot. The closure effect prohibits the grid on syllable 2 in (7b) from being incorporated into the degenerate foot which syllable 1 constitutes. The crossover effect requires that the grids on syllables 6 and 7 in (7c) are not metrified in left-to-right metrification; only grids on syllables 1, 2, and 3 can be metrified.

Among these effects, we must pay attention to the crossover effect. Specifically, H & K propose that English foot construction at level 2 originates from left to right because of this effect. Note that English

words have secondary stresses before primary stress. These pretonic stresses would not be expected if metrification at level 2 originated from right to left as assumed in H & V, because such a merification would cross over a previously constructed foot.

2.4. Summary

In this paper, we will adopt the general assumptions mentioned in section 2.1.; namely two-level phonology and cyclicity. For stress assignment rules, we will adopt all the rules in H & V as they are (cf. section 2.2. and (4)) except for Binary Constituent Construction at level 2. Following H & K, we will assume that level 2 metrification is left-to-right. However, some modifications of rules may be given as the discussion proceeds.

3. The Rhythm Rule and Reexamination of Feet at Level 2

In this section, we explore a reasonable analysis for stress retraction in English. First we review previous studies in section 3.1., concerning the Rhythm Rule. In section 3.2., we show that several problems arise in previous analyses. Then, an alternative analysis is proposed in section 3.3. with modifications of several stress assignment rules. Words which have alternative stress patterns are analyzed in section 3.4.

3.1. The Rhythm Rule

Now let us see how retraction phenomena in English are treated in H & V's framework. They argue that stress retraction is brought about by a rule such as (8), called the Rhythm Rule:[6]

```
(8)   Rhythm Rule
                 *                    *
      (*      *)             (*)      *
      (* *)[*]     -->       (* *)[*]
       X X  X                 X X  X
```

When the last syllable of a word bears primary stress at level 2, this

rule retracts stress leftward onto the nearest syllable that bears stress. With this rule, the stress pattern of the words in (9) is derived as shown in (10):

```
(9)    désignàte       íllustràte       démonstràte
       récognìze       díphthongìze     jéopardìze
       sátisfỳ         dígnifỳ          múltiplỳ

(10)        *                *               *
          (*)           (*    *)          (*)     *
        * * [*]  -->   (* *)[*]   -->    (* *)[*]
        designate      designate         designate
```

The first structure in (10) is the input form at level 2; i.e. after Stress Conflation (cf. (5f)). Since level 2 does not have the Accent Rule, a binary constituent is constructed regardless of syllable weight, producing structure in the middle of (10). Because this structure has primary stress on the last syllable, the Rhythm Rule (8) retracts the stress onto the first syllable, which is the nearest syllable bearing stress.

3.2. Problems

Two problems arise in H & V's and H & K's analysis of stress retraction in disyllabic and quadrisyllabic words with suffixes like -ate.

3.2.1. Disyllabic Words

H & V propose that the application of the Rhythm Rule is "lexically governed". This might be plausible if we assumed that the application of the rule is lexically governed for each suffix, because words with suffixes such as -eer are consistently immune from the Rhythm Rule (e.g. enginéer). In contrast, words with the suffixes -ate, -ize, -ply, and -fy usually receive the application. However, we find that some disyllabic words containing the above-mentioned suffixes do not undergo the Rhythm Rule.

(11) a. abáte, debáte, creáte, reláte, equáte, rebáte
         infláte, transláte, confláte, refláte, ornáte
     b. aríse, surpríse, revíse, demíse, devíse
         baptíze, advíse, disguíse, compríse, despíse
     c. replý, implý, supplý, applý, complý
     d. defý

Saying that the words in (11) are just exceptions to the Rhythm Rule sounds completely ad hoc, because in that case they are individually specified as not undergoing the Rhythm Rule. Note that a generalization is possible that disyllabic words do not have to retract the primary stress, because words with more than two syllables which contain the above-mentioned suffixes always retract that stress (as we will see in section 3.4., some disyllabic words with -ate can undergo stress retraction).

One may argue that Stress Deletion applied to words in (11) before the Rhythm Rule, eliminating the landing site of stress retraction. However, this is impossible because Stress Deletion applies at the latest stage of level 2; i.e. after the Rhythm Rule (cf. (4)). Note that some disyllabic words can undergo stress retraction (e.g. locáte/lócate). If Stress Deletion applied before the Rhythm Rule, no stress retraction is expected for disyllabic words. Even if we assumed words such as lócate are exceptions to Stress Deletion and the Rhythm Rule applied after that, we cannot explain in that case why the stress on -ate is deleted. Thus the Rhythm Rule must precede Stress Deletion.

Therefore, we will reexamine H & V's stress assignment system so that generalization for disyllabic words concerning stress retraction can be captured.

3.2.2. Quadrisyllabic Words

Another serious problem arises when we think about retraction in quadrisyllabic words with -ate and -fy. Below are examples of such words:

(12) a. erádicàte, certíficàte, commúnicàte, domésticàte
elúcidàte, invéstigàte, assóciàte, humíliàte
apprópriàte, negótiàte, inítiàte, intóxicàte
b. syllábifỳ, exémplifỳ, divérsifỳ, inténsifỳ
idéntifỳ, eléctrifỳ, persónifỳ, indémnifỳ

As we see in (12), quadrisyllabic words with -ate and -fy always have primary stress on the second syllable. This fact suggests that stress is assigned on that syllable at level 2 and that the stress serves as a landing site of the stress retraction.

However, in H & K's analysis, it is impossible for stress to be assigned to the second syllable of quadrisyllabic words like those in (12). Recall that H & K propose that constituent construction at level 2 applies left-to-right in English because of the crossover effect. We notice that the left-to-right metrification at level 2 produces a wrong stress pattern for the words in (12).

```
(13) a.       *              *            *
            (*)          (*      *)     (*)        *
      *  *  *[*]  -->  (*  *) *[*]  -->  (*  *) *[*]
      investigate      investigate     * investigate

     b.                          *              *
                          (*      *  *)     (*        *)  *
                          (*  *)(*)[*]  -->  (*  *)(*)[*]
                          investi gate      * investi gate
```

Because of Stress Conflation, only the rightmost constituent survives when the word enters level 2. Left-to-right metrification at level 2 produces a stress on the first syllable, on which the primary stress is retracted, if we assume that a degenerate foot cannot be constructed (the upper derivation). Even if we assume that a degenerate foot is allowed to occur, wrong stress on the third syllable emerges as the lower derivation shows.

One may analyze this as follows: the Accent Rule applies at level 2 for words in (12) (H & K assume that this rule applies at level 2 for lexically restricted words), and primary stress is retracted onto the stress assigned by this rule. However this analysis seems inadequate because of the following two reasons: (1) The generalization is not captured that quadrisyllabic words with these suffixes always have

primary stress on the second syllable because in that case we must specify them individually as undergoing the Accent Rule at level 2. Note also that trisyllabic words do not undergo the rule; e.g. *sátisfy/*satísfy*. (ii) Light second syllables also have primary stress; e.g. *syllábify, certíficàte*, etc.

Stress Copy does not explain the stress on the second syllable, either. First, many words in (12) do not have previous cycles; i.e. do not have any original word to which the suffixes are attached. Second, there are examples which do not have stress on the same syllable as their original words: cf. *sýllable/syllábify, pérson/persónify*.

Therefore, we need a system which assigns stress on the second syllable of quadrisyllabic words with *-ate* and *-fy*.[7] In the following section, we will modify constituent construction rules at level 2 so that the stress pattern of the words in (12) can be accounted for.

3.3 An Alternative Analysis

In this section, we will make the following three assumptions: (i) level 2 metrification is quantity-insensitive; (ii) degenerate feet are avoided in metrification; (iii) metrification at level 2 can be carried out in right-to-left direction. With these assumptions, we can explain stress patterns of words with *-ate, -ize, -ply*, and *-fy*. Moreover, we can solve the two problems raised in section 3.2. Before we see how this system will work, let us examine the adequacy of these assumptions.

The first assumption that level 2 metrification is quantity-insensitive does not seem to be an unreasonable assumption when we notice the fact that the Accent Rule is not provided at level 2 in H & V (cf. (4)). Because of the absence of this rule, heavy syllables do not always have to bear stresses. Consider the following examples:

(14)   récognìze, sátisfỳ, ánecdòte, etc.

If the Accent Rule is at work also at level 2, the primary stresses of the words in (14) would be retracted onto the second heavy syllable. Inevitably this is not the case.

```
(15)           *                    *
          (*    *)  *           (*)      *
          (*)(*)[*]             (*  *)[*]
          * re cognize          recognize
```

Note that an illegal foot [LH] in trochaic system, where L stands for a light syllable and H for a heavy syllable, is constructed in the correct structure in (15) (cf. Prince (1992)). This fact suggests that constituent construction at level 2 applies regardless of the weight of syllables, i.e. quantity-insensitively.

Notice that in English shortening rules seldom or never apply at level 2.[8] This fact also suggests that feet at level 2 are insensitive to syllable weight.

Next we think about the second assumption stated above; i.e. avoidance of degenerate feet in metrification. Notice that Halle and Idsardi (1992) and Idsardi (1992) assume that degenerate feet are prohibited. Here we do not accept such a strong requirement (prohibition), but assume a weaker one (avoidance). The consequence of this difference is that the latter allows degenerate feet under certain conditions. (This matter is treated in section 3.4.) For present purposes, let us assume that degenerate feet do not arise in normal cases.

Finally let us consider the third assumption, i.e. the direction of level 2 metrification can be right-to-left. The assumption is clearly opposed to H & K's, which says that the direction must be left-to-right. Recall that H & K deduce this assumption from the crossover effect stated in (9c); because of this effect, pretonic stress must be assigned by left-to-right metrification. However, the effect just mentions the prohibition of metrification which crosses over previously-established feet, and it is possible to interpret this effect in a different way from H & K's. Here we will assume that right-to-left metrification is possible at level 2, provided the structure as in (16a):

```
(16)  a.          *        b.       *
                 (*)               (*)
          *  *  *  [*]        *  *[*   *]*
          X  X  X   X         X  X  X  X  X
```

Even if metrification originates from right to left in the structure (16a),

no crossing-over would arise: the calculation starts from the rightmost syllable, but this syllable is skipped in metrification because of the opacity effect and the closure effect. On the other hand, the right-to-left metrification in (16b) does cross over because the structure contains a grid on the right of the previously-established foot.

In other words, any directionality is possible for level 2 metrification as long as it does not cross over previously-established feet. Therefore, even though we adopt the crossover effect in English, we can assume that right-to-left metrification is possible at level 2 in some cases.

Now let us see how our assumptions will work to solve the problems mentioned in the previous section. First we consider the fact that disyllabic words always do not retract stress. Observe the examples in (11) again, repeated here as (17):

(17) a. abáte, debáte, creáte, reláte, equáte, rebáte
        inflále, transláte, confláte, refláte, ornáte
     b. aríse, surpríse, revíse, demíse, devíse
        baptíze, advíse, disguíse, compríse, despíse
     c. replý, implý, supplý, applý, complý
     d. defý

Recall that we assume that degenerate feet do not occur in normal cases, and also that level 2 metrification is quantity-insensitive. These assumptions predict that monosyllabic feet are not constructed at level 2, whether they are light or heavy. This prediction correctly derives the actual stress pattern for the words in (17).

In the words in (17), the available grid for level 2 metrification is the one on the first syllable because the one on the second syllable constitutes a foot by level 1 metrification:

```
(18)     *                    *
        (*)                  (*)
       *[*]              *   [*]
       abate              inflate
```

The structures in (18) represent the input to level 2. Since monosyllabic feet are avoided at level 2, the first syllables in (18) do not constitute feet, with the result that any stress is not assigned for disyllabic words

before previously-assigned stress. Therefore, the landing site of the retracted stress is not available and the primary stress remains intact on the last syllable.

Of course, there are disyllabic words which have alternative stress patterns, in which retraction does apply. As for these words (e.g. *lòcáte/lócàte*) we will discuss them in the following section.

The assumption made above also predicts the correct stress pattern for trisyllabic words. Quantity-insensitivity at level 2 predicts that the first syllables of trisyllabic words always bear primary stress through the Rhythm Rule, regardless of the weight of the second syllable. In fact, this is the case for the words in (19):

(19) a. cóntemplàte, álternàte, cónsecràte, íntegràte
         cónsentràte, démonstràte, íllustràte, célebràte

     b. sólemnìze, récognìze, ádvertìze, módernìze

     c. múltiplỳ, sátisfỳ

The derivation of the stress pattern of these words proceeds as follows:

(20)   *   *   *
              (*)   (*   *)   (*)   *
        * * [*]   -->   (* *)[*]   -->   (* *)[*]
        celebrate   celebrate   celebrate

A disyllabic foot is constructed on unparsed syllables in right-to-left metrification at level 2 (the directionality is vague here because there are only two syllables, but compare quadrisyllabic words). Note that the foot [LH] in (20) is only allowed in the quantity-insensitive system. The Rhythm Rule moves primary stress onto the first syllable, the head of the foot constructed here.

As we have observed in section 3.2.2., quadrisyllabic words with *-ate* and *-fy* always have primary stress on the second syllable. Examples are given in (12), repeated as (21) below:

(21) a. erádicàte, certíficàte, commúnicàte, domésticàte
         elúcidàte, invéstigàte, assóciàte, humíliàte
         apprópriàte, negótiàte, inítiàte, intóxicàte

     b. syllábifỳ, exémplifỳ, divérsifỳ, inténsifỳ
         idéntifỳ, eléctrifỳ, persónifỳ, indémnifỳ

Recall that left-to-right metrification at level 2, which H & K propose, produces a wrong stress pattern as we have seen in (13); repeated here as (22), slightly modified:[9]

```
(22)              *                  *              *
              (*)            (*      *)          (*)        *
     *    *   *[*]   -->  (*   *)  *[*]   -->  (*   *)  *[*]
      investigate          investigate         *  investigate
```

Therefore we abandon metrification of this direction for these words. Instead, we will propose that the direction is right-to-left for the words in (21). As we illustrate in (23), this proposal exactly predicts the correct stress pattern:

```
(23)              *                  *              *
              (*)            (*      *)          (*)        *
     *    *   *[*]   -->  *  (*   *)[*]   -->  *  (*   *)[*]
      investigate          investi gate         investi gate
```

Because the last syllable is involved in the previously-established foot, right-to-left metrification skips this syllable and begins from the penultimate syllable. This assigns stress on the second syllable, which serves as the landing site of stress retraction.[10]

From the discussion so far, we can conclude that level 2 metrification for words with -ate and -fy is carried out from right to left. Now we consider the directionality for words with -ize. The direction of metrification is still undetermined for words with this suffix, because there are two types of quadrisyllabic words; one having primary stress on the first syllable, and the other on the second.

```
(24)  a.  monópolize, commércialize, ecónomize
          contémporize, subúrbanize, hypóthesize
      b.  nátionalize, líberalize, géneralize
          náturalize, ánimalize, dígitalize
```

Our impression is that metrification for words with -ize applies from right to left; i.e. the words in (24a) undergo normal derivation. Notice that many words in (24a) do not have a previous cycle (i.e. a word from which the relevant word in (24a) is derived) while all the words in (24b) do. We can attribute the stress on the first syllables of the words in (24b) to the rule Stress Copy.

(25) a.
```
          *                        *                      *
         (*)                     (*     *)               (*)     *
      * * *[*]     -->        *(*  *)[*]      -->      *(*  *)[*]
      monopolize             monopo lize              monopo lize
```

b.
```
           *                          *                        *
          (*)                        (*)                     (*     *)
      *   *   * [*]   ->     *   *   * [*]    ->     *  (*   *)[*]
      commercialize          commercialize           commercialize
```
```
             *
            (*       *)
      ->  *  (*   *)[*]
          commercialize
```

c.
```
          *                         *                       *
         (*)                *      (*)                    (*        *)
      * *  *[*]     -->   * *  *[*]       -->        (* *)  *[*]
      nationalize          nationalize               nationalize
```
```
                                                              *
                                                      (*  *         *)
                                                       *(*   *)[*]
                                                       * nationa lize
```
```
        *
       (*)           *
  -->  (*  *)  *[*]
       nationalize
```

In the derivation of words without a previous cycle, right-to-left metrification at level 2 produces a stress on the second syllable, as shown in (25a). This metrification is vacuous for *commercialize* and *suburbanize* because Stress Copy places a stress on the second syllable as shown in (25b) (cf. *commércial* and *subúrban*). The stress on the second syllable serves as the landing site of the stress retraction and thus this becomes the primary stress by the Rhythm Rule. On the other hand, Stress Copy assigns a stress on the first syllable for the words in (24b), as the second structure in (25c) shows (cf. *nátional*). Quantity-insensitive metrification respects this stress in foot construction, leaving the grid on the third syllable unmetrified. Thus the stress on the first syllable becomes primary stress.

Note that the structure shown below the third structure of (25c) is impossible to be constructed. The right-to-left metrification assigns a stress on the second syllable in this structure, while preserving the stress on the first syllable, which is assigned by Stress Copy. However this stress is not a head of any constituents because we have assumed that metrification is quantity-insensitive and degenerate feet are avoided at level 2. Exactly this violates the Faithfulness Condition proposed by H & V.[11]

Finally, let us discuss in which direction the normal metrification at level 2 applies. First, consider the words in (26), which are listed in H & K:

(26) àbracadábra, Kàlamazóo, Wìnnipesáukee

Clearly, level 2 metrification applies from left to right for these words since the first syllables have secondary stresses. If metrification applied right-to-left, the secondary stress would fall on the second syllable.

From the stress pattern of words in (26), we will assume here that the default value for directionality would be left-to-right, as H & K assume. We have two reasons for this assumption: (i) since the words in (26) do not contain any suffix, it is impossible to attribute the directionality to any suffix just as we did in the analysis for words with -ate, -fy, or -ize. (ii) because those words are loan words, their stress pattern seems to reflect the psychological reality of English speakers.

For validation of this default value and the lexical specification of directionality for suffixes other than those discussed here, we must await future investigation.

3.4. Words with Alternative Stress Patterns

In this section we consider words which have alternative stress patterns. Several disyllabic and a few trisyllabic words do exhibit alternative patterns, but words with more than three syllables do not.

First, let us examine disyllabic words with -ate:

```
(27)   frustráte/frústrate        vibráte/víbrate
       dictáte/díctate            locáte/lócate
       truncáte/trúncate          fixáte/fíxate
       stagnáte/stágnate          prostráte/próstrate
```

The latter pronunciation of these words, which is reported as prominent in the United States (cf. Wells (1990)), contradicts our expectation, since the analysis in section 3.3. predicts no constituent to be constructed on the first syllable because of quantity-insensitivity and avoidance of degenerate feet.

However, we find that retraction in disyllabic words is only observed in words whose first syllable is heavy.[12] As the examples in (28) shows, stress retraction do not apply to words with -ate when the first syllable is light:

```
(28)   abáte, debáte, creáte, reláte, rebáte, etc.
```

Therefore we assume that the Rhythm Rule applies at level 1 before conflation for these words (note that only level 1 has the Accent Rule). Otherwise we cannot predict this light/heavy distinction for stress retraction. The sample derivation is shown in (29):

```
(29)                            *              *
                             (*   *)         (*) *
         *    *    -->       (*)(*)   -->    (*)(*)
         dictate             dictate         dictate
```

Since level 1 is quantity-sensitive, the first heavy syllable can constitute a foot, to which the primary stress moves. In contrast, a light syllable cannot constitute a foot. Thus only words whose first syllable is heavy can bear primary stress when the Rhythm Rule applied at level 1.

When we think about trisyllabic words which have alternative stress patterns, we find that the same explanation holds for this case. Here are examples:[13]

```
(30)   ínculcate/incúlcate        rémonstrate/remónstrate
       démarcate/demárcate        élongate/elóngate
       ínculpate/incúlpate
```

Our analysis in section 3.3. predicts primary stress falls on the first

syllable as British pronunciation shows. American pronunciation is not predicted in normal derivation because these words have two syllables before -*ate*, which as a whole constitute a foot at level 2; i.e. the second heavy syllables may not be assigned stress at level 2. But their stress is accounted for if we assume that for these five words the Rhythm Rule applies at level 1 before conflation, producing the primary stress on the second syllable. The sample derivation in (31) illustrates the point:

```
(31)                               *                 *
                          ( *   *   *)        ( *   *) *
        *   *   *   -->   (*)(*)(*)    -->    (*)(*)(*)
        inculcate         inculcate           inculcate
```

Because level 1 metrificaion is quantity-sensitive, heavy syllables can constitute a foot, as the second structure in (31) shows. Because the stress on the second syllable is the nearest one to the final stress, primary stress is retracted onto this syllable by the Rhythm Rule.[14]

We have another suffix that shows level 1 application of the Rhythm Rule. As we see in (32), words with -*fy* shows light/heavy distinction as words with -*ate* does.

(32) defý
      déify, réify[15]

Thus we conclude that the Rhythm Rule applied at level 1 for *déify* and *réify*.

On the other hand, words with -*ize* or -*ply* do not show this distinction. There are no disyllabic words that undergo the Rhythm Rule at level 1, whether the first syllable is heavy or not. In (33), words whose first syllable is light are represented in upper lines, while words with heavy first syllable are represented in the lower lines:

(33) a. aríse, surpríse, revíse, demíse, devíse
          baptíze, advíse, disguíse, compríse, despíse
      b. replý, supplý, applý
          implý, complý

We can conclude that -*ize* and -*ply* are not specified as undergoing the Rhythm Rule at level 1.

Now we will consider what type of words can be specified as undergoing the Rhythm Rule at level 1. So far we have observed that -*ate* and -*fy* are specified as such, while -*ize* and -*ply* are not. When we compare these four suffixes, we notice that the former suffixes are Latinate suffixes; cf. -*ize* originates in Greek, while -*ply* is borrowed from French although its origin is Latin.

Therefore, it may be possible to conclude that Latinate suffixes can undergo the Rhythm Rule at level 1, although lexically restricted (cf. there are some words in which the stress is not retracted even though they contain -*ate*; e.g. *infláte*). If we assume that the Rhythm Rule is motivated by a constraint such as *Nonfinality*, which requires a stress not to appear word-finally (cf. Prince and Smolensky (1993)), the fact can be interpreted as follows: the constraint *Nonfinality* applies strongly for Latinate suffixes enough to apply at level 1. This special status of Latinate suffixes may result from the fact that the constraint *Nonfinality* itself seems to originate in Latin (Prince and Smolensky (1993) provide this constraint for Latin). As for whether this interpretation is correct, we will leave it open for future research.

4. Words with Lexical Brackets

In addition to the Rhythm Rule, H & V propose a special treatment to account for retraction in words with -*oid, -ite, -ary, -ory,* and so on. We will review H & V's analysis for words with these suffixes in section 4.1. However, as we see in section 4.2., several problems arise in their analysis. Therefore we will propose an alternative analysis in section 4.3.

4.1. "Stress Domain" Analysis in H & V

H & V propose that suffixes as -*oid, -ite, -ary,* and -*ory* constitute "stress domains" in and of themselves. We give the following words as examples with these suffixes:

```
(34)  a.  álkanòid      hóminòid      mágnetìte
          aráchnoid     mollúscoid    staláctite
      b.  sécretàry     inhíbitòry    admónitòry
          eleméntary    reféctory     perfúnctory
```

The upper line exemplifies words with the second light syllable, and the lower line exemplifies those with the second heavy syllable. Now let us see how stresses in these words are assigned under this assumption:

```
(35)                            *             *
           *     *           (*    *)       (*)    *
         (*)   (*)         (*    *) (*)     (*)  (*)
       *  [*]  [*]   ->    (*)[*]  [*]   ->  *  [*]  [*]
       mollusc+oid         mollusc+oid       mollusc+oid
```

The stem and the suffix independently undergo stress assignment rules at level 1 producing stress for both of them, because they each constitute a stress domain. The leftmost structure in (35) represents the output from level 1, which serves as the input for level 2. The primary stress is assigned on the last syllable at level 2, as the second structure in (35) shows. The Rhythm Rule applies here because this structure has primary stress on the last syllable. Because the penultimate syllable bears the nearest stress, the primary stress falls on this syllable.

The reason for H & V's proposing this analysis is as follows. Since the Rhythm Rule applies at level 2, it would be predicted that the retracted stress should always fall on the antepenultimate syllable in all words in (34) in normal derivation, as the derivation in (36) suggests:

```
(36)             *                *             *
              (*)             (*    *)        (*)     *
       *   * [*]     -->    (*   *)[*]   -->  (*    *)[*]
       molluscoid           molluscoid        * molluscoid
```

Since level 2 metrification is quantity-insensitive (i.e. not subject to the Accent Rule), stress should be assigned on the first syllable for trisyllabic words, and this stress should serve as the landing site for the stress retraction. However, this prediction is wrong because the words in (34) suggest that there is a contrast between words whose second syllables are light and words whose second syllables are heavy.

This light/heavy distinction seems to be maintained if the last syllable would be treated as extrametrical, for in that case primary

stress can be assigned on the penultimate heavy syllable at level 1 by the Accent Rule. But this is impossible because the suffixes do have secondary stress if they are not adjacent to the stressed syllable. Note that extrametrical syllables never bear stress.

Therefore, to retain the light/heavy distinction for stress retraction, H & V employ special treatment for these suffixes; that is, these suffixes constitute stress domains in and of themselves (cf. (35)).
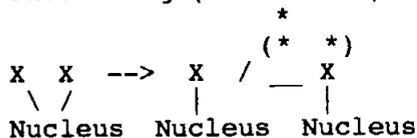
4.2. Problems

The interpretation of "stress domain" in H & V's analysis is as follows: a stem and a suffix each constitute "stress domains" at level 1. At level 2, stress rules apply to the whole string.[16] However, two problems arise with this "stress domain" analysis. The problems are concerned with shortening and stress retraction in disyllabic words. These two problems are taken up in order.

We notice that the shortening effects are observed in words with "stress domain" suffixes:

```
(37)  explain/explanatory        oblige/obligatory
      respire/respiratory        sign/signatory
```

The vowel underlined in original words is shortened when the suffix -ory is attached. H & V employ the following shortening rule in English:

```
(38)  Shortening (H & V: 253)
                           *
                        (*   *)
      X  X  -->  X  /  __  X
       \ /       |      |
     Nucleus  Nucleus  Nucleus
```

Stressed long vowels are shortened by this rule.[17] H & V assume that this rule applies at level 1, since words with non-cyclic suffixes do not undergo this rule (e.g. *kind* / *kindness*). However, as pointed out in Zamma (1993), the words in (37) do not satisfy the structural description of (38). The metrical structures of *explanatory* and *signatory* are shown in (39):

```
(39)        *        *          *          *
       (*    *) (*    *)     (*)  (*    *)
       (*) (*) (*)(*)        (*)  (*)(*)
       explan+ a tory¹⁸     sign+a tory
```

While the structural description in (38) requires the target of shortening to be the head of a binary foot, the vowels in question in (39) constitute a degenerate foot in and of themselves. To satisfy the description in (38), the suffix must be in the same stress domain as the stem:

```
(40)    *    *    *            *        *
       (*) (*  *)(*)         (*    *)(*)
       explana tory¹⁹        signa tory
```

However, the "stress domain" analysis cannot derive the structures in (40). Thus, the shortening of the vowels in the words in (37) is problematic for this analysis.[20]

Another problem with this analysis is that words with a "stress domain" suffix undergo the Rhythm Rule without exception. As we have seen in the previous section, there are some words with suffixes such as -*ate* which do not undergo the Rhythm Rule, especially when they consist of two syllables. Words with a "stress domain" suffix, however, do not show such examples; primary stress never falls on -*ary*, even in disyllabic words.

(41) a. prímàry²¹   únary   cóntrary
         rótary   númmary   térnary
      b. typhoid   glóboid   sárcoid
         cóncoid   ástroid   déltoid
      c. gráphite   hálite   pýrite
         kúnzite   próustite   sýlvite
      d. sénsory

If our analysis in section 3 is correct, this fact poses an important problem, because we have to mark these words seperately as undergoing the Rhythm Rule.

4.3. An Alternative Analysis

Halle and Idsardi (1992) and Idsardi (1992) propose that a

morpheme can have brackets lexically for stress assignment. Here we propose, following this assumption, that the suffixes like -ary in fact have this kind of lexical specification of brackets. We will thus abolish the special treatment of these suffixes as "stress domains".

```
(42)   )*          )*          )*          )*
       )*          )*          )*          )*
       -ary22      -ory        -oid        -ite
```

Unlike the languages discussed in Halle and Idsardi (1992) or Idsardi (1992), these suffixes must have bracket specification both on line 0 and line 1 because they never bear primary stress, but secondary stress.

Now let us see how the assumption in (42) works in detail. First we will examine disyllabic words. Note that disyllabic words containing these suffixes always have primary stress on the first syllable as we have seen in (41) (repeated here as (43)):

(43) a. prímàry   únary   cóntrary
         rótary   númmary   térnary
      b. typhoid   glóboid   sárcoid
         cóncoid   ástroid   déltoid
      c. gráphite   hálite   pýrite
         kúnzite   próustite   sýlvite
      d. sénsory

Lexical specification of brackets exactly predicts these stress patterns, as the derivation in (44) illustrates:

```
(44)                                       *
       )*              *)*              (*)*
      *)*      -->    (*)*      -->    (*)*
      primary         primary          primary
```

The first structure in (44) is the input; i.e. after suffixation. Because of the lexically-specified bracket, stress is assigned on the first syllable. Since a bracket is assigned also on upper line to construct a foot, primary stress falls on the first syllable. (The stress on the last syllable is eliminated by Stress Deletion because this stress is adjacent to a stronger stress.).

Recall that disyllabic words usually do not undergo stress retraction (cf. section 3). Since we do not attribute primary stress of

these words to the Rhythm Rule, the word-initial stress does not contradict our analysis proposed in section 3.3. Now we have solved the problem raised in section 4.2., that is, disyllabic words with these suffixes always show stress retraction.

Stresses in trisyllabic words are more interesting, because words of this kind show the light/heavy distinction of the second syllable. Observe the words in (45), originally listed as (34):

```
(45)  a. álkanòid      hóminòid      mágnetìte
         aráchnoid     ellípsoid     stalágmite
      b. sécretàry     inhíbitòry    admónitòry
         eleméntary    reféctory     perfúnctory
```

The words in the upper lines have light second syllables, while those in the lower lines have the heavy ones. The second syllable can bear primary stress only when the syllable is heavy. This fact is captured in our analysis, as we see in the sample derivations below:

```
(46)  a.                                  *
            )*           *   )*          (*)    *
       *  *)*    ->     (* *)*    ->     (* *)*
       hominoid         hominoid         hominoid

      b.                                  *
            )*           *   )*          (*)    *
       *  *  )*   ->    *(*)   *   ->    *(*)   *
       arachnoid        arachnoid        arachnoid
```

(46a) illustrates the derivation of words whose second syllable is light, while (46b) illustrates that of words with a heavy second syllable. Because level 1 metrification is quantity-sensitive, a heavy syllable can constitute a foot as the second structure in (46b) shows (note that a degenerate foot is not constructed on the first syllable). Just as we have seen for the case of disyllabic words, primary stress falls on the first or second syllable because of the specified bracket.

We have several words which do not have primary stress on the second syllables even though they are heavy. (47) shows examples of such words:

```
(47)  a. légendàry, mómentàry, frágmentàry, vóluntàry
      b. ínventòry, répertòry
```

However, we notice that the second syllable of these words end with a sonorant. Then, the destressing of the second syllable can be explained by a rule called Sonorant Destressing.

```
(48) Sonorant Destressing (H & V: 257)
     * --> . / *  _  *      line 1
            #*  *  *#       line 0
     where # represents a word boundary
     Condition: __ dominates a rime ending with a sonorant
```

This rule eliminates a stress on a syllable which ends with a sonorant, when the syllable lies between stressed syllables and the word consists of three syllables. Although H & V say that this rule applies at level 2, we assume that this applies at level 1. Since the reason H & V postulate this rule at level 2 is that they assume "stress domain" suffixes, it is possible for us to assume this when we abolish such an analysis.[23] See the sample derivation below:

```
(49)                                   *              *
         )*          *   *) *       (*   *) *      (*)     *
   *  *  )*    -> (*)(*)  *   -> (*)(*)  *   -> (*)*   *
   momentary     mo mentary     mo mentary     momentary
```

As in the derivation in (46b), primary stress is assigned on the second heavy syllable (cf. the third structure in (49)). Sonorant Destressing (48) eliminates this stress, and thus the stress on the first syllable becomes primary.

Words with more than three syllables do not undergo Sonorant Destressing because the rule applies only in trisyllabic words. The words listed in (50) can be explained by derivations such as in (51):

```
(50) a. eleméntary    compleméntary    suppleméntary
     b. satisfáctory  introdúctory
     c. annabérgite
```

```
(51)                                          *
          )*          *    *) *        (*     *) *
   *  *  *  )*    --> (*  *)(*)  *  --> (*  *)(*)  *
   elementary         ele mentary       ele mentary
```

Because of the Accent Rule, the penultimate heavy syllable constitutes a foot by itself. Primary stress is assigned on the stress which is the head of this foot.

Finally let us consider the problem concerning shortening, which was discussed in the previous section. This problem can be solved in our analysis, if we assume the following structure for -*atory*.

```
(52)    )*
       *)*
      -atory
```

With this assumption, we can explain the shortening phenomenon by the rule proposed by H & V (cf. (38)).

```
(53)                                          *
              )*         *   *  )*        (*    *)  *
     *    *  *)*   -->  (*) (* *)*  -->  (*) (* *)*
     explanatory        explanatory      explanatory
```

Note that the final structure in (53) satisfies the structural description of Shortening (38), for the relevant syllable is the head of a binary foot.

To sum up, the lexical bracket analysis explains the stress patterns of words with suffixes such as -*ary* and -*ory*. Moreover, the problems raised in section 4.2. can be solved, as we have seen in (44) and (53).

5.   Concluding Remarks

In this paper we have analyzed English stress retraction in two ways: the Rhythm Rule and bracket specification for some suffixes. We now summarize the analysis and make further comments below.

Suffixes which undergo the Rhythm Rule are -*ate, -ize, -fy,* and -*ply*. For the rule to apply properly we have refined the English stress assignment system in the following ways:

```
(54)  a. Degenerate feet are avoided.
      b. Level 2 metrification is quantity-insensitive.
      c. Level 2 metrification applies left-to-right,
         although it can be right-to-left for lexically
         marked cases.
```

With these assumptions, we have solved the problems raised in section 3.2. for H & V's analysis.

The suffixes which have lexical bracket specifications are *-ary*, *-ory*, *-ite*, and *-oid*. Our analysis has succeeded in solving the problems raised in section 4.2.

Notice that these suffixes are treated in H & V as constituting a stress domain in themselves. It will be possible to abolish the "stress domain" analysis completely when we can explain the stress behavior of words with *-ive*, only remaining suffix that is assumed to belong to this class in H & V.[24]

Notes

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1 All examples in this paper are taken from Kenyon and Knott (1944) and Wells (1990).

2 H & V say that "the application of the Rhythm Rule must be lexically governed (H & V: 235)."

3 H & V use the term *stratum* instead of *level*. But we are using the latter term because it is more familiar.

4 Rules that are irrelevant to stress assignment, such as shortening, are omitted in (4).

5 H & K do not adopt the metrification of this direction. As we will discuss later, this matter is important.

6 The original version of the Rhythm Rule is formulated in English (cf. H & V: 235).

7 In fact, H & V's Stress Enhancement, which arbitrarily places a stress on the first or second syllable of a word, allows the stress pattern for the words in (12). However, we do not adopt this rule because we can expect stresses on both of the syllable by means of the directionality of metrification.

8 H & V propose Shortening over Stress Wells, which shortens long vowels that lie between stresses. However, this shortening phenomena can be related to Reduction, and it seems unnecessary to postulate an independent rule like this. Moreover, according to Wells

(1990), *excitation* and *invocation* have alternative pronunciation with long vowels. Note that level 1 shortening is obligatory, thus *decision* never has an alternative like */desaiǰon/.

9 The other possibility in (13) is eliminated because we have assumed that degenerate feet are avoided at level 2.

10 H & K propose that some words, such as *apòtheósis*, *Apòllináris*, and *Epàminóndas*, receive initial extrametricality at level 2 metrification. It may be possible to account for the stress patterns of the words in (19) with this assumption, but this explanation is less plausible, because we have to activate this rule only for quadrisyllabic words. Recall that trisyllabic words with *-ate* and *-fy* have the primary stress on the first syllable. Therefore we will ignore this possibility.

11 The spirit of the Faithfulness Condition is as follows: an accent must be a head of a constituent. For the precise definition of this condition, see H & V, pp. 15-16.

12 There is only one example in which the first light syllable bears primary stress: *nárrate* in American pronunciation (*narráte* in Britain). The stress pattern *frústrate* may be an exception if we syllabify the word as *fru.strate* not as *frus.trate* (I am grateful to Yukiko Kazumi who pointed out this fact).

13 These are all the examples of trisyllabic words that I found in Wells (1990).

14 Of course, we have to assume that these words are exceptions also to Sonorant Destressing.

15 Interestingly, both British and American pronunciations show this pattern.

16 Yamada (1992) analyzes the "stress domain" in a different way: a "stress domain" corresponds to a word, that is, the string stem + suffix constitutes a compound. However we do not consider this interpretation since it is not clear in his analysis whether the whole string is completely equal to a compound.

17 Prince (1992) gives a theoretical explanation for why the head of a binary foot undergoes shortening. In his account, the foot [L L] is preferred to [H L] because a foot in which the size of its first member is equal to that of the second is better than a foot in which the size of each

member is different, as in the trochaic system. Note also that there are no feet [L H] in trochaic system, which means we can expect no shortening on the dependent of a foot.

18 H & V assume word-final *y* is regarded as a consonant in English. We adopt this assumption in our analysis in 4.3. Note that *y* in -*fy* is not included in this class because its pronunciation is /ai/.

19 Primary stress is not indicated because it is irrelevant here. Compare our analysis in 4.3., where primary stress is indicated.

20 H & V's Shortening over a Stress Well also does not account for this shortening because the relevant vowels are not in the position of "stress well" (note that the vowels have stresses). Yip's (1987) proposal that shortening occurs before consonant-initial suffixes seems to explain this at first glance (in this case the relevant vowels shortens before a consonant-initial suffix -*tory*). However, assuming that the vowel /a/ is inserted before -*tory* is problematic, because in such a case there is no prediction about where -*ory* occurs and where -*atory* occurs (both forms appear after consonant-final stems).

21 Only this word, among disyllables, has secondary stress on the suffix in Kenyon and Knott (1944). This word may be an exception to Stress Deletion. Wells (1990) does not make this distinction between *primary* and others.

22 Masao Okazaki (p.c.) points out that the asterisks in the upper line may be derived from the Accent Rule because these suffixes are heavy syllables. Though we do not deny this possibility, we will assume the structure in (43), because a structure like that below seems a little bit odd:

(i)   )
)*
      -ary

In this structure, only a bracket is present in the upper line, without a grid.

23 Since in the "stress domain" analysis metrical rules apply to the whole string the stem and the "stress domain" suffix at level 2 and not at level 1, Sonorant Destressing must be placed at level 2.

24 We ignore -*ive* in the present paper because we do not observe the stress retraction phenomena in words with this suffix.

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