Optionality in English Subsidiary Stress Assignment[*]

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0 Introduction

This paper seeks a possible solution to one of the lexical treatments of some of the Positional Functions proposed for English by Yamada (2010). We aim to show that setting a restricted order of application for a limited number of Positional Functions would be one possible way of minimizing such lexical treatment.[1]

Stress has been one of the major topics of phonology since the early days of generative grammar, and much studied so far. However, compared to primary (i.e. main) stress, comparatively less light has been shed on the mechanisms of subsidiary stress assignment. One of the main reasons why subsidiary stress has not attracted many researchers lies in its complexity and elusive data. An account of this issue has recently been presented in Yamada (2010). Thus, in this paper the account will be examined and one problem pointed out. We will then put forward a possible solution.

Of the previous studies dealing mainly with the issue of subsidiary stress assignment in English, Halle and Kenstowicz (1991) and Pater (1995, 2000) are prominent. However, a number of problems of these studies have already been highlighted in Yamada (2010). Thus, we will not dwell on them further in this paper.
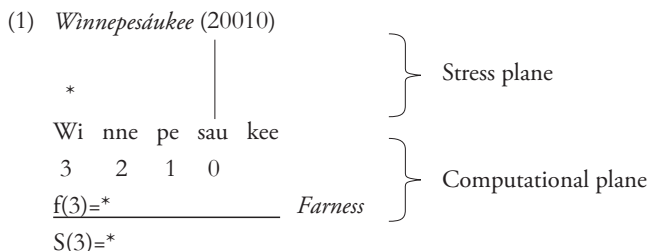
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[1] Note that this paper will not attempt to remove all lexical treatment from the grammar, rather to minimize it where possible. In this paper, "English" refers to American English.

Eiji Yamada

1 Overview of Positional Function Theory

Yamada (2010) suggests that the subsidiary stress rule of English is composed of 16 Positional Functions. For each word, a number of the Positional Functions are activated according to their specified conditions for application. The values of the Positional Functions triggered on specific positions are added vertically on the computational plane, and consequently mapped onto the stress plane to represent the subsidiary stress contour of the word.

To take a simple example, the Positional Function representation for the word *Winnepesáukee* (20010) is given as follows: [2]

(1) *Winnepesáukee* (20010)

```
         *                            ⎤
                     |                ⎬─ Stress plane
    Wi   nne   pe   sau   kee         ⎦
     3    2    1    0                 ⎤
    f(3)=*_____  Farness    ⎬─ Computational plane
    S(3)=*                            ⎦
```

Here, on the computational plane,[3] the Positional Function *Farness*, discussed below in (2), is triggered under the leftmost syllable *Wi*, which is numbered 3 indicating the *third* syllable position counted from the primary stressed syllable *sau*.[4] Since no other Positional Functions are triggered for this word, as discussed in detail in Yamada (2010), only the stress value of one "*" under the leftmost syllable is mapped onto the stress plane to give the single subsidiary stress of the word on the first syllable.[5]

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[2] Primary stress is represented by an acute accent (´), secondary stress by a grave accent (`), and tertiary stress by a circumflex (ˆ), followed by a numerical stress value enclosed in parentheses: 1 for primary stress, 2 for secondary, and 3 for tertiary.

[3] The numerals under the central segmental melody line indicate each syllable position counted leftward from the primary stressed position.

[4] Hereafter, syllabification will be by means of a standard method in generative phonology; see for example Steriade (1982), Clements and Keyser (1983), Levin (1985), and Clements (1990).

[5] $S(3) = *$ on the bottom line in (1) shows that the sum of the stress values on the syllable numbered 3 is *, i.e. one stress value *.

(2) *Farness* (*F*)

Subsidiary stress is placed as far left as possible from the position of primary stress, with the value "*" of the Function *Farness*, by means of the formula $f(x) = y$, i.e. $f(x) = *$.   (Yamada 2010: 206-207)

In the case of another word, *ântìcipátion*, three Positional Functions are used, *Heaviness*, *Trace*, and *Binarity*, as in (3):[6]

(3) *ântìcipátion* (< *antícipate*)

```
              +          |
  +           +          |
  an     (ti      ci)   pa    tion
  3       2        1     0
  h(3)=+   t(2)=+              Heaviness, Trace
           b(2)=+              Binarity
  ─────────────────────
  S(3)=+  <  S(2)=++                        (Yamada 2010: 190)
```

In this case, since the first syllable *an* is heavy, the *Heaviness* Positional Function is triggered under the syllable by means of the formula $h(3) = +$. The position of the second syllable *ti* is the position where primary stress is assigned to the stem verb *antícipate* of the derived noun *ântìcipátion*. Thus, *Trace* is triggered under the second syllable, i.e. $t(2) = +$, as well as *Binarity* at the same position, i.e. $b(2) = +$, since "the immediately following syllable is weak and unmarked for any other Function," which is one of the conditions for the application of *Binarity*.

So far, there are no problems: all the examples are properly accounted for within the framework of the Positional Function Theory proposed by Yamada (2010). Closer examination of the cases taken up in the next sections, however, reveals that certain Positional Functions contain an ambiguous wording within their statements.

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6   The Positional Functions used here are described as follows in Yamada (2010): *Heaviness* (*H*): assign stress "+" to the heavy syllable by the formula $h(x) = y$ with the stress value "+", i.e. $h(x) = +$; *Trace* (*T*): stress the position of a trace with a value "+" using the expression $t(x) = +$, where a trace is defined as a position of stress given on an earlier cycle; and *Binarity* (*B*): add "+" under a syllable position where a Positional Function *Trace* is given, using the expression $b(x) = +$, if and only if the immediately following syllable is weak and unmarked for any other Function.

2 Optionality of Positional Functions

2. 1 Meaning of the Term "Optionally" in *Free Binarity*: Its Use or Non-Use

According to Yamada (2010), the next example in (4) is accounted for with the help of the Positional Function *Free Binarity* in (5):

(4)   *ònomàtopóeia* (202010) (< Ø)

```
                              │
 +           +                │
(o     no)   (ma    to)   poei    a
 4      3     2      1      0
fb(4)=+     fb(2)=+            Free Binarity
S(4)=+   =   S(2)=+
```
                                                        (Yamada 2010: 280)

(5)   *Free Binarity* (*FB*)
      In a successive sequence of light syllables before a primary stressed syllable, an
      intrinsic Positional Function *Free Binarity* (*FB*) is *optionally* triggered on the
      left head of each binary constituent created leftward from the primary stressed
      syllable, placing a stress for each binary constituent by the formula $fb(x) = +$.
      [italics added]   (Yamada 2010: 279)

In (4), *Free Binarity* is activated under the left head of each binary constituent composed of light syllables: hence, $fb(4) = +$ and $fb(2) = +$ under the first and third syllables, respectively.

At first sight, there seems to be no problem with this analysis of the word *ònomàtopóeia* (202010) and its representation in (4). In fact, however, closer examination reveals that there is an ambiguity in the statement of (5), which would lead to an unsettled situation. The problem concerns the treatment of the italicized term in (5), that is, "optionally." What does "optionally" mean? Clearly it means "in an optional fashion" or "at our discretion," indicating here that we can choose whether or not to use the Positional Function in question. In other words, we could arbitrarily decide whether or not to use the Positional Function *Free Binarity* for each case under consideration. This will pose a serious problem for a system of rules. We will take up such a case in the following sections.

2. 2 Without *Free Binarity*: Lexical Treatment

As outlined above, theoretically it is possible that the Positional Function *Free Binarity* is not used for analysis of a word such as *ònomàtopóeia*, as matters now stand. Thus, the following is a result of an analysis and representation of the stress contour of the word if *Free Binarity* in (5) is *not* used:

(6)   *ònomàtopóeia* (202010) (< Ø)

```
                               |
    *
    *o      no     ma    to    poei   a
    4        3      2     1     0
    f(4)=*_____  Farness  in (2) [Free Binarity in (5) is
    S(4)=*                                          not used]
```

In (6), when *Free Binarity* in (5) is not used, only *Farness* in (2) is triggered, yielding an incorrect subsidiary (in this case secondary) stress on the first syllable, which does not reflect the actual stress pattern of the word.

Therefore, it would be necessary for the application of *Free Binarity* in (5) to a word such as *ònomàtopóeia* to be specified directly in the grammar. This would mean that we would have to resort to what is termed "lexical treatment," that is, describing the use of *Free Binarity* in the lexical representation, as something like:

(7)   Lexical Treatment: *onomatopoeia* <+FB>

<+FB> in (7) specifies that the application of *Free Binarity* in (5) is obligatory in the case of *onomatopoeia*. In other words, the inclusion of the term "optionally" in the statement of a Positional Function means that the Function needs to be treated *lexically*, i.e. we must use "lexical treatment" regarding the Function when a word with a specified <+FB> is analyzed. In addition, the Function has to be activated preferentially by definition when its condition for application is satisfied. Note, however, that this kind of ad hoc treatment should if possible be minimized in constructing an acceptable theory. To summarize, then, the term "optionally" in the statement of (5) results in a problem of lexical treatment. In the following section, therefore, in an attempt to minimize such treatment, we will examine what happens if we remove "optionally" from (5).

2. 3 Without Lexical Treatment: Removal of the Term "Optionally"

In this section, we will explore the possibility of removing the term "optionally" from the statement of (5). If "optionally" is removed, we will get the following new *Free Binarity* Positional Function in (8):

(8) *Free Binarity* (*FB*) without the term "optionally"
     In a successive sequence of light syllables before a primary stressed syllable, an intrinsic Positional Function *Free Binarity* (*FB*) is triggered on the left head of each binary constituent created leftward from the primary stressed syllable, placing a stress for each binary constituent by the formula $fb(x) = +$.

Now, since the Positional Function of (8) is not "optionally" applied, it should be applied obligatory if the condition for application is met. In this case, *Farness* in (2) and the new *Free Binarity* in (8) would both be activated in a word such as *ònomàtopóeia*, as follows:

(9) *ònomàtopóeia* (202010) (< Ø)

```
   *                              │
   +              +              │
  *(o     no)    (ma     to)    poei    a
    4      3      2       1       0
  f(4)=*                              Farness in (2)
  fb(4)=+          fb(2)=+            Free Binarity in (8) [without
  S(4)=+*    >    S(2)=+                             "optionally"]
```

However, the analysis in (9) is inappropriate, as secondary stress is incorrectly assigned to the first syllable, numbered 4, and tertiary stress to the third syllable, numbered 2.

In addition, if the term "optionally" is removed from the statement of *Free Binarity*, a new problem will arise. In the case of a word such as *Wìnnepesáukee*, its analysis and representation was not problematic when dealt with in (1), where the "optional" *Free Binarity* of (5) remained in our inventory of Functions but was *not* employed. On the other hand, if the *Free Binarity* of (8) without the term "optionally" is included in the inventory instead, the subsidiary stress pattern of *Wìnnepesáukee* (20010) will not be accounted for, as exemplified by (10):

(10)   *Wìnnepesáukee* (20010)

```
      *              +               |
    *?Wi          (nne     pe)      sau      kee
       3             2        1        0
     f(3)=*                                Farness in (2)
                  fb(2)=+                  Free Binarity in (8) [without
    ─────────────────────────────
     S(3)=*    =    S(2)=+                             "optionally"]
```

In this case, an incorrect stress will be assigned to syllable 2 because of the activation of *Free Binarity* on the syllable, since the condition for application is satisfied: namely, *Free Binarity* in (8) will be triggered on the left head of each binary constituent created on the light syllables leftward from the primary stressed syllable.

Let us summarize what we have seen in this section. We have tried to remove the term "optionally" from the statement of *Free Binarity* in (5), since this seems to be the cause of the problematic lexical treatment. If we keep the term "optionally" of *Free Binarity* in (5) intact, and at the same time *Free Binarity* in (5) is *not* used (by virtue of this non-use option), we will not be able to find a solution to such a case as *ònomàtopóeia* in (6). This will compel us to invoke a lexical treatment. Thus, in order to minimize lexical treatment in the grammar, we must remove the term "optionally" from the *Free Binarity* of (5) to create a new *Free Binarity* in (8). In spite of this remedy, however, we are unable to account for *ònomàtopóeia* in (9) and *Wìnnepesáukee* in (10) – in (10) because of an undesired activation of the new *Free Binarity* which is applied freely by definition if the condition for application is met, and in (9) because of the unnecessary application of *Farness* in (2) which is not blocked by the new *Free Binarity* of (8). We seem to have no way to solve the problem. In the next section, therefore, we will explore another possibility.

3 Partial Ordering of Positional Functions

In the preceding section, demonstrating that the term "optionally" is the cause of the problematic lexical treatment, we removed it from *Free Binarity* as in (8). Nevertheless, merely removing "optionally" does not solve the problem, but rather creates new problems. In this section, therefore, let us tentatively assume that there is an ordering among a few of the Positional Functions. The relevant ordering of Functions to be

examined here is of *Farness* in (2) and *Free Binarity* in (8).

First, suppose we have the following ordering as in (11a). The result of the analysis of *Winnepesáukee* will be as follows (11b):

(11) a.   Ordering: *Farness* in (2)   →   *Free Binarity* in (8)
       b.   *Winnepesáukee* (20010)

$$
\begin{array}{c}
\quad * \qquad\qquad\ + \qquad\qquad\ \big| \\
\text{*Wi} \qquad \text{(nne} \quad \text{pe)} \quad \text{sau} \quad \text{kee} \\
\ \ 3 \qquad\quad\ \ 2 \qquad 1 \qquad 0
\end{array}
$$

f(3)=*   *Farness* in (2)

$$\underline{\qquad\qquad \text{fb(2)=+} \qquad\qquad\qquad}$$ *Free Binarity* in (8)

  S(3)=*   =   S(2)=+

In (11b) *Farness* in (2) is first applied, followed by *Free Binarity* in (8). Notice here that they are not disjunctively ordered: namely, the application of the former will not block the application of the latter. However, the analysis and representation in (11b) is not a desired one with even stress on the first and second syllables, which does not reflect the actual stress pattern of 20010 without stress on the second syllable.

In that case, if the order is reversed as in (12a), what result can we obtain?

(12) a.   Ordering: *Free Binarity* in (8)   →   *Farness* in (2)
       b.   *Winnepesáukee* (20010)

$$
\begin{array}{c}
\qquad\qquad\ + \qquad\qquad\ \big| \\
\text{*Wi} \qquad \text{(nne} \quad \text{pe)} \quad \text{sau} \quad \text{kee} \\
\ \ 3 \qquad\quad\ \ 2 \qquad 1 \qquad 0
\end{array}
$$

$$\underline{\qquad\qquad \text{fb(2)=+} \qquad\qquad\qquad}$$ *Free Binarity* in (8)

  S(3)=Ø   <   S(2)+

Again, the result will be an incorrect analysis and representation, shown in (12b), where secondary stress is given to the second syllable by means of $fb(2) = +$ of the *Free Binarity* in (8). Here, the *Free Binarity* activated under the second syllable blocks the application of *Farness*, since "*Farness* is activated only when the same type of syllable

appears successively on the same level," as prescribed in Yamada (2010: 241). In (12b) the levels of the first and second syllables differ: the first syllable is a unary syllable, the second syllable a head of a binary constituent.

At first sight, it appears that consideration of an ordering of *Farness* in (2) and *Free Binarity* in (8) fails to compensate for undesirable outcomes resulting from the removal of the term "optionally" from the *Free Binarity* of (5). In fact, however, consideration of the ordering will save us from the deadlock, which will be shown in the next section.

4 Condition for *Free Binarity*

To find a solution to this problem, let us now compare the two analyses and representations in (11b) and (12b), since we do not wish to revert to a lexical treatment by restoring the term "optionally" in the statement of *Free Binarity*.

In (12b) we can find two defects: one is the undesired secondary stress placed on the second syllable *nne*; the other is no stress on the first syllable *Wi*. On the other hand, in (11b) we can find only one defect – placement of superfluous stress on the second syllable *nne*. In other words, (11b) is comparatively better than (12b). Thus, we will focus our attention on the analysis and representation in (11b).

The reason why the representation of (11b) is not permissible is that stress is incorrectly assigned to the second syllable by means of the *Free Binarity* of (8), since the light syllables numbered 2 and 1 both meet the condition for application, resulting in stress on the left head of the binary constituent. If the application of *Free Binarity* to this position is blocked, the undesired stress will not appear on the syllable numbered 2. Here, we propose that this be done with the help of the following condition for *Free Binarity*:

(13) Condition for *Free Binarity*
   Free Binarity may not be triggered on a Stress Protection Domain, by which we mean a domain that is composed of a stressed syllable immediately followed by a light syllable without any Functions triggered on it.

Once the condition is imposed on *Free Binarity*, the correct result will be obtained for *Winnepesáukee* as follows:

(14) *Wìnnepesáukee* (20010)

       |
  *

  <u>Wi   nne</u>   pe   sau   kee

   3   2   1   0

<u>f(3)=*   </u>   *Farness* in (2) [Triggering of (8) is blocked because

S(3)=*   of the condition for *Free Binarity* in (13)]

where a Stress Protection Domain is marked by the underline on the
segmental melody line.

Here, *Farness* is triggered first, as we have already set the order of the two Positional
Functions: namely, *Farness* in (2) followed by *Free Binarity* in (8). The *Farness* here
prompts the construction of a Stress Protection Domain "*Wi+nne*" "composed of
a stressed syllable immediately followed by a light syllable without any Functions
triggered on it." Thus, triggering of *Free Binarity* is blocked because the syllable
numbered 2 is already incorporated into a binary constituent of *Wi+nne* (underlined),
and is thus protected by the newly constructed Stress Protection Domain from being
used as a head of another constituent. This is a mechanism to block an incorrect
application of the *Free Binarity* of (8).

    In this section, we have proposed in (13) a condition for *Free Binarity* to ensure
a correct analysis of a word such as *Wìnnepesáukee*, as well as the following order of
application: *Farness* in (2) followed by *Free Binarity* in (8).

5 Verification and Remaining Issues

    Let us now examine whether the condition for *Free Binarity* in (13) and the order of
application work for another word. Here is an example:

(15) *àbracadábra* (20010) (< Ø)

        |
  +

  <u>ab   ra</u>   ca   da   bra

   3   2   1   0

<u>h(3)=+   </u>   *Heaviness* [Triggering of (8) is blocked]

S(3)=+

In this case, the Positional Function *Heaviness* is triggered under the first syllable by means of the formula $h(3)$ = +, in contrast to *Farness* activated in (14), since the first syllable is heavy in (15) which is the condition for *Heaviness*, as shown in footnote 6 above. The *Free Binarity* of (8) is not triggered under syllable number 2, since the position is protected by a newly created Stress Protection Domain. Note here that setting the order of application of *Heaviness* and *Free Binarity* is also necessary, namely *Heaviness* is followed by *Free Binarity*, as in (16):

(16)   Ordering: *Heaviness*   →   *Free Binarity* in (8)

If the order of application is reversed, we will find the same kind of problem again as in (12b). There seems to be a general ordering principle between those Functions without the term "optional(ly)" and those with it, which is an interesting issue to be examined in future research.[7]

The final example to consider is *ònomàtopóeia*, our starting point of the discussion in this paper. We can provide the following analysis and representation for the word, along with the ordering:

(17) a. Ordering: *Farness* in (2)   →   *Free Binarity* in (8)

   b. *ònomàtopóeia* (202010) (< Ø)

```
*                  +                |
o        no    (ma      to)    poei    a
4         3       2        1        0
f(4)=*                              Farness in (2)
            fb(2)=+                 Free Binarity in (8) [Partial
S(4)=*      =    S(2)=+                         blocking of (8)]
```

In this case, after the activation of *Farness* of (2), a Stress Protection Domain is created on a binary constituent "*o+no*" (underlined), which will block activation of the *Free Binarity* of (8) on the same constituent. Notice, however, that syllables 2 and 1 are

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[7]   Note that we are not setting a complete order for all the Positional Functions, but rather suggesting that there may be a restricted order of application among a few sets of the Positional Functions.

not covered by a Stress Protection Domain, as "no stress" is provided on the syllable numbered 2 except for "+" by means of $fb(2) = +.$[8] Consequently, on syllables 2 and 1 a binary constituent can be constructed by the *Free Binarity* of (8), giving stress to the constituent's head *ma* numbered 2, in contrast to syllables 4 and 3. Thus, we can obtain the correct representation with even-stressed subsidiary stresses before the primary stressed syllable.

To support the argument here, we give below a number of additional examples, which can be treated in a similar fashion as *ònomàtopóeia*:

(18) a. *Àpalàchicóla* (202010) (< Ø)
      b. *hàmamèlidánthemum* (2020100) (< Ø)

Note, however, that in the case of *ònomàtopóeia* (202010) in (19a) there is a variant pronunciation with a different stress pattern, shown in (19b):

(19) a. *ònomàtopóeia* (202010)
      b. *ònomâtopóeia* (203010)

In (19a) secondary stress is assigned to the first and third syllables, while in (19b) secondary and tertiary stress are assigned to the first and third syllables, respectively. While the pattern in (19a) is already accounted for in (17b), the pattern in (19b) requires additional consideration.

When the term "optionally" is removed from the statement, as in (8), and if there were no ordering between *Farness* and *Free Binarity*, the stress pattern of the representation in (9) would account for the stress variant *ònomâtopóeia* with a 203010 pattern. This option will not be employed here, however, since it will contradict our argument in favor of ordering. Then, what remains now is the representation in (17b). Namely, we have to augment the leftmost stress on the stress plane by one in this case. For this purpose, we could use the "optional" *Rhythmic Adjustment* (*RA*) Positional Function proposed by Yamada (2010), which reads as follows: "when an even-stressed pattern appears, augment the leftmost of the relevant syllables by one, by means of the

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[8] In this case, "stress" on the syllable numbered 2, except for "+" by means of $fb(2) = +$, is a condition for the construction of a Stress Protection Domain.

formula $ra(x) = *$." Notice, however, that this is another *optional* Positional Function, which needs to be reconsidered, and will be left open for future research.

6 Conclusion

In this paper, because the term "optionally" in (5) required us to apply a problematic lexical treatment, we have removed it from the statement of the *Free Binarity* Positional Function (20a). As we removed the term from the Positional Function, we had to introduce an ordering of application of *Farness* in (2) and *Free Binarity* in (8) – with *Farness* followed by *Free Binarity* (20b) – along with a condition for the application of *Free Binarity* (20c).

(20) a. Removal of Lexical Treatment from *Free Binarity* in Yamada (2010)
b. Ordering of Positional Functions: *Farness* in (2) → *Free Binarity* in (8)
c. Condition for *Free Binarity* with a new concept of a Stress Protection Domain (13)

In addition, we have shown that in order to account for variant pronunciations we need to make explicit the relationship and/or ordering of those Functions marked "optional" and those without this marking, which will be an interesting topic for future research.

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