# Prosodic Structure and Lexical Prefernces in Allomorph Selection

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It is well-known that allomorph selection is largely conditioned by phonolgocial structure of the base. The choice of one allomorph is determined by a specific phonological condition, while the other allomorphs occur with its complmentary conditions. This study explores the allomorph selction of English noun suffixation -*ce* and -*cy* from its base /-ənt/ ending adjectives (e.g., *abundant to abundance*, \**abundancy*, but *diligent* to *diligency*, \**diligence*). I propose that the favor of one allomorph to the other is attributed to the interaction of phonology and morphology by providing the anlaysis of stress-dependent suffixation of English allomorphy.

Keywords: phonological conditioning, prosodic structure, allomorph se-
    lection, stress, quantity sensitive

## 1. Introduction

It has been suggested that an allomorph selection is not random but systematically conditioned by knowledge of grammatical principles. The systematic condition regarding the choice of allomorphs are either phonological or morphological.

It is known as 'phonological conditioning' when the allomorph selection depends on the phonological environments (i.e., phonologically conditioned allomorph selection). That is, the allomorphs that attach to the roots are determined by the precediing sound. For instance, the /-s/ ending of the plural form in English has three allomorphs as in [-s], [-z] and [-əz] and the allomorph selection depends on the phonological condition of the preceding environment such as whether they appears after a voiced or voiceless consonant as in [kæts], [dəgz] and [wat∫əz].

Phonological conditioning includes the prosodic features of the base as well. It is widely known that the lexicon provides more than one allomorphs of one morphological category, and the 'prosodically-optimal allomorph' is selected after evaluation (Drachman *et al.,* 1995). Phonological conditioning is widely found in many langauges. Various languages provide cases of prosodically governed morphology in terms of stress-dependent suffixation. Swedish definite suffix allomorphy, for instance, has two allomorphs *-en* (after heteromorphemic nasals) and Ø (elsewhere). Thus, a nasal ending noun as in [pilgrim] '*pilgrim; stem, def.*' becomes [pilgrimen] while the other nouns are suffixed with Ø (Löfstedt, 2008). Haitian definite article has two allomorphs *-la* and *-a* wherein a C-initial *-la* occurs after consonant ending base and *-a* after vowel ending base as in *liv-la* 'the book' vs. *papa-a* 'father' (Klein, 2003).

On the other hand, there may be no explicit phonological pattern that the roots share with the allomorphs in common. Instead of the phonological link between the roots and the allomorphs of affixes, a specific allomorph associates with a specific morpheme. It is known as 'morphological conditioning' or morphologically conditioned allomorph selection. The irregular noun plurals in English are typical examples. The plural form of *ox* is *oxen* rather than *oxes* in which the plural marker *-en* is not phonologically associated with the root *ox* but lexically assigned.

In the study of allomorph selection, there have been several attempts to account for the systematic distribution of allomorphs according its phonological condition (Liberman and Prince, 1977; Bonet *et al.*, 2007, 2008; Drachman *et al.*, 1995; Kager, 1996). It is because to minimize the burden of lexical listing of individual allomorphs while morphologically specific allomorphs does not.

This study deals with a case of phonologically conditioned allomorph selection. I examine the prosodic structure of adjective roots and their noun suffixation in English. Specifically, the data is taken from the case of nomilization (i.e., *-ce* vs. *-cy* noun endings) from adjective bases (i.e., /-ənt/ adjective endings, which are spelled as *-ent* or *-ant*).

(1) *-ant/-ent* adjective bases and *-ce/-cy* allomorphsuffixation

|  | *-ce* ending noun | *-cy* ending noun |
|---|---|---|
| *-ant* ending adj | *abundant → abundance*<br>*\*abundancy* | *irritant → irritancy*<br>*\*irritance* |
| *-ent* ending adj | *diligent → diligence*<br>*\*diligency* | *fluent → fluency*<br>*\*fluence* |

As shown in (1), either *-ce* or *-cy* noun allomorphs are suffixed to /-ənt/ adjectives and each base is in favor of a certain allomorph. I argue that the allomorph selection which prefers one to the other (i.e., lexical preference) has to do with the properties of prosodic patterns of the roots. That is, the prosodic structure of the roots interacts with the affix allomorphs to complete the metrical structure. I also argue that the metrical structure matters in terms of syllable weight and stress assignment, which results in morphology-phonology interface.

This idea that phonology partly determines morphology was discussed in several previous studies (Malikouti-Drachman and Drachman, 1994; Drachman *et al.*, 1995; Mester, 1994; Kager, 1995 among others). They yielded theoretical accounts on the interaction of phonology-morphology, however, no corpus evidence was provided.

Below, I will provide quantitative analysis of corpus data and show comprehensive analysis of the data, which possibly contribute clear understanding of phonology-morphology interaction.

## 2. Stress Placement in English

English is known as a quantity-sensitive language wherein every syllable is treated as not equal but different in terms of its weight. They are either heavy (H) or light (L). Heavy syllables have long vowels, diphthong or coda while light ones have short vowels with no coda. The syllable weight determines feet assignment, and stress is in favor of heavy syllables.

English is famous for containing various etymologies and to have the messy nature of langauge data; thus, as for the rules, it is hard to pin

down a straightforward stress placement rules. Nevertheless, some of generalized rules are widely accepted, which are described below.

(2) English Stress Placement Rules (Kager, 1989; Roca and Johnson, 1999)
    1. All lexical items have a stress. e.g., *pút*
    2. If the final vowel is long, it is stressed. e.g., *kangaróo*
    3. Heavy penults are stressed, e.g., *agénda* (Mester, 1994)
       light penults are antepunult-stressed. e.g., *Cánada*
    4. "Maximality of Stress Placement: Stress is on the antepenult whenever it can, otherwise on the penult" (Kager, 1989: 29). e.g., *América*

Every English word contains at least one lexical stress. When it ends with a long vowel, stress is placed on that syllable. Stress assignment varies depending on the weight of penultimate syllables. Finally, antepenult stress overrides penult stress, especially in word ending in nominal suffixes due to the extrametricality. These rules can be explained by moraic accounts as follows:

(3) Moraic accounts of English adjective stress (revised from H-Y Kim, 2000: 69)
    a. *with heavy penult:* penultimate stress
      $\mu$ $[\mu \ \mu]$ .              moraic trochee
      abun<dant >           extrametricality

    b. *with light penult:* antepenultimate stress
      $[\mu \ \mu]$ .               moraic trochee
      dili<gent>            extrametricality

English stress assignment is weight-sensitive trochaic footing with the ultimate syllable extrametrical. This stress assignment results in heavy penults being stressed, and light penults yield the stress to antepenults.

    Now, let us apply the set of stress placement rules to our /-ənt/ data.

Eight patterns of stress placements in English trisyllabic /-ənt/ ending adjectives are discribed in (4), and the adjective bases have one of the following patterns:

(4) Eight Patterns by Stress Placement and Syllable Weight

| Patterns | Example words | Nominalized |
|---|---|---|
| 1. Ľ L X | *réverent* | *réverence* |
| 2. L Ľ X | *efficient* | *efficiency* |
| 3. H L X | *ámbient* | *ámbience* |
| 4. H Ľ X | *incéssant* | *incéssancy* |
| 5. L H X | *abúndant* | *abúndance* |
| 6. Ľ H X | N/A | |
| 7. H H X | *obsérvant* | *obsérvance* |
| 8. H H X | N/A | |

Syllables can be either light or heavy, and either stressed or unstressed, which generate 8 patterns. The final syllable /-ənt/ ending is always heavy and denotes as X. As the example words show, the adjective roots select either *-ce* or *-cy* as their suffixes. Please note that *-ce* allomorph is selected for Patterns 1, 3, 5 and 7, while *-cy* for Pattern 2 and 4. Pattern 6 and 8 are not attested.

When a base selects one allomorph to the others by phonological conditioning, the difference of phonological environment should be specified as in the plural suffix example in English. The key difference of the allomorphs *-ce* and *-cy* lies on syllable counts. With *-ce* suffixation, the total number of syllables of the base does not change. However, *-cy* increases the number of syllables by adding one extra syllable after suffixation. In other words, *-ce* does not influence the base in terms of syllable numbers but *-cy* does. This difference of the two allomorphs *-ce* and *-cy* is crucial due to the fact that English is quantitiy sensitive langauge.

In fact, the difference is deeply involved with the eight patterns. According to the Rule #3 in (2), light penults yield stress to antepenults as in LLX (Pattern 1) and HLX (Pattern 3), and heavy penults are stressed as in LHX (Pattern 5) and HHX (Pattern 7). In short, Patterns 1, 3, 5 and 7 complies with the English Stress Placement Rule #3 descibed in (2). These four patterns have well-formed bases in terms of pro-

sodic structure, therefore, the bases does not need to be modified in some way through suffixation. Rather, it is pefered to preserve the number of syllables after suffixation in order not to affect the base structure.

Yet, Pattern 2 and 4 work differently. The stress patterns of the bases in LĹX (Pattern 2) HĹX (Pattern 4) do not coincide with the general English rules. Light penults are unstressed when another stresseable syllables exist regardless of their weight. It can be arguably said that LĹX and HĹX stress patterns do not follow typical stress rules; thus, the stress patterns need to be modified in some way when possible in order to be more acceptable.

Morphological process such as suffixation is one of 'when possible' strategies for the syllables to be more acceptable. In the English *-ce* or *-cy* selection, by employing *-cy* rather than *-ce* allomorph, the syllable counting can be modified. It should be observed that *-cy* suffixation increase the total number of syllable counting. After the suffixation, the stressed penults are no longer penults. They become the stressed antepenults, which satifies the general stress placement Rule #4 described in (2). Adopting *-cy* instead of *-ce* improves the prosodic structure, so *-cy* is preferred for phonological reasons in Pattern 2 LĹX and Pattern 4 HĹX.[1]

To sum up, it is suggested that when the stress assignment of the base forms is adequate and well-formed (i.e., follows general English stress assignment rules), the base slects an allomorph that does not influence its syllable counting. On the other hand, when the stress assignment of the base forms is inadequate and ill-formed (i.e., do not follow the rules), the base selects one that possibly modifies its prosodic structure.

The phonological structure of the base conditions the choice of the proper allomorph, and *-ce* vs. *-cy* allomorph selection is apparently governed by the foot structure of the adjective bases. Allomorph selection never operatates in the way of producing ill-formed strurcture. That is, after undergoing a morphological process, a lexical item can only be im-

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1) One of my anonymous reviewers pointed out that the -*cy*suffixofthePattern2and4yieldsLĹ HX and HLĹHX respectively, and it still violates Rule #3. The violation of Rule #3 motivates the suffixation of -*cy*,whichnowsatisfiesRule#4.

proved in terms of its phonological structure. Morphological processes do not generate ill-formed items. Therefore, it can be suggested that the phonological configuration predicts (i.e., *governs*) the allomorph selection.

Below, I will examine phonologically governed allomorph selction in English in terms of corpus data analysis. I will explore the stress patterns of the adjective bases and the base-affix combination. The results of the corpus data will support the argument that the allomophy is completed by the considertation of phonology and morphology.

## 3. Corpus Data Analysis

After having shown English stress placement, this section investigates the previously discussed idea by means of corpus data analysis. The corpus data examined here is CELEX lexical database (Baayen *et al.*, 1995) of British English. All adjective bases and allomorphs were collected, and items that do not have its noun forms were excluded. The corpus also excludes disyllabic adjectives wherein it is difficult to figure out the stress pattern by syllable weight. Additionally, nominalized words that have different meaning from its bases are excluded as well (e.g., *president* vs. *presidency*).

CELEX contains word features such as syllable boundary which is marked as [ ] as below. The table in (5) illustrates the relevant words collected in CELEX.[2]

(5) Base Syllable Patterns and Example Lexical Items

| Patterns | expected | Item # | Lexical Items | |
|---|---|---|---|---|
| | | | Adjective | Noun |
| 1. Ĺ L X | *ce* | 1 | [a][rro][gant] | [a][rro][gance] |
| | | 2 | [de][ca][dent] | [de][ca][dence] |
| | | 3 | [di][ffi][dent] | [di][ffi][dence] |

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2) English words that end with -scent as in *candescent or putrescent* are not part of the collected data. -scent seems to has its own etymology that is not relevant to *-ant* or *-ent* ending bases.
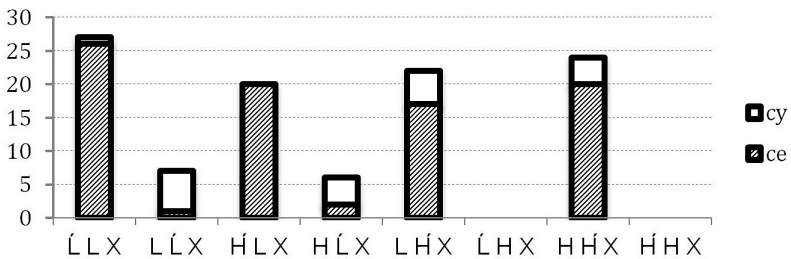
| | | | | |
|---|---|---|---|---|
| **1. Ĺ L X** | *ce* | 4 | [di][li][gent] | [di][li][gence] |
| | | 5 | [di][ssi][dent] | [di][ssi][dence] |
| | | 6 | [di][sso][nant] | [di][sso][nance] |
| | | 7 | [do][mi][nant] | [do][mi][nance] |
| | | 8 | [e][le][gant] | [e][le][gance] |
| | | 9 | [e][lo][quent] | [e][lo][quence] |
| | | 10 | [e][mi][nent] | [e][mi][nence] |
| | | 11 | [e][vi][dent] | [e][vi][dence] |
| | | 12 | [fla][tu][lent] | [fla][tu][lence] |
| | | 13 | [mi][li][tant] | **[mi][li][tan][cy]** |
| | | 14 | [o][pu][lent] | [o][pu][lence] |
| | | 15 | [pe][ni][tent] | [pe][ni][tence] |
| | | 16 | [pe][sti][lent] | [pe][sti][lence] |
| | | 17 | [pe][tu][lant] | [pe][tu][lance] |
| | | 18 | [pre][ce][dent] | [pre][ce][dence] |
| | | 19 | [pre][va][lent] | [pre][va][lence] |
| | | 20 | [pro][mi][nent] | [pro][mi][nence] |
| | | 21 | [pro][vi][dent] | [pro][vi][dence] |
| | | 22 | [re][do][lent] | [re][do][lence] |
| | | 23 | [re][so][nant] | [re][so][nance] |
| | | 24 | [re][ti][cent] | [re][ti][cence] |
| | | 25 | [su][ccu][lent] | [su][ccu][lence] |
| | | 26 | [to][le][rant] | [to][le][rance] |
| | | 27 | [vi][gi][lant] | [vi][gi][lance] |
| **2. L Ĺ X** | *cy* | 1 | [de][fi][cient] | [de][fi][cien][cy] |
| | | 2 | [de][te][rrent] | **[de][te][rrence]** |
| | | 3 | [di][scre][pant] | [di][scre][pan][cy] |
| | | 4 | [e][ffi][cient] | [e][ffi][cien][cy] |
| | | 5 | [pro][fi][cient] | [pro][fi][cien][cy] |
| | | 6 | [re][cu][sant] | [re][cu][san][cy] |
| | | 7 | [su][ffi][cient] | [su][ffi][cien][cy] |
| **3. H L X** | *ce* | 1 | [ab][sti][nent] | [ab][sti][nence] |
| | | 2 | [am][bu][lant] | [am][bu][lance] |
| | | 3 | [cog][ni][zant] | [cog][ni][zance] |
| | | 4 | [con][fi][dent] | [con][fi][dence] |
| | | 5 | [con][se][quent] | [con][se][quence] |
| | | 6 | [con][so][nant] | [con][so][nance] |
| | | 7 | [con][ti][nent] | [con][ti][nence] |
| | | 8 | [ex][ce][llent] | [ex][ce][llence] |
| | | 9 | [frau][du][lent] | [frau][du][lence] |
| | | 10 | [ig][no][rant] | [ig][no][rance] |
| | | 11 | [im][po][tent] | [im][po][tence] |
| | | 12 | [in][ci][dent] | [in][ci][dence] |
| | | 13 | [in][di][gent] | [in][di][gence] |
| | | 14 | [in][do][lent] | [in][do][lence] |
| | | 15 | [in][so][lent] | [in][so][lence] |
| | | 16 | [neg][li][gent] | [neg][li][gence] |

| | | | | |
|---|---|---|---|---|
| | | 17 | [per][ti][nent] | [per][ti][nence] |
| | | 18 | [pu][ru][lent] | [pu][ru][lence] |
| | | 19 | [som][no][lent] | [som][no][lence] |
| | | 20 | [vi][o][lent] | [vi][o][lence] |
| **4. H Ľ X** | *cy* | 1 | [ab][ho][rrent] | **[ab][ho][rrence]** |
| | | 2 | [con][sti][tuent] | [con][sti][tuen][cy] |
| | | 3 | [in][cle][ment] | [in][cle][men][cy] |
| | | 4 | [lieu][te][nant] | [lieu][te][nan][cy] |
| | | 5 | [om][ni][scient] | [om][ni][science] |
| | | 6 | [in][de][cent] | [in][de][cen][cy] |
| **5. L H X** | *ce* | 1 | [a][bey][ant] | [a][bey][ance] |
| | | 2 | [a][bun][dant] | [a][bun][dance] |
| | | 3 | [a][scen][dant] | **[a][scen][dan][cy]** |
| | | 4 | [a][ssi][stant] | [a][ssi][stance] |
| | | 5 | [a][strin][gent] | **[a][strin][gen][cy]** |
| | | 6 | [a][tten][dant] | [a][tten][dance] |
| | | 7 | [de][fi][ant] | [de][fi][ance] |
| | | 8 | [de][lin][quent] | **[de][lin][quen][cy]** |
| | | 9 | [de][spon][dent] | **[de][spon][den][cy]** |
| | | 10 | [di][scor][dant] | [di][scor][dance] |
| | | 11 | [e][bul][lient] | [e][bul][lience] |
| | | 12 | [e][fful][gent] | [e][fful][gence] |
| | | 13 | [ma][lig][nant] | **[ma][lig][nan][cy]** |
| | | 14 | [o][be][dient] | [o][be][dience] |
| | | 15 | [per][sis][tent] | [per][si][stence] |
| | | 16 | [re][ful][gent] | [re][ful][gence] |
| | | 17 | [re][li][ant] | [re][li][ance] |
| | | 18 | [re][luc][tant] | [re][luc][tance] |
| | | 19 | [re][pen][tant] | [re][pen][tance] |
| | | 20 | [re][pug][nant] | [re][pug][nance] |
| | | 21 | [re][sis][tant] | [re][si][stance] |
| | | 22 | [re][sur][gent] | [re][sur][gence] |
| **6. Ľ H X** | N/A | | | |
| **7. H H X** | *ce* | 1 | [ad][he][rent] | [ad][he][rence] |
| | | 2 | [ad][ver][tent] | [ad][ver][tence] |
| | | 3 | [clair][voy][ant] | [clair][voy][ance] |
| | | 4 | [com][plai][sant] | [com][plai][sance] |
| | | 5 | [com][pli][ant] | [com][pli][ance] |
| | | 6 | [con][cor][dant] | [con][cor][dance] |
| | | 7 | [con][sul][tant] | **[con][sul][tan][cy]** |
| | | 8 | [con][tin][gent] | **[con][tin][gen][cy]** |
| | | 9 | [con][ve][nient] | [con][ve][nience] |
| | | 10 | [con][ver][gent] | [con][ver][gence] |
| | | 11 | [ex][xi][stent] | [ex][xi][stence] |
| | | 12 | [flam][boy][ant] | [flam][boy][ance] |

| | | | | |
|---|---|---|---|---|
| | | 13 | [im][por][tant] | [im][por][tance] |
| | | 14 | [im][pu][dent] | [im][pu][dence] |
| | | 15 | [in][cum][bent] | **[in][cum][ben][cy]** |
| | | 16 | [in][dul][gent] | [in][dul][gence] |
| | | 17 | [in][sol][vent] | **[in][sol][ven][cy]** |
| | | 18 | [in][sou][ciant] | [in][sou][ciance] |
| | | 19 | [lux][xu][riant] | [lux][xu][riance] |
| | | 20 | [mal][fea][sant] | [mal][fea][sance] |
| | | 21 | [o][bei][sant] | [o][bei][sance] |
| | | 22 | [ob][ser][vant] | [ob][ser][vance] |
| | | 23 | [sub][ser][vient] | [sub][ser][vience] |
| | | 24 | [sub][sis][tent] | [sub][si][stence] |
| 8. **H H X** | | N/A | | |

Each pattern has its own expected allomorph, and the lexical items that do not meet the expected form is marked as underlined. The frequencies according to each pattern can be shown as follows:

(6) CELEX token frequencies of *-ce* and *-cy* suffixation by base patterns



The figure describes the allomorphy of *-ce* and *-cy* according to the base patterns. The y-axis shows the raw number of token frequency by the token (i.e., eight patterns). In general, it was found that *-ce* ending words are more frequently attested than *-cy* ending ones, which means that *-ce* is much more frequently selected allomorph than *-cy*.

It should be observed that (i) when *-ce* is expected as in Pattern 1 ĹLX and Pattern 3 HLX, Pattern 5 LHX and Pattern 7 HHX, the majority met the expected pattern by adopting *-ce* allomorph, and that (ii) when *-cy* is expected as a proper allomorph as in Pattern 2 LĹX and 4 HĹX,

*-cy* was largely selected. That is, the result of the corpus data shows that the actual lexical items are consistent with the suggested analysis.

## 4. Conclusion

In this study, it was shown that the distribution of allomorphy in suffixation depends on the prosodic structure of the base, and that the structure of the base involves syllable weight and stress pattern. The syllable weight and stress assignment operate and produce eight patterns. Among the eight patterns, two of them were unattested in actual corpus data. The rest six patterns showed that the allomorphy of each base matched to the expected allomorph selection.

The corpus data showed that the allomorph selection of English nominalization *-ce* and *-cy* involves morpheme-specific stress realization. One allomorph *-ce* is preferred in ĽLX, LHX, HLX and HHX since it does not adversely affect the stress assignment. On the other hand, it is implied that LĽX, (ĽHX), HĽX and (HHX) patterns are not natural and so not desirable, which means the undesirable stress assignment needs to be improved. The unnaturalness can be solved by choosing the other allomorph -cy. The idea that the allomorphy is processed in the way of generating a not-ill-formed struture is known as *output optimization model* (Kager, 1996). The morphological operation is processed to complete base-plus-affix structure, which means the best fit allomorphs are selected in the morphological process.

The analysis of phonologically conditioned allomorphy in English has following theoretical consequences. It was shown that the allomorph selection of *-ce* and -cy is not random but fully prosody-governed. The internal structure of syllables such as syllable weight and the number of syllables can straightforwardly account for the allomorphy. The phonological structures are deeply involved in the choice of allomorphs in the way of *-ce* being chosen when the base is properly stressed, and *-cy* when it is not.

Allomorphy is prosodically conditioned, that is, phonologically gov-

erned, thus, the proper allomorph can be determined by the structure of each base. The influence of syllable weight and stress of the base, makes it possible to predict correct allomorph selection. For language learners, it would be a great advantage in that they avoid memorizing a specific allomorph for each base.

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