Phonological Requirements on Suffixation*

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1. Introduction

In the literature of generative phonology, the primary concern with regard to suffixation has been what happens to a word as a whole when a suffix attaches to a stem; e.g. vowel shortening, spirantization, stress movement, and so on. In other words, little attention has been paid to a suffix itself on suffixation. There has been little discussion of an issue such as what kind of suffix can attach to what kind of stem. Even when such a problem arises in an analysis, it has been reduced simply to the 'allomorphy' of a suffix, which is determined by stems.

In this paper, therefore, I will provide a new approach to suffixation in English, which focuses primarily on suffixes, not on stems. With this approach, I will try to account for some of the seeming 'allomorphy' phenomena in English. Before I provide the analysis, let us briefly survey the basic assumptions on suffixation in traditional generative phonology.

1.1 Overview of Previous Analyses

As I have just mentioned, there have been few analyses on suffixation that pay attention to suffixes. When 'allomorphy' emerges in an analysis, most studies have treated it in a way such as the following; one form appears in a certain environment (say, when the stem ends with certain segments, etc.), and another form otherwise. This kind of analysis clearly focuses on stems rather than suffixes, in the sense that a form of a suffix is *selected*, depending on the environment. No condition or restriction is assumed for suffixes.

Actually, there is only one condition for suffixes postulated in previous studies. In the framework of Lexical Phonology, advocated by Kiparsky (1982), it is assumed that suffixes belong to one of two classes, i.e. Level 1 or Level 2, and that Level 1 suffixes do not attach to Level 2 suffixes: since Level 1 precedes Level 2, Level 2 suffixes can attach to Level 1 suffixes, but not vice versa. Note that many phonological phenomena are accounted for in this framework. Vowel shortening, for example, can be analyzed as applying only to words with Level 1 suffixes, since the rule is distributed to Level 1 and Level 2 suffixes are attached after shortening. However, no other restriction is postulated for suffixes in this theory.

There is just one study that analyzes suffixation by paying attention to suffixes per se.

Fabb (1988) tries to capture English suffixation by positing selectional restrictions on suffixes. Specifically, in addition to the restriction of level-ordering, Fabb proposes that some suffixes are specified as not attaching to an already-suffixed word, and that others are specified as attaching outside one other suffix. This analysis succeeds in answering the question why only a limited combination of suffixes can be found in English although there are much more combinations that are logically possible. Unfortunately, however, Fabb does not discuss the problem of allomorphy, because it is not his concern.

1.2 A New Approach

What is important in Fabb's paper is the idea that suffixes, not stems, are provided with some restrictions. In this paper, expanding this idea, I will make the following proposal: some suffixes are endowed with phonological restrictions. In other words, I will posit segmental and prosodic restrictions on suffixes, although Fabb postulated only selectional ones. And I will propose that some of the 'allomorphy' problem can be accounted for by means of these restrictions. In what follows, we will examine some concrete examples in English.

2. -ory and -ive

2.1 An Analysis under the New Approach

The suffixes -ory and -ive are highly productive and we can list many examples containing them. Some are shown in (1).

(1)　a.　dismissory (< dismiss), sensory (< sense), vomitory (< vomit),
　　　　　depository (< deposit), contributory (< contribute)

　　　b.　reflexive (< reflex), regressive (< regress), active (< act),
　　　　　effective (< effect), prohibitive (< prohibit), possessive (< possess)

In the words in (1), -ory and -ive are attached directly to the stems. However, this is not the case for the words in (2).

(2) a. signatory (< sign), reformatory (< reform), observatory (< observe),
          declaratory (< declare), inflammatory (< inflame)

     b. accusative (< accuse), conservative (< conserve), provocative (< provoke),
          comparative (< compare), affirmative (< affirm)

In these words, the forms *-atory* and *-ative*, not *-ory* and *-ive*, are attached to the stems. In previous studies, this phenomenon is often analyzed simply by postulating certain allomorphs for *-ory* and *-ive*. Here, neglecting this traditional analysis, we will propose that this difference in form is brought about by phonological requirements specified for the suffixes. Notice that our analysis requires just *-ory* and *-ive* but no allomorphs.

The analysis to be presented here is as follows. First, we will propose that *-ory* and *-ive* have a lexical specification as follows.

(3) *-ory* and *-ive* attach to stems which end with a voiceless coronal obstruent
     (i.e. /s/ and /t/).[1]

Notice that all the stems in the words in (1) have /s/ or /t/ at the end while those in (2) do not. We also propose that when the specification in (3) is not satisfied, the suffix *-ate* is brought in to satisfy the requirement. The last consonant of *-ate* clearly satisfies (3).

The question then naturally arises: Why must it be *-ate* that is brought in? We will answer this question by assuming that *-ate* is a suffix that has a special status. Because of this characteristic, the suffix is called upon when the situation demands. There are two facts which suggest that *-ate* behaves in a special way. One is shown in the suffixation of *-able*, as we will see in the following section: *-ate* is deleted when *-able* is attached to it. The other is exemplified in the accentuation of the words in (2). The suffix refuses to bear primary stress even when that stress would fall on the suffix. (For the detail, see Zamma (1993).)

Next we will consider the following examples:

(4) a. introductory (< introduce)

     b. subjunctive (< subjoin), subscriptive (< subscribe)
          introductive (< introduce), perceptive (< perceive)

In these words, the forms *-tory* and *-tive* seem at first glance to be attached to the stems (we will ignore segmental changes such as /b/ to /p/). However, positing such allomorphs is not necessary in our analysis. First, notice that words which have *-tory* or *-tive* are limited to those which have particular roots *-join*, *-scribe*, *-duce*, and *-ceive*. Interestingly, for each of these roots there is a form which ends with the noun-forming suffix *-t*.[2]

(5)   a.   -join/-junct

adjoin/adjunct, conjoin/conjunct

b.   -scribe/-script

transcribe/transcript, prescribe/prescript

c.   -duce/-duct

produce/product, conduce/conduct

d.   -ceive/-cept

conceive/concept, perceive/percept

This fact suggests that *-junctive*, for example, is derived by attaching *-ive* to *-junct*, rather than by attaching *-tive* to *-join*. Otherwise we cannot capture the fact that it is always the words with the roots in (5) that have the forms *-tory* and *-tive*. However, we notice that not all the words in (4) have the corresponding form in (5). Thus, we conclude that these suffixes are specified as selecting the noun-forming suffix *-t* over the default suffix *-ate* to satisfy (3): when the suffix is introduced, the same segmental change occurs to the form that words in (5) undergo. Note that this analysis is only possible with the assumption we have just made; that is, a certain suffix is introduced to satisfy a lexical specification.

The following words can be accounted for in the same way. Postulation of allomorphs such as *-icatory* or *-icative* is not necessary.

(6)   a.   applicatory (< apply), justificatory (< justify)

b.   significative (< signify), multiplicative (< multiply)

First, we notice that the root *-ply* and the suffix *-fy* have the following forms when they are attached by *-ate*.

(7)   a.   pacificate (< pacify), vivificate (< vivify)

   b.   implicate (< imply)

Thus, we can assume that *-ory* and *-ive* are attached to these forms, that is, to the forms in which *-ate* is introduced to satisfy (3). Since not all the words in (6) have the corresponding words as in (7), we assume that it is the property of *-ply* and *-fy* that they constitute the form in (7) when *-ate* is introduced (note that a form like **appliatory* would not violate the condition in (8)). All we have to do here is then to clarify why the words in (7) have the sequence *-ic-* between the stem and *-ate*. We propose that this is another suffix which is introduced to satisfy another condition; that is, the adjective forming suffix *-ic*.

Now we recall that Strauss (1980) proposes the following constraint in English word-formation (the abbreviation "V" stands for verb, and "A" stands for adjective).

(8)   * V
               / \
              V   X

This constraint says that a verb-forming suffix cannot attach to a verb.[3] The words in (7) are easily accounted for by means of this condition. If *-ate* were attached to *imply* with nothing intervening between them, the form would violate the condition in (8): **impliate*. We will illustrate this in (9).

(9)   * V
               / \
              V   -ate
             / \
           im -ply

The verb-forming suffix *-ate* is attached to the verb *imply* in this form. On the other hand, when *-ic* is introduced between the stem and *-ate*, the form never violates the condition.

(10)
```
              V
             / \
            A   -ate
           / \
          V   -ic
         / \
       im   -ply
```
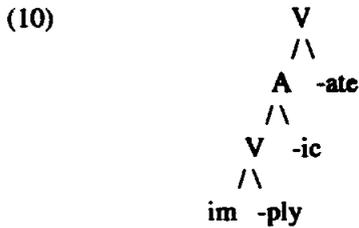
The words in (7) are produced in this way; that is, by introducing *-ic* in order not to violate the condition (8). The suffixes *-ory* and *-ive* are attached to these forms, producing the words in (6). As we have seen, positing allomorphs is unnecessary in our analysis with the idea of 'introducing something' to satisfy some restrictions.

The words in (11) also seem to be accounted for by our analysis.

(11) expansive (< expand), decisive (< decide), abrasive (< abrade)

In these words, the last consonant of the stem undergo a segmental change; i.e. from /d/ to /s/. Chomsky and Halle (1968) analyzed this phenomenon by means of the rule called Spirantization, which turns /d/ to /z/, and a subsequent devoicing rule, by which /z/ becomes /s/. However, this analysis is insufficient in that the following two points remain unclear. First, although it is usually the segment /i/ which is followed by another vowel, or the glide /y/ (cf. Rubach (1984), Halle and Mohanan (1985), etc.), that causes Spirantization, the /i/ in *-ive* does not correspond with this generalization. Note that *-ity* does not cause Spirantization; cf. *stupidity*. Second, the devoicing rule applies only when *-ive* follows the target consonant. It is necessary for the previous analysis to account for these two facts. On the other hand, our analysis provides a reasoning for them. Recall that we have posited the lexical specification in (3) for *-ive*. We can say that the last consonant /d/ becomes /s/ to satisfy this specification.

In fact, there are some more words in which the last consonant of the stem seems to be replaced with another consonant. Consider the following examples.

(12) a.   /z/ → /s/: abuse/abusive, effuse/effusive

      b.   /r/ → /s/: cohere/cohesive, adhere/adhesive

      c.   /ʃ/ → /t/: admonish/admonitory, punish/punitory

We will not argue how we can formulate the rules to account for the segmental change in the words in (12), since what is important here is the fact of the replacement of the stem-final consonant. Note that both /s/ and /t/ satisfy the specification in (3).

Finally, we will consider some exceptional cases. We find that some words do introduce -ate even when the stem ends with a voiceless coronal obstruent. The words in (13) are some of examples of these.

(13) a.   consultatory (< consult), gustatory (< gust), exhortatory (< exhort)

b.   argumentative (< argument), condensative (< condense), adversative (< adverse)

Because the stem *exhort* ends with /t/, a form like *exhortory* is predicted.[4] Contrary to our prediction, -ate is introduced before the suffix. However, we notice that the last consonant of the stems in (13) have a sequence C + {/t/, /s/} at the end, not just /t/ or /s/. Moreover, the consonants preceding /t/ or /s/ have the same specification for the place feature; i.e. [coronal/anterior]. Therefore, the sequence C + {/t/, /s/} seems to have the structure in (14).

(14)   X   X

[place]

In this structure, /t/ or /s/ shares the place feature with the preceding consonant. We claim here that the /t/ or /s/ in the words in (13) is not regarded as a 'genuine' /t/ or /s/ because of this linked structure.[5] In this case, -ate is introduced to satisfy the specification in (3).

Although most of the 'exceptional' words can be accounted for in the way just given, there still remain some exceptional words. In the words in (15), -ate is introduced even though the last consonant /t/ of the stem does not have the structure in (14).

(15) a.   invitatory (< invite), excitatory (< excite), salutatory (< salute)

b.   optative (< opt), interpretative (< interpret), limitative (< limit)

On the other hand, -ate is not introduced in the words in (16), even though they have the structure in (14).

(16) plaintive (< plaint), assertive (< assert), sportive (< sport)

Because we cannot find any generalization for these, and because the number of the words in these classes is rather small, we should mark them simply as exceptions.

2.2. *Alternative Analyses and Their Problems*

In this section, we will show that other possible analyses are problematic in some respects. There seem to be three alternative analyses for the seemingly 'allomorphy' phenomenon: (i) an analysis which admits *-atory* and *-ative* as allomorphs (cf. Aronoff (1976), etc.); (ii) an analysis which assumes *-tory* and *-tive* as underlying forms, positing vowel epenthesis for *-atory* and *-ative* (cf. Yip (1987)); (iii) an analysis which posits only *-ory* and *-ive* and regard the medial sequence *-at-* as an inserted vowel plus an inserted consonant. Let us discuss each of these possibilities in order.

The first alternative, which posits allomorphs *-atory* and *-ative*, is problematic in that the analysis must also admit another kind of allomorphs: *-tory* and *-tive*. Although one may assume an /a/-deletion rule which produces *-tory/-tive* from *-atory/-ative*, such a rule is not convincing at all since the rule does not have any motivation: /a/ is deleted irrespective of the syllable structure, and only when these two suffixes are attached. Therefore, three Word Formation Rules for each of the two suffixes are necessary in this analysis; i.e. for *-ory/-atory/ -tory* and for *-ive/-ative/-tive*.

Perhaps, the most serious problem with the first alternative analysis may be that this analysis cannot capture the generalization that the allomorphs both contain the sequence *-at-* (or *-t-* in case of *-tory/-tive*) at the beginning. This fact may not be counted as a problem for the Epenthesis analyses, i.e. the second and the third alternatives. Since *-a-* (and also *-t-* for the third alternative) is an epenthetic segment, it is natural that all the "allomorphs" have the segment(s) at the beginning.

However, a fatal problem arises in the epenthesis analyses: it is not clear why this/these segment(s) must be inserted before the suffixes. As Zamma (1993) points out, the inserted segment(s) appear(s) inside the sequence which is perfectly allowed in English phonotactics, which suggests that the epenthesis is not motivated by the theory of syllable structure. The third alternative seems more unnatural since it is sometimes only a consonant (i.e. /t/) and sometimes both a vowel (i.e. /a/) and a consonant that are inserted. The occurrence is totally

unpredictable.

Even if the epenthesis is motivated on some grounds, the second alternative must recognize the allomorphs -ory and -ive, since the analysis regards -tory/-tive as the underlying forms. Positing a /t/-deletion rule does not make this analysis valid since the rule lacks motivation. Recognition of the allomorphs clearly weakens the adequacy of the analysis: the advantage of not postulating allomorphs -atory/-ative is no longer maintained.

Moreover, the fact that -atory and -ative are often pronounced as /eitɔri/ and /eitiv/ as well as /ətɔri/ and /ətiv/ in the same dialect may constitute another problem for these Epenthesis analyses.[6] Recall that Yip (1987) claims that the epenthetic vowel is a schwa in the relevant cases. If a claim is made for an insertion rule involving a diphthong, justification will be needed for the rule in other phenomena in English, which seems to be hopeless. Moreover, again, even if the process of diphthong epenthesis is motivated elsewhere, predictions of when a schwa appears and when the diphthong appears cannot be obtained at all. Even though Yip argues that the words with the pronunciation /eitɔri/ and /eitiv/ are produced by attaching -ory/ -ive to the stems which end with -ate, this explanation is not adequate because the pronunciation with the diphthong can be observed with many stems which do not have -ate.

Along with these inadequacies, all of these analysis cannot account for words which end in -icatory/-icative. They can do nothing but recognize these forms as allomorphs.

On the other hand, our analysis has several advantages. First of all, we do not have to postulate any allomorphs for -ory and -ive. The seeming phenomenon of 'allomorphy' is accounted for by postulating the introduction of -ate (or -t) to satisfy the lexical specification. Such introduction does not pose the problems found in the epenthesis analyses, since it does have motivation.

Moreover, we can reduce the introduction of -ate to its special status. As we have mentioned, this suffix behaves in a special way in accentuation and in the suffixation of -able. Our analysis can treat the introduction of this suffix in parallel with these phenomena.

Finally, a form which remained unanalyzed in previous studies can be accounted for in a principled way. The allomorph -icatory/-icative need not be postulated in our analysis. Besides these forms, we can analyze the words in (11) and (12), which are rarely discussed in previous studies.

3. *-able*

The suffix *-able* is also a very productive one and can attach to many verbs and nouns. In most cases, the suffix never hesitates to attach to verbs which already have a suffix. In (17) we observe examples in which *-able* is attached to the verb-forming suffixes *-ify* and *-ize* and the verb root *-ply* .

(17) a.   identifiable (< identify), specifiable (< specify)

b.   recognizable (< recognize), criticizable (< criticize)

c.   multipliable (< multiply), compliable (< comply)

It is clear that no segmental change occurs in the suffixation of *-able*.[7]

However, this is not the case for verbs with the suffix *-ate*, as we hinted in the previous section: *-able* does not attach directly to words with this suffix. Observe the following examples.

(18)   vindicable/*vindicatable (< vindicate), educable/*educatable (< educate),

calculable/*calculatable (< calculate), generable/*generatable (< generate),

communicable/*communicatable (< communicate)

In cases where *-able* is to attach to words with *-ate*, the latter suffix is deleted. This must result from the special property of the suffix *-ate*, as we have suggested in section 2.

Although this deletion of *-ate* occurs in most words when *-able* is attached, there are several words which do not go through this process. The words in (19) are the examples.

(19)   debatable (< debate), relatable (< relate), inflatable (< inflate)

It is clear that in these examples *-ate* is maintained in *-able*-suffixation. One may assume that the words in (19) are marked as exceptions for the *-ate*-deletion, but such an analysis misses the generalization among them; that is, the stems of this class are all disyllabic words. In other words, it is always disyllabic stems that do not undergo *-ate*-deletion in suffixation of *-able*. Therefore, we assume that *-able* has a lexical specification as follows.

(20)   *-able* attaches to stems which can constitute a binary foot.

Note that if *-ate*-deletion applied to the words in (19), forms like **debable* would be produced. In this case, the specification in (20) is violated because in such a form the stem consists of monosyllable, which cannot constitute a binary foot.[8] In order to satisfy the specification, *-ate*-deletion is avoided in these words.

4. *-ic*

The suffix *-ic*, which is also productive, usually attaches to nouns to make adjectives without causing any segmental changes. The words in (21) are some of the examples with this suffix.

(21)   cubic (< cube), periodic (< period), symbolic (< symbol), satanic (< satan),
         basic (< base), acrobatic (< acrobat), Slavic (< Slav)

We see in (21) that *-ic* attaches directly to various segments; /b/, /d/, /l/, /n/, and so on. However, there are two cases in which *-ic* shows difficulty in direct attachment to stems.

(22)   thematic (< theme), problematic (< problem), theorematic (< theorem),
         systematic (< system), idiomatic (< idiom), symptomatic (< symptom)
(23)   Asiatic (< Asia), lunatic (< Luna), operatic (< opera), aquatic (< aqua)

In the words in (22), the sequence *-at-* is inserted between the stem and *-ic*, and *-t-* in the words in (23). We notice that the last segments of the stems in (22) and (23) are /m/ and /a/ respectively. Therefore, we assume that *-ic* is specified in the following way.

(24)   *-ic* does not attach to stems which end with /a/ and /m/.

It should be noted that the specification in (24) is defined in a negative way, while that of (3) for *-ory* and *-ive* is defined in a positive way. Since direct attachment is prohibited by (24) for two segments only, we have a much smaller number of words than was the case of *-ory* and *-ive* in which a certain intervening sequence is introduced.

The remaining issue to be accounted for here is the identity of the introduced sequences in (22) and (23). We assume that these are both the suffix *-ate*, as in the case of *-ory* and *-ive*. As we have argued so far, the reason why *-ate* is introduced can be reduced to a special property of the suffix. (Note that most suffixes would satisfy the specification, since it is defined in a negative way.) The last segment of *-ate* clearly satisfies the specification in (24). As for the case of (23), we posit a truncation rule for a sequence of $a + a$.

(25) Asia + ate + ic → Asiatic

The following words seem at first glance to constitute a class of counterexamples to our analysis, because *-ic* seems to be attached directly to /m/.

(26) academic (< academy), economic (< economy), monogamic (< monogamy)

However, this is not so. Actually, the stems in (26) all end with *y*, not *m*. Therefore, it is highly likely that the sequence *y* plus *i* is truncated into a single *i* in these words. In fact, there are many examples which suggest the existence of the truncation rule.

(27) specific (< specify), philologic (< philology), geographic (< geography),
        symmetric (< symmetry)

The *y* at the end of the stems is truncated when followed by *i* of the suffix even when the preceding consonant is not /m/, which suggests the generality of the rule.

Although we have analyzed *-ate* as being introduced after /a/, there are many cases in which this is not so. We have examples of such words.

(28) encyclopedic (< encyclopedia), nostalgic (< nostalgia), vanillic (< vanilla),
        parabolic (< parabola), olympic (< olympia), silicic (< silica)

In the examples in (28), the last segment /a/ is deleted before the suffix *-ic*, instead of introducing *-ate* (truncation of *i*'s applies in some words). Since the number of the words which belong to this class is much bigger than that in (23), we conclude that the default

procedure needed to satisfy the specification is to delete /a/ as far as this segment is concerned.

It is interesting to note that this word-final /a/ originates from a noun-forming suffix in Latin. Actually, *Webster's Third New International Dictionary* lists this /a/ as a noun-forming suffix. Moreover, the contrast *scheme/schema* seems to suggest the existence of the suffix *-a*. Therefore, we assume that this /a/ is regarded as something like a suffix, although its role as a suffix is not clear yet. If this is the case, we can answer the question why it is the deletion of /a/ rather than the introduction of *-ate* that is carried out in this case. That is, we can analyze *-a*-deletion as a property of the suffix itself rather, as we have done for the case of *-ate*-deletion before *-able*.[9]

Even if this is true, we cannot simplify the specification for *-ic* by eliminating the reference to /a/, since we still have several facts which suggest the direct attachment of *-ic* to /a/ is avoided. First, recall the case in (23), where *-ate* is introduced after the stems which end with /a/. This clearly suggests that *-ic* has the specification in (24). For this case, we can assume that the /a/'s in the words in (23) are not regarded as suffix. Since this is not a suffix, the *-a*-deletion rule does not apply, and thus introduction of *-ate* is carried out.

There also seem to be a class of words which systematically introduce *-ate* rather than deleting word-final /a/. The words in (29) are the examples.

(29) dramatic (< drama), schematic (< schema), enigmatic (< enigma), dilemmatic (< dilemma), plasmatic (< plasma), dogmatic (< dogma)

We notice here that the segment preceding /a/ is /m/ in these words. Therefore we can analyze these words in the following way: since deleting /a/ produces the illegal sequence /m/ + *-ic*, another procedure, that is, introduction of *-ate*, is taken.

There is one more class which does not undergo the deletion of /a/. In the words in (30), the stem final /a/ is lengthened to be a diphthong /ei/.[10]

(30) deltaic (< delta), moraic (< mora), stanzaic (< stanza)

We can analyze this phenomenon in the following way: this is another procedure taken to satisfy the lexical specification. However, it is not clear why such a procedure is taken only for these words. One way to solve this problem may be to mark them simply as exceptions. Yet,

we can find a generalization in these words; that is, the stems in this class consist of two syllables. Thus, it may be possible to assume that -*ic* is specified in a similar way to -*able*, that is, to attach to stems which constitute at least a binary foot: since the deletion of /a/ would render the stem monosyllabic, the deletion is avoided so that the stem can constitute a binary foot.

But, in such a case, it is not clear why it is lengthening rather than the introduction of -*ate* that is chosen here. Recall that lengthening never applies to the words which belong to the class of (29). Therefore, we should treat the words in (30) in a somewhat exceptional way.[11]

In summary, there are three procedures for the stem-final /a/ to satisfy the lexical specification for -*ic*. First, as the unmarked case, the deletion of -*a* applies. Second, when the preceding segment is /m/, -*ate* is introduced. Third, the /a/ is lengthened to be a diphthong /ei/, when the stem consists of two syllables.

Finally, we list some exceptions to the analysis we proposed here.

(31) islamic (< islam), rhythmic (< rhythm), atomic (< atom),
      morphemic (< morpheme)

(32) dioramic (< diorama), panoramic (< panorama)

(33) hanseatic (< Hanse), lymphatic (< lymph)

In the words in (31), -*ic* is attached directly to the stem which ends with /m/ (cf. (29)). Similarly, in (32), -*ate* is not introduced even when the segment preceding /a/ is /m/ (cf. (29)). In (33), unmotivated introduction of -*ate* occurs: note that none of these examples violates the specification in (24). Since the number of the words which belong to these cases is extremely small, it is natural that we regard them simply as exceptions.

5. -*al*

The last suffix we will examine in this paper is -*al*, which is also productive. As (34) suggests, this suffix is attached directly to various segments.

(34) verbal (< verb), physical (physic), economical (< economic), primal (< prime),
      formal (< form), original (< origin), personal (< person), adjectival (< adjective)

There are two classes to which a certain procedure applies in suffixation. We will give examples of these in (35) and (36).

    (35) a.   facial (< face), racial (< race), official (< office), provincial (< province)

          b.   substantial (< substance), circumstantial (< circumstance),

              influential (< influence)

    (36) actual (< act), intellectual (< intellect), habitual (< habit), spiritual (< spirit)

In (35), the form *-ial*, rather than *-al*, is attached to the stem which ends with /s/. Although the letter which expresses /s/ differs between (35a) and (35b), it is clear that the stem of both classes ends with /s/. Similarly, the form *-ual* is attached to /t/-ending stems.

There are two ways to analyze this phenomenon. One is to regard *-ial* and *-ual* simply as allomorphs (cf. Rubach (1984), Halle and Mohanan (1985)). The other is to assume that /i/ and /u/ are epenthetic vowels (cf. Chomsky and Halle (1968), Borowsky (1986)). Here we adopt the latter analysis, assuming that the suffix *-al* has the following specification.

    (37) *-al* does not attach to stems which end with a voiceless coronal obstruent

          (i.e. /s/ and /t/).

Since *-al* has this specification, the epenthetic vowels are introduced after /s/ and /t/.[12] It is interesting to note that the specification is the mirror image of that of *-ory* and *-ive*. Therefore, contrary to the cases for *-ory*, *-ive*, and *-ic*, the suffix *-ate* cannot be introduced, having /t/ at the end.

The reason why we do not adopt the allomorphy analysis is as follows. First, observe the words in (38).

    (38) a.   annunciate (< announce), substantiate (< substance),

              differentiate (< difference)

          b.   actuate (< act), effectuate (< effect), accentuate (< accent), habituate (< habit)

The words in (38) are those which are produced by attaching *-ate* to verbs. Interestingly, when *-ate* is attached to the stem which ends with /s/, the vowel /i/ appears between the stem and the

suffix. And when the stem ends with /t/, /u/ appears. This phenomenon is quite the same as we saw in (35) and (36). Therefore, if we regard -ial and -ual simply as allomorphs, we cannot obtain a unified analysis for these two phenomena. In such a case, we would be forced to recognize the allomorphs -iate and -uate for -ate, and would not be able to capture the fact that these allomorphs have the same vowels at the beginning in the same environment.

The following words seem at first sight to be exceptions to our analysis, since they do not have the epenthetic vowels even after /s/ and /t/.

(39)   reversal (< reverse), universal (< universe)

(40)   accidental (< accident), parental (< parent), rental (< rent), segmental (< segment)
       experimental (< experiment), portal (< port), coastal (< coast), postal (< post)

Recall, however, that we have treated the same kind of "exceptional" words in analyzing the cases for -ory, and -ive. The conclusion we made there was the following: a segment which constitutes a linked structure of a place node with the preceding segment (cf. (14)) is regarded as distinct from one which does not. This analysis holds for the cases in (39) and (40). Note that the stems in (39) and (40) all have a sequence of consonants at the end, both of which have the same specification for the place feature. Since this sequence is regarded as distinct from genuine /s/ or /t/, the epenthetic vowels are not required for the satisfaction of the lexical specification.

However, there are several words which do not conform to this analysis. In the analysis above, it is predicted that the following words do not take the epenthetic vowels, since they have the sequence /ns/ at the end of the stem.

(41)   financial (< finance), provincial (< province), essential (< essence)
       evidential (< evidence), substantial (substance), referential (< reference)

The vowel epenthesis in the words in (41) suggests that the stems are regarded as having /s/ at the end. Therefore, we here propose the following assumption.

(42)   The sequence /ns/ does not have the linked structure as in (14).

Note that the assumption also holds for the case of *-ory* and *-ive*. Consider the following examples.

(43) sensory (< sense), responsory (< response), offensive (< offense), expensive (< expense)

Although the stems all have the sequence /ns/ at the end, *-ory* or *-ive* is attached directly to the stem.

It is not clear why only the sequence /ns/ behaves in this way. Yet, there seems to be a hint for solving this problem. When we compare the feature specifications (other than for [coronal] and [anterior]) of alveolar consonants with one another, we notice the following fact.[13]

(44)	/t/	/s/	/n/	/l/	/r/
sonorant	-	-	+	+	+
continuant	-	+	-	+	+
strident	-	+	-	-	-

While all the other combinations have at least one feature that is specified with the same value (e.g. /t/ has the same stridency with /n/, /l/, and /r/, and /s/ has the same continuancy with /l/ and /r/), /s/ and /n/ have none. Therefore, it is possible to assume that at least one more feature other than [place] must be identical for a cluster to be regarded as constituting a linked structure. However, we must wait for further research to prove this assumption.

There are still more exceptional words in our analysis.

(45) a. dismissal (< dismiss), glossal (< gloss)
      b. fatal (< fate), dialectal (< dialect), orbital (< orbit)
(46) a. sensual (< sense), sexual (< sex)
      b. partial (< part)
(47) commercial (< commerce), accentual (< accent), eventual (< event), conventual (< convent)

The words in (45) do not have the epenthetic vowels even though -al is attached to stems which end with /s/ or /t/. In (46), a 'wrong' vowel is inserted; i.e. /u/ after /s/ and /i/ after /t/. In (47), the vowel epenthesis is carried out although they have the linked structure (14). Since the words which belong to these classes are quite rare, it seems to be safe for us to mark them simply as exceptions.

6. Summary

In this paper, we proposed a new approach to facts about suffixation in English. In particular, we posited the following specifications for several suffixes.

(48) a. *-ory* and *-ive* are specified as being attached to stems which end with
/s/ or /t/.

b. *-able* is specified as being attached to stems which can constitute a .
binary foot.

c. *-ic* is specified as not being attached to stems which end with /a/ or /m/.

d. *-al* is specified as not being attached to stems which end with /s/ or /t/.

Assuming these specifications, we have analyzed several phenomena of suffixation without encountering any problems. I believe that this approach will be fruitful in the study of phonology and morphology in that it simplifies the structure of the lexicon.

NOTES

1 The suffix *-ion* seems to be specified in the same way, although I have not investigated the issue yet.

2 This suffix may originally be the suffix used to make past participles of verbs (cf. *keep/kept*).

3 Strauss says that this is a surface condition. Note that the sequence is allowed in intermediate structures. In a word like *observatory*, for example, the verb-forming suffix *-ate* is attached to a verb *observe* in an intermediate structure, which never appears on the surface (cf. **observate*).

4 Some of the words listed in (13) have the form in which *-ate* is not introduced. However, all of these are archaic or rare.

5 This fact seems to suggest that a stem is examined by a suffix at a rather closer stage to the surface. Note that in the theory of underspecification, /t/ and /s/ are one of the least marked segments in English and thus could be provided with the specification of just a few features. The /t/ and /s/ in the structure in (14) are already specified for the place feature. However, I will not become involved in this issue any more since further investigation seems to be needed.

6 The pronunciations are confirmed in Wells (1991).

7 We will ignore the alternation in letters such as *y* into *i*. Note that they both are pronounced in the same way: /ai/.
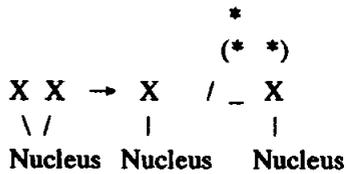
8 Two ways of explanation seem to be possible for examples like *readable, washable*, and so on, in which *-able* is attached to monosyllabic stems. One is to assume that these stems constitute feet by themselves because of the Strict Layer Hypothesis (cf. Selkirk (1984)). The other is to assume that any procedure such as introduction is not available to save the situation, because (20) is a prosodic restriction (cf. footnote 11). To decide which analysis is better, we must investigate English suffixation much further.

9 What is more, the fact that the /a/ is not deleted when the stem consists of two syllables is quite similar to the case of *-ate* (cf. (19) and (30)).

10 Note that a shortening, rather than a lengthening, is predicted for these words. The metrical structure which the words in (30) constitute (cf. (i)) satisfies the environment of the shortening rule (cf. (ii)) proposed by Halle and Vergnaud (1987).

(i)   *
         (* *)
         (*)(* *)
         mo ra ic

(ii)   Shortening

```
                        *
                      (*  *)
        X X  →  X   /  _  X
         \ /        |        |
        Nucleus  Nucleus   Nucleus
```

Since this is not the environment in which C*i*V-Lengthening (cf. Rubach (1984), etc.) applies, an explanation is necessary to account for this lengthening. Here we have explained this fact by means of the lexical specification of the suffix -*ic*.

[11] This may result from the fact that the restriction governing the deletion is a prosodic one. One possibility is that introduction of something only occurs to satisfy segmental restrictions. We should await further research to decide whether this hypothesis is correct or not.

[12] Although we can predict that /i/ is introduced after /s/ and /u/ after /t/, it is unclear why different vowels should appear in those environments. For this issue, we should wait further research.

[13] In (44), features such as following are omitted in the comparison; those that are the same in value for all the segments in (44), e.g. [consonantal], [syllabic], etc.; those that are relevant only for one of the segments, i.e. [nasal] and [lateral].

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