ON ORDERING PARADOXES IN MORPHOLOGY*

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The so-called Level Ordering Hypothesis is one of the most important theoretical claims to account for the well-formedness of a complex word. There is, however, a range of cases where the morphological structural relation of existing words conflicts with the hypothesis. Various attempts have been made to explain such ordering paradoxes. However, they suffer from serious difficulties. In this paper, espousing the notion level-ordered morphology, I will propose a new word formation system where complex words derived or compounded at a certain level can be returned to the earlier levels with conventions.

1. INTRODUCTION. Within the context of generative grammar, remarkable progress has been made in the study of morphology in the last ten years or so. Generative morphology, for one thing, aims at explaining why certain derivatives or compounds cannot exist, though similar ones are well-formed; and various proposals have been made. Among them, one of the most noticeable and groundbreaking theoretical claim is the Ordering Hypothesis proposed in Siegel (1974), which makes it possible to draw an explicit distinction between well-formed and ill-formed derivatives. Dividing affixes into two classes, Siegel states the ordering claims as follows (p. 152):

- (1) a. In English, Class I affixation precedes Class II affixation.
- b. The cyclic stress assignment rules follow Class I affixation and precede Class II affixation.

In this Ordering Hypothesis (hereafter OH) the distinction between Class I affixes and Class II affixes plays a crucial role. The distinction is

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principally based on the differences in the phonological behavior of affixes.¹ That is, such affixes as *-ity*, *-ic*, *-al*, *in-* which cause stress shift and allow segmental change as shown in 2a and 2b are Class I affixes:

- (2) a. stress shift: *égal* + *ity* → *égalité*
 métal + *ic* → *métalíc*
 b. segmental change: *nature* + *al* → *natural*
 in + *regular* → *irregular*

In contrast with Class I affixes, Class II affixes such as *-ness*, *-less*, *-ly*, *un-* do not have the properties shown in 2.

Given the OH and the criteria listed in 2, we can correctly account for the well-formedness of such examples as those in 3:

- (3) a. [_I[[organ]ic]_I], [_{II}[[organ]ic]_I],
 [[[time]l_{II}]ness_{II}], [_{II}[[friend]ly_{II}]],
 [[[[toxic]ity_I]less_{II}]ness_{II}]
 b. *[[[time]ly_{II}]ity_I], *[_I[[friend]ly_{II}]],
 *[[[employ]ment_{II}]al_I], *[[[event]less_{II}]ity_I]

In 3a, Class I affixation precedes Class II affixation or the same class affixation occurs contiguously, so the OH is not violated; while in 3b a Class II affix is attached first, and is thus ill-formed.

The general theoretical validity of the OH in reducing the number of possible morphological derivations is considerably high. But counter-examples to the OH have often been pointed out, too. Consider the following examples:

- (4) [_{II}-Adj]-ity_I:²
 ungrammaticality, unconditionality, unproductivity,
 unpracticality, unsubstantiality, unoriginality,
 unreality, unpopularity, unusuality, unfertility

As is well known, the negative (not reversal) prefix *un-* is subcategorized to attach to adjectives. Moreover, *ungrammaticality*, for instance, does not mean 'not the state of being grammatical', but rather 'the state of being not grammatical'. Therefore, the bracketing [[*un-Adj*]-ity] is justi-

¹ For other differences in the behavior of two affix classes, see Siegel (1974), Aronoff (1976), Allen (1978).

² In order to handle such paradoxical words as those in 4, Selkirk (1982) assumes that *un-* belongs to two classes, both I and II. This claim, however, untenable, since *un-*, as argued in Allen (1978), does not exhibit the properties of Class I prefixes such as *in-*. In the following argument, I will stick to the standpoint that *un-* is a Class II prefix.

fied. This results in the crucial violation of the OH.

Many solutions have been proposed in order to account for such paradoxical cases as those in 4.³ But, in my opinion, no one has given a natural and principled explanation without ad hoc stipulations. In this paper, exploiting the notions of "head of a word" and "percolation", I will try to solve the ordering paradoxes in question in a level-ordered model of the lexicon. And I will show that my approach also provides an account of the paradoxes involved in compounds.

2. HEADS AND PERCOLATION

2.1. HEAD OF A WORD. Let us first define the morphological "head" which plays a crucial role in the following discussion. In syntax, the head of a phrase is the element of the phrase that has the same distribution and belongs to the same category as that phrase. Also in morphology, the head of a word, in Williams' (1981) system, determines (or is meant to determine) the category membership of the items to which it attaches as illustrated in 5:

(where the circled element is the head of each word). Then, one might say that the head of a word is its category-determining element, as Selkirk (1982) actually does so. Notice, however, that if we define the morphological head in terms of category-determination, we need to know *both* the category of a certain word as a whole and which element is of the same category. Thus, I think that the definition of the head in 6 which does not refer to the notion "category" is preferable.

(6) *Righthand Head Rule*

"In morphology, we define the head of a morphologically complex word to be the righthand member of that word."

(Williams 1981: 248)

In word structure, according to Williams, the head is defined in terms of the position of a constituent, not in terms of category matching,

³ See, e.g., Strauss (1982), Kiparsky (1983), Pesetsky (1985), Sproat (1985).

though the constituent determines the category of the word including it.⁴

2.2. HEAD CLASS PERCOLATION. In this section, on the basis of the notion "head of a word" stated above, and by means of the "feature percolation" mechanism I will present a general idea to solve the problem of ordering paradox.

It is well known that derived words as a whole characteristically adopt all feature values of their outermost morphemes. Consider the following examples (cited from Lieber (1980: 85)):

In order to formally state this mechanism for labeling tree structures, Lieber (1980) proposes the following conventions:

(8) *Feature Percolation Conventions:*

Convention I: All features of a stem morpheme, including category features, percolate to the first non-branching node dominating that morpheme.

Convention II: All features of an affix morpheme, including category features, percolate to the first branching node dominating that morpheme. (pp. 85-6)

In such words as [counter[act]_V]_V, [counter[example]_N]_N, however, features of their outermost morphemes are not adopted. Moreover, these conventions are of no help as to compounds. Therefore she adds two further conventions:

(9) *Feature Percolation Conventions (contin.)*

Convention III: If a branching node fails to obtain features by Convention II, features from the next lowest labeled node are automatically percolated up to the unlabeled branching node. (p. 88)

Convention IV: In compound words in English features

⁴ There are few types of exceptions to 6 in the sense that the rightmost member does not determine the category of a word of which it is a part: [en[rich]_A]_V, [a[sleep]_N]_A. I will assume such examples to be marked in some sense.

from the righthand stem are percolated up to the branching node dominating the stems. (p. 93)

Lieber's theory makes crucial use of the distinction between stem and affix and hence needs these four-fold conventions. However, notice that if we adopt the notion "head", we can reduce the four conventions to only one. In such derivatives as *breakable*, *breakableness*, *counteract*, *counterexample*, and also in compounds such as *black board*, *duty-free*, their head, i.e., the rightmost element, determines their category and other properties. Hence, provided that all features of a head, including a category feature, percolate up, we can dispense with the conventions in 8 and 9.

Here I will add another stipulation to my proposal. In Lieber's theory, such features as [$\pm N$], [$\pm V$], [$\pm plural$], [$\pm latinate$], [$\pm present$], [$\alpha person$], etc., are given as the features to be percolated up. In these features, I will include the affix class labels, namely, I and II, regarding them as a kind of *feature* assigned to affixes.⁵ Is it unreasonable to regard such class labels as a kind of feature to be percolated up? One might say that the class label is numerical, i.e., 0, I, II, unlike such features as [$plural$] whose value is bipolar: + or –, thus they cannot be regarded as the same kind of features. But notice that the feature [$person$], for example, also have numerical value. Moreover, in order to account for the impossibility of words such as **inorderly*, it will be preferable to assume the class percolation. The two affixes of *inorderly*, unlike **friendlyity* for example, are not immediately adjacent. Thus, it is more natural to assume that the class of *-ly* is percolated up and *orderly* as a whole is assigned the status of a Class II item than to regard only *-ly* as a Class II item. This is parallel to the percolation of categorial features. In affixation, the affix to be attached checks the category of its base form as a whole, not the category of its part: for example, the *in-* of *inactive*, which is subcategorized for adjectives, checks the category of *active* as a whole, not the categorial feature of *-ive*. We can thus formulate the new feature percolation convention as follows:

(10) *Head Feature Percolation*

All features of a head, including category and class features, percolate up to the branching node dominating it.

⁵ In addition, as will be argued in the following section, I assume that Class "0" is assigned to non-affixal items.

With this convention, we can give a new interpretation to such exceptional words as *ungrammaticality*. In previous analyses, attention has been paid only to the co-occurrence of *un-* and *-ity*. But notice that in *ungrammaticality* another suffix, i.e., *-ical* is also involved. In the stage of *grammatical*, *-ical* is the head, and its class feature "I" percolates up. Next, though a Class II prefix *un-* is attached to *grammatical*, *un-* cannot be the head, so *ungrammatical* as a whole is a Class I item. Thus, a Class I suffix *-ity* can attach to *ungrammatical* without violating the general restriction that Class I affixation cannot take place outside the Class II affixed form. This is illustrated below:

(11)

(where $\Rightarrow$ represents the path of percolation of head features; features which are irrelevant to the present discussion are omitted.)

In such examples as *unreality*, whose structure is not $[[II[[X]I]]I]$ but $[[II[X]]I]$, since we assume that the stem class is 0, *unreal* is a Class 0 item as a whole and accordingly *-ity* attachment is possible.

These accounts are true of other paradoxical cases like those shown below:

- (12) [hydro_{II}electric]_Ity_I, [macro_{II}econom]_Ist_I,
[mis_{II}apprehens]_Iible_I, [re_{II}analyzabil]_Iity_I,
[re_{II}organiz]_Iation_I, [de_{II}valuat]_Iion_I

To sum up, we have shown that the head class, rather than the affix class, is important in explanation of the well-formedness of a derived form.⁶

3. THE STRUCTURE OF THE LEXICON. As mentioned above, I suppose that the lexicon is organized into several different levels, but so far I have not precisely formulated the nature of lexical structure. In this section, let us consider the organization of the lexicon; and examine how such

⁶ Such ill-formed words as $*[in_1[un_{II}[equal]]]$, $*[in_1[anti_{II}[religi-ous]]]$ which have doubly attached prefixes may be counterexamples to our analysis, for the present analysis generates them as possible words. In relation to this problem, recall Allen's (1978) argument that *un-* may not attach to a word which has negative content: **unhopeless*, **unmisinformed*. If the same condition applies also to *in-*, the words in question can be ruled out.

words as *ungrammaticality* are derived through the lexicon.

In the above discussion, I have mainly argued about derivation, i.e., the process of forming words from bases by the addition of affixes. But there is another important lexical process: compounding. Though Siegel (1974) discussed only derivation as a lexical process, compounds must also be formed in the lexicon. As the following examples show, compounds cannot be subject to syntactic processes which are allowed in syntactic phrases (see Bloomfield (1935: 232), Allen (1978: 113)):⁷

(13) *bláck—I should say, bluish-black—bird

*I saw a very bláckbird.

(cf. I saw a very bláck bîrd)

*They picked bláck and blúebèrries.

*Give me a góldfish and a silver one.

This is because compounds are formed in the lexicon and frozen as a word before they enter the syntactic component, so syntactic processes are inaccessible to the internal elements of compounds.

Then, where should we place compound formation in the lexicon? It is common, in English, for derivatives to occur inside compounds as seen in 14 but not vice versa:

(14) [[coffee][plant+ation]], [[solubil+ity][test]],
[[ballad][sing#er]], [[din#ing][car]]

Hence we can say that derivation precedes compounding. Following Allen (1978), I will call the level where compounds are formed "Level III", and the levels where Class I affixation and Class II affixation take place, Level I and Level II, respectively. Moreover, following Allen's Extended Ordering Hypothesis (hereafter EOH), I will suppose that Level I affixation is ordered before Level II affixation and both levels of affixation are ordered before Level III processes; though, as was argued above, in certain cases Level II affixed forms can be returned to Level I (and as will be shown, some compounds can be returned to Level I or II).

By the way, the morphological component in the lexicon does not exist by itself, but it coexists with other components interacting with each other. As stated in introduction, Class I affixes can affect the placement of word-stress, while Class II affixes are stress neutral. This means that

⁷ Although there is no one formal criterion that can be used for a general definition of compounds in English, it is well known that there is a contrast between the prosodic pattern of a phrase and that of a compound. The latter has primary stress on the first constituent: *a bláckbird* vs. *a bláck bîrd*.

the word stress rules are related with Level I affixation. And compounds, whether they are nouns, adjectives, or verbs, usually have primary stress on the first element, so we must assume that there is a compound stress rule which is set at Level III. Moreover, in *hymn*, for example, when Class I suffixes such as *-al*, *-ary*, *-ic*, *-ist* are attached the final *n* is pronounced, but when such Class II suffixes as *-ing*, *-less* (or in compounds such as *hymnbook*), the final *n* is not pronounced. Thus, we can suppose that a kind of deletion rule which simplifies the word final nasal cluster is placed at Level II. Accordingly, it is natural to presume that the phonological component in the lexicon is also three-leveled in parallel with the morphological component (cf. Kiparsky's (1982) model).

In addition, it is evident that there is a semantic component in the lexicon, too, because all words are assigned their own lexical meanings in the lexicon, not in the course of post-lexical processes. Moreover, the lexical semantic component also seems to be three-leveled. Taking the three different negative morphemes *in-*, *un-* and *non-* as examples, let us examine the meanings of the forms derived by their attachment. These morphemes are similar in that they negate the meaning of the base form to which they are attached. But a closer inspection reveals that they give rise to delicately different meanings:

- (15) immoral 'not moral'
- unmoral 'neither moral nor immoral'
- nonmoral 'having no relation to morality'

Among these negative morphemes, the most productive *non-* freely attaches to compound adjectives, too: *non*-[color-blind], *non*-[shock-resistant], *non*-[class-conscious], etc. (see Allen (1978: 222-3)). Thus, we can suppose that *non-* is a prefix-like combining word rather than a pure prefix, and attached at Level III. These facts imply that the lexical semantic component is also organized with different levels in parallel with the morphological component, and each level behaves differently in assignment of meaning.

To this point, I have mentioned that Level I and Level II are concerned with Class I and Class II affixation, respectively, and Level III is concerned with compound formation. In addition to these, there is another essential level which contains underived lexical items (entries). Since underived lexical items must exist before affixation or compounding takes place, let us call the level where underived items are

stocked "Level 0".⁸

Consequently, we can picture the structure of the lexicon as follows:

(16)

Passing through three levels, underived lexical items are affixed or compounded, and at the same time they undergo phonological and semantic interpretation.

Next, let us again consider the correspondence between class numbers and level numbers. Following Allen (1978), I stipulated that Class I affixation and Class II affixation occur at Level I and Level II, respectively; and I newly proposed that underived lexical items exist at Level 0, therefore I will assume that underived lexical items are of the Class 0 type. Then, along this line of argument, is it possible to say that the elements of compounds are assigned the status as "Class III" items?

Following the theory of Lexical Phonology and Morphology, I assume that Class I affixes and Class II affixes are placed on separate levels and thus they show different behavior (cf. Archangeli (1984), for example). That is, affixes do not coexist with underived words (stems), but exist in levels other than that where stems exist, and furthermore Class I affixes and Class II affixes are placed on different levels. By assuming this model, we can account for why Class II derived words do not undergo phonological rules which affect Class I derived words. If we assume that all stems and affixes are stocked in the same place, we need to specify that *un-*, for example, must be attached to adjectives at Level II, not Level I; but such specifications become unnecessary by placing *un-* on Level II. However, in the case of compound formation there are no grounds

⁸ I assume that all arbitrary and unpredictable information such as category, inflection class (e.g., [$\pm$ umlaut]), phonological and semantic representations, subcategorization, etc. are specified as lexical entries in Level 0.

for setting the compound forming elements into Level III. Note that the internal elements of compounds are underived items or Class I or II affixed items (cf. 14), and not ones newly formed at Level III. Therefore, I will assume that in Level III there are no items standing by to form compounds, and that the morphological operation at Level III is to pair up words listed or formed in preceding levels. Consequently, I will do without the notion or feature Class III.

4. RE-DEEPENING. In this section, I will propose a new mechanism RE-DEEPENING, which is closely related to the convention Head Feature Percolation. Let us examine how the paradoxical words are derived with this mechanism through the lexical structure presented above.

In the preceding two sections, I have argued that the class of an affix or a stem is also a kind of feature to be percolated up, and that the number of class corresponds to that of level in the lexicon. Then, it would not be unreasonable to propose the following convention:

(17) *Re-deepening Convention*⁹

A derivative or compound that is at Level n may return to a deeper Level $(n - \alpha)$ (α is greater than 0) if the head of that item is of the Class $(n - \alpha)$.

Taking *ungrammaticality* as an example, this convention will allow the following derivation (1, 2, 3, ... represent the order of derivation):

(18)

⁹ We will stipulate that when a certain item returns to the deeper Level $(n - \alpha)$, the semantic content assigned at Level n does not delete. Even if *unmoral*, for example, returns to Level I to take *-ity*, its meaning is not changed to *immoral*.

Though *ungrammatical* is formed at Level II, since its head *-ical* is a Class I suffix, (as a result, *ungrammatical* as a whole becomes a Class I word by feature percolation) it can return to Level I, making it possible to attach *-ity*.

Notice that our Re-deepening mechanism is generalized enough to derive such paradoxical words as *ungrammaticality*, and at the same time it is restrictive enough in such a way as not to derive such ill-formed words as **infriendly*, **faithfulness*. In the latter cases, since *-ly* and *-ful* are Class II suffixes, *friendly*, *faithful* cannot return to Level I, and as a result, only Class II affixes such as *un-*, *-ness* can be attached: *unfriendly*, *faithfulness*.¹⁰

A serious problem for the Re-deepening mechanism concerns nasal deletion. In order to account for such contrasts as [in[legal]] → *illegal*, but [un[lawful]] → **ullawful*, Allen (1978) assumes that each level assigns a specific boundary to the morphological structure created at that level. Thus, Level I assigns the +-boundary to *illegal*, and Level II the #-boundary to *unlawful*; and the #-boundary blocks nasal deletion. This assignment of boundary symbols within phonological strings is necessary because she assumes that phonological rules apply to the output of morphological (syntactic) operations. However, in the present analysis, it is no longer necessary to encode morphological information in terms of boundary symbols, because phonological rules can apply as part of word formation. Specifically, by assuming that the rule of nasal deletion is set at Level I, we can account for the fact that only Class I prefixes such as *in-* undergo nasal deletion. Therefore, in order for *un-* not to undergo nasal deletion (when *un-* attached forms return to Level I) if the boundary distinction were invoked, theoretical redundancy would be brought about. Then, what device will block nasal deletion in such cases as *ungrammaticality*?

In the theory of Lexical Phonology, in order to impose a powerful restriction on possible grammars, the Opacity Principle (or Bracket Erasure Convention) has been proposed and generally accepted.

¹⁰ In Strauss (1982), it is stipulated that, in English, prefixation and suffixation apply independently of each other so as to solve the ordering paradoxes. With this stipulation, we are able to account for the possibility of *ungrammaticality*, but we will conversely come to be unable to rule out such words as **infriendly*. His proposal, therefore, deteriorates the value of the OH.

(19) *The Opacity Principle*

The internal structure at one stratum (=level) is invisible to processes at another. (Mohanan (1982: 23))

Notice that in 18, this principle allows the internal brackets of *ungrammatical* to be erased when it returns to Level I. Thus, the status of *ungrammatical* in Level I is equal to that of underived words. On the other hand, in [in[legal]], for example, as long as it is in Level I the internal brackets are not erased. Then it seems that *un-X* forms undergo no more nasal deletion than such underived words as *Stanley*, *Henry*, *Monroe*, *unless*, *only* do. Therefore, we can propose the following condition:

(20) Structure-changing operations applying on Level I can change only forms derived on Level I.

By imposing this condition, even if we assume Re-deepening, we succeed in having only Class I affixes undergo nasal deletion without invoking the boundary distinction.

5. ANOTHER PARADOX. Summing up the (standard) order of word formation we have discussed above, we will have the following schema:¹¹

- (21) Level 0: Underived lexical items
 ↓
 Level I: Class I derivation
 ↓
 Level II: Class II derivation
 ↓
 Level III: Compounding

In the preceding sections, we have discussed paradoxes like *ungrammaticality*. Along with those, there are other examples of compounds which violate the ordering shown in 21. Consider the following examples:

- (22) a. [atomic scient]ist, [language-specific]ity,
 [self-suffici]ency, [transformational grammar]ian
 b. [heartbroken]ness, [word-initial]ly,
 un-[self-sufficient], ex-[film star]

¹¹ There are debates about whether inflectional morphology should be included along with derivational morphology and compounding as part of lexical operations. In Siegel (1974), Aronoff (1976), Allen (1978), Anderson (1982), for example, inflection is considered to operate in the syntactic component, or later. On the other hand, in Halle (1973), Lieber (1980), Selkirk (1982), Kiparsky (1982), etc., it is considered that inflection operates entirely within the lexical component. In this paper, I will leave it as an open question where inflection should be positioned in the grammar.

The words in 22a are affixed with a Class I suffix after compounding. Note that *atomic scientist*, for example, is semantically related to the compound *atomic science*: an *atomic scientist* is a person who does *atomic science*, and not a scientist who is atomic. Thus, the bracketing [[atomic scient]ist] is certified. The examples in 22b are also attached with affixes of Level II after compounding.

I will show that the convention of Head Feature Percolation and the mechanism of Re-deepening are valid also in accounting for these cases. First, to take *atomic scientist* as an example, in the stage of *atomic science*, the head is *science*. Recall here that underived words such as *science* are Class 0 items. *Atomic science* can, therefore, return to Level 0. As a result, it can take *-ist* which is in Level I. Next let us examine *heart-brokenness*. The head of *heartbroken* is the suffix *-en*, and this is a Class I suffix because it can affect segmental change: *break* → *broken*, *write* → *written*, etc. Therefore, *heartbroken* can go back to Level I and proceed again to take *-ness*. These processes are illustrated below:

These considerations seem to be true also of such compound adjectives as *kind-hearted*, *hard-hearted*, *three-cornered*, *blue-eyed*. In Allen (1978), these words are assigned the following structure, because it is assumed there that no affixation takes place after compounding.

(24) [[...]A [[...]Ned]A]

However, the concatenation of adjectives is rare, and moreover, the second elements *-hearted*, *-cornered*, *-eyed* cannot ordinarily be used as independent adjectives. Hence, it will be plausible to assign these words the structure in 25:

(25) [[[...]A [...]N]Ned]

Now such words as *kind-hearted* are also counterexamples to Allen's EOH. However, in the present theory, there is no problem, for *kind-heart* can get back to Level 0.

Finally, let us consider the "conversion" or "zero-derivation" of compounds. As the name *zero-derivation* suggests, conversion should be regarded as a kind of derivation. But is it a Level I process or a Level II process? In order to elucidate the level of conversion (especially the conversion of nouns to verbs), let us consider *document*, for example. *Document* functions as a noun and a verb. Which is the primitive form?

Notice that in order to define the meaning of the verb *document*, we must resort to the noun *document*: 'to prove or support with *documents*', but not vice versa. Thus, we may say that the noun *document* is the base form. Moreover, we can affix *-ation*, which is a Class I item and attaches only to verbs, to *document*: *documentation*. These indicate that *document* must be converted at Level I. If this speculation is on the right track, such compound verbs as *blacklist*, *sandpaper*, which are converted from the corresponding compound nouns, will also be counterexamples to Allen's theory in that they undergo a Level I operation after compounding. But also in this case, we can account for their zero-derivation by the mechanism of Re-deepening.

In Siegel's OH, attention was paid only to the affix class. In the present study, however, we have assumed that the feature complex of the head of a word percolates up, and as a result the entire word comes to have a certain class feature. Under this system, we have given a correct account of the counterexamples to OH and Allen's EOH. Along the lines of the argument so far presented, therefore, we can here formulate the revised well-formedness condition on word formation as follows:

(26) *Generalized Ordering Hypothesis*¹²

In affixation, the class number of the base must be equal to or smaller than that of the affix.

6. A RESIDUAL PROBLEM. In the above discussion, we have tried to solve the problem of ordering paradoxes, and showed how such examples as *ungrammaticality* may be derived. However, as was shown in Allen (1978), *un-* does not occur as productively with *-ity* as *in-* does. That is, the number of *un-X-ity* forms is smaller than that of *in-X-ity* forms such as *inhumanity*, *impurity* (cf. **unhumanity*, **unpurity* vs. *unhumanness*, *unpurenness*); in this sense, *un-X-ity* is marked. In this section, let us consider why *un-X-ity* forms cannot occur productively though they are not ungrammatical.

One possible answer is that *in-*, which is in Level I, can be attached before the attachment of *un-*, which is in Level II, so a kind of blocking takes place. Another answer can be given in terms of the length of

¹² With Quirk et al. (1972), I distinguish the base of a derived word from the stem, the latter being the part of the word remaining after every affix has been removed: *friend* in *un-friend-li-ness*. In a word which has only one affix, such as *friendly*, the stem is equal to the base; *friendly* is the base of *unfriendly*, but not the stem.

process. That is, in the case of *un-X-ity*, X must first go down to Level II and then return to Level I; on the other hand, in the case of *in-X-ity*, as both *in-* and *-ity* are in Level I, X need not return (this hold true also in the case of *un-X-ness*), and as a result, the derivational process is shorter. The contrast is illustrated below:

Hence, if there is some principle which prefers the shorter process, the fact that *un-X-ity* forms are not so productively derived will be a natural consequence of that principle.

Incidentally, the same line of explanation will be true of the non-existence of such words as **in-[self-sufficient]* (cf. *un-[self-sufficient]*).¹³ In order to generate *inself-sufficient*, *self-sufficient* must return to Level I, while in the case of *unself-sufficient*, *self-sufficient* has only to return to Level II as can be seen in 28:

Thus, I conclude that in word formation, the principle of “economy” of derivation often plays a crucial role to reduce the number of possible derivatives if and only if they are synonymous.

7. CONCLUSION AND ADVANTAGES. In this paper, we have made the following proposals: the head of a word is the rightmost element within the word; all the features of the head, including the class feature, percolate up; and the class number corresponds to the number of level where derivation takes place or underived lexical items are stocked; thus, if the class number of a certain word is smaller than the level number where it is, it can return to the deeper levels. With these proposals, we have given an account of the counterexamples to the OH and EOH.

Finally, I will present the advantages of my proposals which were not mentioned above.

In Mohanan (1982) in order to account for the derivation of such examples as *un#self-sufficient*, the device of the “loop” which plays the

¹³ Notice that *self-sufficient*, in principle, may return to Level I to take *in-* because *-ent* is a Class I suffix.

role of bypass for compounds to return to Stratum (Level) II is proposed:

With our conventions, however, without stipulating such a route for compounds, we can reset compounds in earlier levels according to the class of the head of a compound. Moreover, our Re-deepening mechanism, unlike Mohanan's returning system, can account not only for paradoxes involving compounds, but also for such examples as *ungrammaticality* for which Mohanan does not have a solution.

In Lieber (1980), it is argued that the syntax or structural aspect of word formation is not necessarily isomorphic with the semantics of word formation and that the two should in principle be considered independent of one another. This assertion comes mainly from the consideration that such words as *ungrammaticality*, *nuclear physicist*, in the light of OH or EOH, should be bracketed as follows: [un[grammaticality]], [nuclear [physicist]]; but our intuitive sense of the semantic composition of these words is the following: [[ungrammatical]ity], [[nuclear physic]list]. Notice, however, that in our system, *un-* of *ungrammaticality* can be attached before *-ity* is attached, and also in *nuclear physicist*, *-ist* can be suffixed after the compound *nuclear physics* is formed. This means that, in these cases, we can make lexical semantics isomorphic with lexical structure.

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