WORD-FORMATION AND THE LEXICON

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According to a widespread view the lexicon is a kind of appendix to the grammar, whose function is to list what is unpredictable and irregular about the words of a language. In more recent studies it has been acquiring a rich internal organization of its own and is becoming recognized as the site of pervasive grammatical regularities. The particular approach to the lexicon that I will assume in this paper comes out of this trend, integrating several ideas from work on both morphology and phonology in the seventies. I shall begin by outlining the central assumptions and their motivation, and proceed to a series of issues raised by this framework which have to do with the proper formulation of word-formation processes.[1]

1. The lexicon. The idea that morphology is organized in a hierarchy of levels is implicit in Panini and was adopted from him by Whitney (1889) and Bloomfield (1933, 1939) in terms of the distinction between "primary" and "secondary" suffixation. Siegel (1974) introduced the notion of level-orded morphology into generative grammar and showed that it reveals interesting generalizations in English.

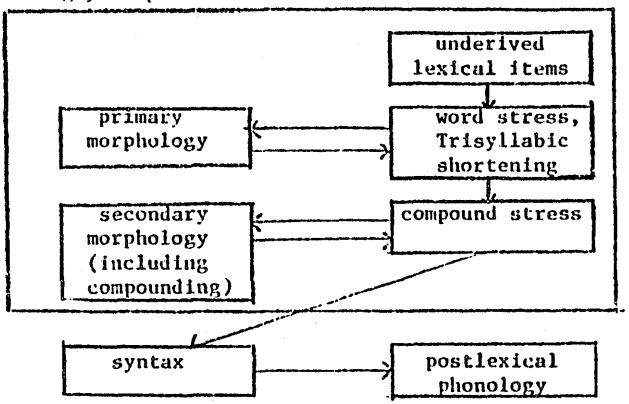
The significance of level-ordered morphology is that it relates the "positional" properties of affixes to their phonological properties. In particular, the order in which an affix occurs relative to other affixes is correlated with the kind of boundary with which it is associated. For example, phonological considerations in English motivate a distinction between primary (+ boundary) affixes and secondary (# boundary) affixes. Primary affixes form a unit with their stem for purposes of such rules as word stress and trisyllabic shortening, while secondary affixes do not either trigger or undergo these rules. Level-ordering captures the generalization that primary affixes are always placed closer to the stem than secondary affixes. Thus, in the morpheme order of English words, all primary suffixes must precede all secondary suffixes, and all primary prefixes must follow all secondary prefixes.

Let us illustrate the point with a concrete example. The suffix -(i)an, as in Mendelian, Mongolian, Parkinsonian, Shakespearian, grammarian, is primary, while -ism, as in Mendelism, Mongolism, Parkinsonism, nationalism, capitalism is secondary. This is shown most clearly by the fact that -(i)an occasions stress shift while -ism does not. Level-ordering now predicts

that if both suffixes are added to a stem, -(i)an precedes -ism. This is confirmed by words like Mendelianism, Mongolianism, versus *Mendelismian, *Mongolismian. In fact, as predicted there are no words at all in *-ismian. More generally, the primary suffix -(i)an is capable of being followed by primary (as well as secondary) suffixes, while the secondary suffix -ism is not capable of being followed by primary suffixes. Thus, with the primary suffix -ize, it is possible to form such verbs as mongolianize, parisianize, hegelianize, but not such verbs as *mongolismize, *southernismize, *capitalismize. Correspondingly, -ism is capable of being preceded by secondary (as well as primary) suffixes, while -(i)an is not capable of being preceded by secondary suffixes. So the secondary suffix -er can precede -ism, witness dissenterism, booksellerism (which happen to occur in Webster's Unabridged but could in any case be freely made up), while -er cannot precede -(i)an: *dissenterian, *booksellerian (compare the acceptable Hitlerian, Carterian, where -er is not a secondary suffix).

As pointed out by Pesetsky (1979), the correlation between affix order and phonology brought out by level-ordering can be formally expressed by having the phonological rules themselves apply at their respective levels within the lexicon after each step in the morphological derivation of a word.[2] The lexicon of English may accordingly be pictured as follows:

(1) lexicon



The phonological and morphological differences between -(i)an and -ism may now be accounted for simply by introducing them at level 1 and level 2 respectively. Thus, -ism does not participate in the assignment of word stress and is not followed by primary suffixes because it is added at level 2, where word stress does not apply and primary suffixes are not available. Boundary symbols such as # and + can consequently be eliminated from phonological representations (cf. Mohanan 1981), and the statement of combinatorial restrictions on affixes is greatly simplified.

The system can be further constrained by adopting the following Bracketing Erasure Convention (BEC):

(2) Internal brackets are erased at the end of every level.

An immediate consequence is that morphological and phonological processes cannot be sensitive to internal structure from preceding levels. Thus, a secondary affix such as -ism could not be sensitive to the difference between an underived base and a primary derivative. This captures the essence of the Adjacency Condition proposed by Siegel (1977) and Allen (1978), cf. Pesetsky (1979). Since, in particular, the BEC forces the erasure of all word-internal bracketing at the end of the lexicon, it follows moreover that syntactic processes, and postlexical phonological rules, cannot refer to or apply to constituents distinguished below the word level.

We shall call any (possibly vacuous) pass through the morphology and phonology of a level a layer of derivation, and stipulate that the output of any layer of derivation is a lexical item. The vocabulary of a language is thus recursively defined by a lexicon such as (1).

This reorganization of the grammar has dramatic consequences for both phonology and morphology. On the phonological side, it forces a fundamental division of rules into rules of lexical phonology, which apply at a given level within the lexicon -- e.g. word stress and Trisyllabic Shortening -- and rules of postlexical phonology, which apply to sentences after they have been put together from words by the syntax -- e.g. sentence stress and aspiration. What is interesting about this bifurcation is that the model entails very different properties for the two sets of phonological rules. The predicted bundling of these properties is generally borne out by the preliminary investigations that have been carried out so far (Mohanan 1982, Kiparsky 1982, Withgott 1982, Pulleyblank MS.). The following table summarizes the differences between lexical and postlexical rules. Not all the cited authors necessarily agree on all of these points although they probably agree on the majority of them.

	Lexical rules	Postlexical rules
1.	word-bounded	not word-bounded
2.	access to word-internal structure assigned at same level	access to phrase structure only
3.	precede all postlexical rules	follow all lexical rules
4.	cyclic	apply once

5.	disjunctively ordered w.r.t. other lexical rules	conjunctively ordered w.r.t. lexical rules
6.	apply in derived environments	apply across the board
7.	structure-preserving	not structure-preserving
8.	apply to lexical categories only?	apply to all categories
9.	may have exceptions	automatic

Most of these properties follow directly from the structure of the lexicon and the principles governing its operation, such as the Bracketing Erasure Convention. This is clear at once for points 1-3. The others require some comment here.

4. To say that lexical rules are cyclic is in our terms to stipulate that the output of every word-formation process undergoes the phonological rules of its level. Cyclicity, though not strictly deducible, comes out not as some baroque ordering convention but as a natural consequence of the way lexical derivations work, like the hierarchy of levels itself. Moreover, postlexical rules cannot be cyclic because syntax does not operate by pairwise concatenation as word-formation does, so that postlexical rules must apply in a single pass to the entire phonological phrase.

5. Lexical rules enter into disjunctively ordered blocks with each other but not with respect to postlexical rules. We shall therefore want the principle that imposes disjunctive ordering to apply within the lexicon but not across components. For some discussion of what this principle might be, see Anderson (1982), Kiparsky (1982), and section 3 below.

6. The property of applying in derived environments, originally attributed to the class of neutralization rules (Kiparsky 1973), has since been recognized as a characteristic of cyclic rules (Mascaró 1976, Halle 1978, Rubach 1981), which in the present model are coextensive with lexical rules. For an attempt to derive this property ("Strict Cyclicity") from disjunctive ordering, see Kiparsky (1982).

7. Lexical rules are structure-preserving in the sense that the output of every layer of derivation, being a lexical item, must satisfy the same conditions as basic lexical items. Namely, all are subject to the phonotactic and other constraints that govern the lexicon as a whole.

8. A more speculative possibility is that lexical rules apply to lexical categories only, that is, to such categories

as Noun, Verb, Adjective, Adverb, but not to such categories as Determiner, Pronoun, Auxiliary, Complementizer, Conjunction, Interjection. (The status of certain categories, such as Preposition in English, is problematic in this respect in that they appear to have a mixture of lexical and nonlexical properties.) By excluding nonlexical categories from the lexical system we account, on the left side, for their failure to enter into word-formation processes,[3] and, on the right side, for their failure to undergo rules of lexical phonology. Thus, it is exactly the class of non-lexical categories in English which do not get assigned word stress. That is why nonlexical monosyllabic words in English get reduced vowels, unless of course they get contrastive or emphatic stress in the syntax, while lexical monosyllabic words never get reduced vowels.

9. Mohanan (1982) has argued persuasively that postlexical rules admit no exceptions. This has far-reaching consequences, in that it forces such rules as Velar Softening in English to be lexical, contrary to what was assumed in Kiparsky (1982). One might suppose that all lexical exception features are erased along with internal bracketing at the end of the lexicon, though at present it is not clear that this can be made to follow from any deeper principles.

With this much background we now turn to the morphological side of the lexicon. We seem to be much further from a coherent picture of lexical morphology than of lexical phonology, and the best strategy for filling it out is probably to investigate complex systems of word-formation and inflection in languages where the added perspective of a reasonably well worked out lexical phonology is available. The general question I will be concerned with below is how word-formation processes operate. I will restrict myself exclusively to English material in this presentation.

2. Zero derivation and conversion. If we recognize affixation and compounding as the basic types of word-formation processes, then the problem immediately arises how to relate words such as $\underline{\text{permít}}_V$ and $\underline{\text{pérmit}}_N$ where no affix is visible. It has usually been assumed that either the noun or the verb in such pairs is basic and that the other is derived from it by a process known as zero derivation or conversion. Traditional treatments are less concerned with the nature of these processes or with the structural basis for the direction of derivation than with the question of the historical priority of one or the other word in such pairs.

More recently several linguists have suggested synchronic criteria for determining the synchronic directionality of derivation in the system. Marchand (1963, 1965, 1969) proposes that the decisive factor is semantics: the more basic member

of the pair is that in terms of which the other must be defined. For example, since to pattern is "to arrange into or be in a pattern" we consider the verb to be derived from the noun. Although, as Ljung (1977) has shown, this criterion is extremely problematic in practice, it is based on what seems to be the correct insight that a derivational process can add but not eliminate some element of meaning in a word. For example, although languages commonly have augmentative or diminutive affixes (e.g. pig+let), they do not have affixes which neutralize inherent augmentative or diminutive meanings in lexical items (e.g. a hypothetical suffix *-bung such that *calf+bung means 'bovine animal'). A more easily applicable but less general criterion (Kastovsky MS.) is based on finding parallel cases of overt derivation; according to it, the verb pattern is derived from the noun because the relation $pattern_N$: $pattern_V$ is like that of $drama_N$: $dramatize_V$, $system_N$: $systematize_V$ and similar noun/denominal verb pairs. This method is not foolproof either since the models may be ambiguous or lacking. For example, in the pair $search_N$: $search_V$, are we to say that the noun is basic, on the analogy of $scrutiny_N$: $scrutinize_V$, or the verb, on the analogy of $investigate_V$: $investigation_N$? And in cases like $bone_N$: $bone_V$, surely the noun is basic, but what overt derivational pattern authorizes that conclusion?

A more promising approach will seek to ground "zero derivation" in the overall derivational system of English, taking into account phonology as well as morphology and semantics, but without necessarily expecting any single "litmus test" to emerge. The lexical framework provides a basis for such an analysis. We note first that our approach does not countenance simple "conversion" of one category into another. The two possibilities which it does allow that might come into question are multiple category membership of lexical items, and zero affixation. The first was suggested by Chomsky (1970) for all derived nominalizations. The idea was that a lexical item such as destroy might be entered in the lexicon indifferently as a verb and a noun, in the latter case receiving the affix -ion in the phonology. The feature system usually assumed for lexical categories does not accommodate this solution very naturally since in it nouns and verbs differ minimally in two feature specifications. Moreover, Aronoff (1976) justified the traditional view of directional derivation in the case of overt affixation (destroy→destruction), and because of his arguments Chomsky's suggestion has generally been abandoned. Lieber (1982) however has argued that underspecification of entries is the correct analysis of "conversion pairs," at least in English and German.

The other possible approach to conversion is to allow zero affixes. Thus $pattern_V$ might be derived from $pattern_N$ by a verbalizing affix with roughly the properties of -ize but no phonological content. Allowing such affixes is in no way an ad

hoc extension of the power of the word-formation component. It would actually be mysterious if they did not exist: note that autosegmental tonology routinely encounters affixes with a tonal specification but no segmental substance. Allen (1978) has explored English morphology from this point of view and found evidence that supports a directional derivation just as in the case of overt affixation.

If we approach the problem with due attention to the phonology and semantics as well as to the interaction with other morphological processes, we find that both kinds of derivation must be recognized for English. Hayes (1981) has already argued that stress and semantics reveal both a class of deverbal nouns and a class of nouns paired with verbs by virtue of merely sharing the same root. The key observation is that nouns which keep the verbal stress tend to retain also a predictable semantic relationship to the verb:

(3) exháust, consént, refórm, resúlt, resérve, revérse, retúrn, despaír, debáte

while nouns with stress retraction are semantically more idiosyncratic:

(4) recórd$_V$/récord$_N$, permít$_V$/pérmit$_N$, conflíct$_V$/cónflict$_N$, transfér$_V$/tránsfer$_N$, rebél$_V$/rébel$_N$, convért$_V$/cónvert$_N$, produce$_V$/próduce$_N$

Hayes attributes both properties of the former type to their deverbal status, on the assumption that the principle of Strict Cyclicity blocks stress from being reassigned on the second cycle to the derived noun. In the second type, noun and verb undergo stress independently, each receiving the stress appropriate for its category.

The phonological evidence for the second type is clearest in the case of words in -ment and -ate:

(5) a.

expérimentN	experimentV
régimentN	regimentV

b.

advocateN	advocateV
aggregateN	aggregateV
associateN	associateV
subordinateN	subordinateV

The nouns here can hardly be derived from the verbs because the stress assigned to the verbs on the last syllable in the first cycle cannot be eliminated in the derived noun no matter what formulation of Strict Cyclicity we adopt.

The lexical approach to morphology allows these two sources for "deverbal nouns." Moreover, it predicts a range of specific properties for each. Since the output of every level consists of lexical items, which must in particular be fully specified as to lexical category, the nouns and verbs derived from roots must be derived at level 1. This entails that they receive their stress by the rules that apply to basic nouns and verbs (cf. Hayes 1981). Further, it entails that both the verbs and nouns should be inputs to level 1 (primary) affixation. This can be tested with primary affixes that are attached to verbs and to nouns, such as those shown in (6):

(6) a. primary affixes attached to verbs:

$-(at)ion_N$ ($confess_V + ion_N$, $explan_V + ation_N$)

$-al_N$ ($dismiss_V + al_N$)

$-ive_A$ ($attract_V + ive_A$)

b. primary affixes attached to nouns:

$-(i/u)ous_A$ ($furi_N + ous_A$, $tempest_N + uous_A$)

$-(i/u)al_A$ ($aspect_N + ual_A$, $sentiment_N + al_A$)

$-y_N$ ($candidac_N + y_N$)

Examples showing that both nouns and verbs in root-derived pairs can take primary affixes are given in (7):

(7) $rebel_{V,N}$: $rebell_V + ion_N$, $rebell_N + ious_A$
$contract_{V,N}$: $contract_V + ion_N$, $contract_N + ual_A$
$rent_{V,N}$: $rent_V + al_N$, $rent_N + al_A$
$experiment_{V,N}$: $experiment_V + ation_N$, $experiment_N + al_A$
$advocate_{V,N}$: $advoc_V + ation_N$, $advocac_N + y_N$

Note that the level 1 suffix -ment of (5a) is to be distinguished from the homonymous suffix in words like management, establishment, which differs in being stress-neutral, being added to verbs rather than roots, and in not allowing level 2 suffixes after it (*managemental). All these properties follow directly from assigning this -ment to level 2 (cf. Aronoff, 1976, 53-55 for discussion of the two -ment suffixes).

As for the derivational process responsible for the deverbal nouns in (3), this applies at level 2. Because word stress is assigned only at level 1, the resulting nouns do not undergo stress shift. As predicted, the nouns cannot get level 1 suffixes:

(8) *exhaust + ious, *consent + ual

and they can be made from verbs derived at level 2, in particular,

from compounds:[4]

(9) deep-freeze$_V$ ⟶ deep-freeze$_N$, winterkill$_V$ ⟶ winterkill$_N$,
broadcast$_V$ ⟶ broadcast$_N$

The noun compounds in (9) are evidently deverbal. They cannot be regarded as primary noun compounds because the second members do not occur on their own as nouns in the appropriate senses (a freeze is an event rather than a device, a kill is a single act or result rather than a process). Nor could the verbs be derived from the nouns, because of their level 1 inflection: deep-frozen, broadcast.

In addition, it is clear that we must recognize zero derivation from nouns into verbs. This can also be located at level 2 on the basis of arguments parallel to those just given for verb-to-noun zero derivation. Again, there is no stress shift, e.g. to páttern, not *patterń like such primary verbs as usúrp, cavórt. The resulting verbs never admit level 1 affixes:

(10) *pattern + ation, *comfort + al, *doctor + ive

and they may be freely formed from compound nouns:

(11) to lipstick, to sandbag, to wallpaper, to loanshark,
to paperclip

A consequence of the above system is that triplets may exist, in that either the noun or the verb of a level 1 pair may yield a zero-derivative at level 2. Thus we have such verbs as to prótèst (beside primary protést) and such nouns as permít (beside pérmìt):

(12) level 1: protést$_V$/prótèst$_N$ permít$_V$/pérmìt$_N$
↓ ↓
level 2: prótèst$_V$ permít$_N$

For more detailed evidence we can turn to particular types of noun/verb pairs. Consider cases where the noun denotes an object with which the verbal activity is carried out. A closer examination shows that they fall into two distinct classes depending on how the noun and verb are semantically related. In the first class (see 13) the noun is merely the most typical instrument used for the activity; the verb itself does not require any particular instrument.

(13) hammer, brush, paddle, string, whistle, saw, anchor, comb,
wedge

One can hammer not only with a hammer but also with a rock, a shoe, and so forth. Ljung (1977) notices this pattern and

discusses its consequences in an interesting way though he mistakenly thinks all instrumentals work like this. See the further examples:

(14) He brushed his coat with his hand.
I paddled the canoe with a copy of the New York Times.
String him up with a rope!
Can you whistle with a blade of grass?
The prisoner sawed off the bars with her dentures.
She anchored the ship with a rock.
He combed his hair with his fingers.
We wedged the window open with a screwdriver.

We shall consider these to be level 1 N/V pairs. In another set (15) the noun is necessarily involved as an instrument in the activity. Here the verbs are derived from the nouns by zero affixation at level 2:

(15) tape, rivit, chain, button, pitchfork, bicycle, screw, staple, hacksaw, snowplow, ink

The following sentences are deviant and can at best be understood in a metaphorical sense (unlike those of (14), which are interpretable quite literally):

(16) *She taped the picture to the wall with pushpins.
*They chained the prisoner with a rope.
*Jim buttoned up his pants with a zipper.
*He pitchforked the manure with a shovel.
*Let's bicycle across France on our tricycles.
*Screw the fixture on the wall with nails.

The semantics follows from this derivational difference in that the verbs in (15) cannot be interpreted with reference to the nouns since they are not derived from them. Rather, the verbal root meaning is basic. Thus, to hammer means not "to strike with a hammer" but something like "to strike with the flat surface of a solid object" and a hammer is whatever is intended to be used for that purpose. In (15) the verbs are derived from nouns and the meaning of the nouns enters into the meaning of the verbs. To tape is "to apply tape to" (or something similar) and tape is defined independently of any verbal notion.

Assigning these word-formation processes to levels 1 and 2 respectively entails a number of further predictions. Verbs from nouns derived at level 2 must themselves be derived at level 2. Hence all compounds are predicted to fall in with the type of (15, 16).

(17) *You have to padlock the door with a latch.
*He snowplowed the sidewalk with a shovel.
*She charcoaled the drawing with ink.

Secondly, all instrumental pairs that enter into triplets like (12) will have to be of the level 1 type. Thus, from the verb paddle (paired with an instrumental noun at level 1, see 13) we can derive an action noun at level 2 (they went for a nice paddle). Further, all verbs with level 1 phonology will also work like (13): since string, sting have the level 1 past tense strung, stung they cannot be derived from the nouns string, sting at level 2; compare the level 2 denominal verbs ink, ring, with level 2 past tenses inked, ringed.

(18) a. to string up someone with a rope
to sting with a needle

b. *to ink a drawing with crayons
*to ring pigeons with dye marks

We may conclude that the level-ordered lexical framework discloses nontrivial regularities in the phonology, morphology, and semantics of English noun/verb pairs. It seems also that rather rich principles must be at work to permit the acquisition of this much structure that is not encoded by any overt affixes.

3. Blocking. We have seen that level ordering explains why verbs derived from nouns have weak inflection even if they are phonologically of a form which ordinarily gets strong inflection (winged, inked), indeed even if their second member actually contains a strong verb (grandstanded, *grandstood). What we have not explained yet is how a strong verb, provided with a special past tense and participle at level 1, escapes the regular -ed suffix at a later level. It is clear that we should not have to state both that a verb like sing has the special forms sang, sung, and that it does not also form *singed. The second fact follows from the first. Similarly, in noun inflection the existence of men, feet automatically entails the expectation that *mans, *mens, *foots, *feets do not exist. We require a principle of Blocking to insure that special forms block general forms derived at later levels of the lexicon. This is, however, not easy to formulate in an approprate and comprehensive way.

According to Aronoff (1976, 43), blocking is a constraint which prohibits synonyms containing the same stem from being listed in the lexicon. The criterion for lexical listing in Aronoff's theory is that items are listed if and only if they have at least one idiosyncratic property. Although there are unclarities on this point, it seems that Aronoff assumes that this criterion forces derivatives with what we are calling level 1 suffixes,

such as -ous and -ity, to be listed, even if their semantics, morphology and phonology are regular, perhaps because they are not fully productive. If we grant this assumption, Aronoff's version of the blocking principle accounts for the pattern of complementary distribution between root nominals and deadjectival nominals in -ity shown in (18):

(18)	glorious	glory	*gloriosity
	furious	fury	*furiosity
	gracious	grace	*graciosity
	curious	--	curiosity
	precious	--	preciosity

The reason nouns in -ness are freely formed from all the adjectives in (18) would then be that they are not listed in the lexicon and therefore escape the blocking principle.

On this understanding, then, blocking is a relation between lexically listed items and could certainly not be invoked to account for the absence of *singed and *mans since the regular inflectional forms are in no way idiosyncratic and would not be listed even in the most generous lexicon because of their total productivity.

However, it is apparent even from derivational morphology that blocking is more widely applicable. Aronoff himself (p.55) ntoes that productive -(c)y from -ate, -ant, -ent blocks productive -ness:

(19)	decency	*decentness
	aberrancy	*aberrantness
	profligacy	*profligateness

As we just saw, -ness is not listed in the lexicon by Aronoff's criteria and so (19) is actually inconsistent with his formulation of blocking. As for the availability of -ness in the previous cases (18), we are at worst faced with marked exceptions to blocking (such as kneeled, knelt in the inflectional domain); anyway, the nouns are arguably not exactly synonymous. Grace and graciousness at least are clearly different in meaning, and fury, glory perhaps lend themselves more to concrete and degree interpretation while furiousness, gloriousness tend to be fractive though the distinction is elusive at best.

Similarly, the various level 1 agent noun formations block the productive level 2 suffix -er:

(20)	$bore_N$	*borer
	$guide_N$	*guider
	spy	*spyer

applicant, applicator	*applyer
inhabitant	*inhabiter

If we assume that words are built by word-formation rules we could have special rules block general rules in their shared domain by some form of the Elsewhere Condition proposed on independent grounds for phonology (Kiparsky 1982). This solution has been adopted also by Anderson (1982) and his collaborators (Flinders-Thomas 1981).

Blocking can be partial in the sense that the special affix occurs in some restricted meaning and the general affix picks up the remaining meanings. For example, level 2 agent and instrument nouns derived by adding -er to verbs have specific meanings carved out of them by level 1 derivatives, as illustrated in (21):

(21) drill (device): driller (person)
cook (person): cooker (device)
refrigerant (substance): refrigerator (device)
informant: informer
contestant: contester

The Elsewhere Condition can account for these cases too if the appropriate semantic conditions are made part of the word- formation rules.

There is also a constraint on vacuous affixation which it would be nice to be able to subsume under the same principle that governs blocking in general. For example, nouns like cattle and people, where the plural feature is an inherent part of the stem, do not get a plural suffix. Marantz (1981) makes much use of a principle which blocks an affix from being added to a stem which already carries all the features of the affix. In Kiparsky (1982) it is pointed out that this effect can be reduced to the Elsewhere Condition if we interpret lexical items as limiting cases of rules, namely as maximally special rules assigning the idiosyncratic properties of the lexical item itself.

However, the Elsewhere Condition in turn fails for such cases as (18). There is no way, evidently, to extend it in such a way that it causes the mere existence of glory to block -ity from being added to glorious. Thus, neither Aronoff's blocking condition nor the Elsewhere Condition are sufficiently general.

To have a single principle which covers all of these cases it seems we must view the matter at the level of semantics (cf. Clark and Clark 1979). The interpretation of a compound or of a stem plus affix combination is subject to the restriction that the resulting meaning must not already be expressed by an existing

lexical item, that is a lexical item which is either basic or has been derived at or before the level at which the combination in question is interpreted. (Recall that the result of every layer of derivation is itself a lexical item.) Let's call this the "Avoid Synonymy" principle:

(22) The output of a lexical rule may not be synonymous with an existing lexical item.

We shall assume that (22) blocks affixation or compounding in cases where synonymy would result. If the entire potential meaning of the derived form overlaps with an existing lexical item, the derivation blocks completely. If the meaning of the derivative overlaps in some meanings with an existing lexical item, then those meanings will be blocked out (partial blocking). (22) is admittedly a curious principle and it may turn out to be more correct to view it as a language learning strategy rather than as a formal constraint of grammar.

The "Avoid Synonymy" version of blocking gets us all the standard blocking cases, including partial blocking and the prohibition against vacuous affixation. For example, the plural *cattles is blocked by the lexical entry cattle which is entered in the lexicon with the meaning that the derived plural would have. Aronoff's cases, such as (18), are covered by it too. Note that this implies that such pluralia tantum as alms cannot be derived but must be entered in the lexicon, which is shown to be correct by compounds like almsgiving.

Perhaps the most important way in which (22) differs from both alternatives we have considered is that it allows blocking between different stems. This is in fact what is required. Consider the meaning of cutter as an instrument. A cutter is any cutting tool that lacks a specific designation of its own. Thus, knives, scissors, adzes, chisels, axes etc. are not cutters, while various otherwise unnamed implements for cutting glass, cheese, cookies, cloth etc. are called cutters. Similarly, a sweeper is a sweeping implement of any sort other than a broom, brush, or other specially designated item.

Note further that if the existing word covers the entire meaning range of the derived word we get complete blocking, even with different stems. For example, thief blocks stealer, since a thief is someone who steals and by the "Avoid Synonymy" version of the blocking principle, a stealer would be someone who steals and is not a thief, so that the word is blocked because it cannot have a meaning assigned to it. However, someone who steals in certain special senses is not a thief, and as predicted such a person can be called a stealer. Thus a player who steals a base on the pitcher in baseball would be a base stealer and not a

*base thief.

One welcome result of (22) is that it correctly predicts that blocking will be from earlier levels to later levels. The reverse does not happen since a derived lexical item does not "exist" in the sense relevant for (22) prior to the level at which it is derived. This excludes the possibility of a language which is like English except that level 1 affixes are the productive affixes of choice and level 2, "outer" affixes represent lexically specified marked cases. There is nothing a priori impossible about languages designed after that fashion and so their apparent nonexistence is a striking consequence of (22) in conjunction with level-ordered morphology.

In Kiparsky (1982) I took the position that generic terms such as blackbird or cranberry should be semantically represented in the lexicon of the grammar merely as "a kind of bird," "a kind of berry" etc., since their biological and other characteristics cannot be a matter of lexical semantics but encyclopedic knowledge. The "Avoid Synonymy" principle now incorporates in addition the Saussurian notion that they denote kinds which are distinct from other kinds which have designations in the lexicon. From the language learner's point of view, this says in effect that in acquiring a new word one assumes that it means something different from the words one already knows. Synonyms can be acquired as marked exceptions to the principle in much the same way that one learns that kneel has both kneeled and knelt as past tenses.

In the same paper I argued that the "derived-environment-only" application of lexical rules is reducible to a special case of blocking under certain assumptions. I shall not enter into this question here as it concerns phonology rather than morphology, except to note that the equivalent reduction can be obtained under our reformulation of blocking by extending (22) to lexical phonological rules as well, as already implicit in the formulation given to it above.

4. Are there word-formation rules? So far, we have looked at the blocking relation that restricts word-formation processes but we have not said anything about how these word-formation processes actually work. Our conclusion that blocking is a semantic constraint on the output of word-formation turns out to have important consequences for that question. In this section I shall argue that it eliminates the remaining arguments for "word-formation rules" (WFRs) and allows us to treat affixes simply as bound lexical entries.

The morphology of a grammar must provide certain kinds of information for any given affix: to what sorts of things the affix is added, whether it is put before or after the stem, and

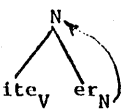
what are the properties of the resulting form. There are basically two ways to represent this information. If we assume that affixation is done by word-formation rules, we can construe them as contextual restrictions on the rules which insert them. Each affix A would then be introduced by a rule of the form

(23) Insert A in env. $[Y \_\_\_ Z]_X$

For example, writer would be derived from write by the rule

(24) Insert -er in env. $[V \_\_\_]_N$

R. Lieber (1980) and T. Wohle (1982) here proposed that the information is encoded in the lexical entry of the affix itself by means of a subcategorization frame and an inherent categorial specification which percolates upward from an affix to the category whose head it is. For example, the agent suffix in writer would subcategorize for post-verbal position and be inherently specified as a Noun. This and other features of the affix percolate up to become features of the derived word:

(25) 

On this approach there are no word-formation rules and affixes are just lexical entries which differ from stems in being obligatorily subcategorized.

This second approach has a number of advantages: (a) It unifies the treatment of the two major types of derivational processes, affixation and compounding. The percolation from the head in writer (25) works just as the percolation from the head of a compound, say dog-house.[5] (b) The percolation conventions are needed anyway for features such as ± Foreign which play a role in the phonology (cf. Selkirk 1982). For example, Velar Softening in English appears in the [+ Romance] vocabulary and [+ Romance] affixes can make unspecified stems [+ Romance], as in longitude. (c) If affixation is simply lexical insertion then we correctly predict that affixation processes never need be extrinsically ordered with respect to each other (Aronoff 1976, 56-62). Cases like nation + al + iz + ation, sens + ation + al + ize, organ + iz + ation + al in fact show that they cannot be extrinsically ordered. On the lexical insertion approach that is the only possibility, but if affixation is done by WFRs it would be an unexplained fact. (d) Finally, the features that would trigger WFRs are exactly the same features that figure in lexical entries of stems. If affixes are themselves lexical entries, then this generalization falls out directly.

The question now is whether the lexical insertion approach can be fitted into the lexical morphology framework. In Kiparsky (1982) I opted for WFRs instead. One reason was to get blocking by the Elsewhere Condition, a condition defined upon rules rather than lexical entries. Second, word-formation processes have to be assigned to particular levels in the lexicon, which seems puzzling if affixes are just lexical entries, but understandable if they are rules, since stem entries do not have to be level-ordered, while phonological rules do. Third, WFRs can be collapsed by the ordinary notational conventions to allow an affix to be introduced in more than one context, making polysemy of affixes non-accidental, as opposed to the formally accidental polysemy of stems like bank. This would account for Janda's (1982) observation that it is indeed normal for suffixes to have a number of meanings, often unrelated. Finally, it would account directly for the observation that affixes, on phonological grounds, must not be allowed to be cyclic domains. If affixes are added to stems by rules, they cannot be cyclic domains, but if they are lexical entries we seem to have lost the explanation for why stems are cyclic domains but affixes are not. All these considerations might seem to require the WFR format in spite of the conceptual attractiveness of construing affixes simply as bound lexical entries.

However, given what we said above, all this is equally compatible with the lexical insertion approach to affixation. Since we already decided that blocking is properly viewed as a principle governing the semantic interpretation of words, we do not have to invoke the Elsewhere Condition as a relation between WFRs, and so blocking in no way argues for WFRs.

The lexical insertion format can also account for the level ordering of affixation, namely by assigning the rules that semantically interpret affixes to the appropriate levels. This means that lexical semantics has to be done cyclically as you build up the word. But that must be the case anyway because of the Bracketing Erasure Convention; moreover, the output of every layer of derivation is a lexical item, and lexical items must be fully interpreted. (Note that we also must make this assumption in order to be able to use the failure of meaning assignment induced by (22) to block a word-formation process, as we did above.)

As for affixal polysemy, it allows simplification by collapsing rules of affixal interpretation in the lexical insertion format to exactly the same extent as it allows simplification by collapsing WFRs in the other format, so that it does not bear on the question one way or the other.

The final point, concerning the fact that affixes unlike stems are not cyclic domains, can be answered as follows. The correct generalization apparently relates not to affixes but to bound mor-

phemes. Thus, not only affixes but also roots, obligatorily affixed noun stems etc. are shown by phonological considerations not to be cyclic domains, as argued in Kiparsky (1982).

We conclude that under our revised conception of blocking the advantages of the lexical insertion approach can be maintained without any sacrifice. It must be admitted, though, that the arguments for adopting this format in preference to WFRs so far given have to do with the overall simplicity of the theory rather than with hard-core empirical consequences.

The material in the next section constitutes one such piece of empirical evidence. It will be argued there that the correct solution to the problem of apparent level-ordering violations in English involves morphological reanalysis constrained by preservation of subcategorization requirements. This solution is simply not statable in the WFR format but fits very well with the idea that affixes are bound lexical entries.

5. Morphological reanalysis. From the earliest work on level-ordered morphology it has been noticed that the predictions of the theory are off the mark in certain combinations of affixes, and numerous attempts have already been made to solve the problem. Assuming for English two levels as in (1), a level-ordering violation would be any case in which a level 2 morphological process has to be applied before a level 1 morphological process. Setting aside compounding for the moment, we get four theoretically possible types depending on whether prefixes or suffixes are involved. In the schema below we use subscripts to identify the level of an affix.

(26) 1. Stem + Suffix_2 + Suffix_1 (e.g. *national + ism_2 + ous_1)

2. Prefix_1 + Prefix_2 + Stem (e.g. *in_1 + anti_2 + religious)

3. Prefix_1 + [Stem + Suffix_2] (e.g. *in_1 + success + ful_2)

4. [Prefix_2 + Stem] + Suffix_1 (e.g. un_2 + grammatical + ity_1)

A violation of types 1 and 2 would be recognizable at once from the linear ordering of the prefixes and suffixes in the word. To detect a violation of the third and fourth types, we have to know the constituent structure of the word, as determined by the morphology and semantics of its affixes. Thus, a putative *insuccessful (type 3) could not be derived by adding -ful at level 2 to *insuccess formed at level 1, because in- is normally added to adjectives rather than nouns, and our theory in any case forbids us to postulate an intermediate *insuccess because the output of every layer of derivation must be a lexical item. So this word, if it existed, would have to be derived by prefixing in- to successful,

in violation of level ordering. Similarly, it seems that the productive type ungrammaticality, unclarity, unconventionality, unpopularity has to be derived from ungrammatical etc. contrary to level-ordering, because un- is normally prefixed to adjectives, not nouns.

The actual vocabulary of English contains a small number of apparent cases of type 1 and a large number of cases of type 4. Types 2 and 3 are entirely absent. In what follows I shall first indicate briefly how the cases of type 1 can be fitted into the model as is, and then proceed to a more extensive discussion of the more problematic type 4. Given the conclusions of the preceding section, a solution is available which explains why type 4 has a special status and why only certain subtypes within it occur.

Aronoff (1976, 84) called attention to a number of examples where secondary suffixes seem to be misplaced before primary suffixes (our type 1 level-ordering violation). One apparent case is -ment-al, but in section 2 we saw that the -ment that figures in these words must on other grounds be classed as primary, so that there is no question of any level-ordering violation. Another case is standardization. Here the paradox is that -ize is apparently stress-neutral and therefore secondary, so that it should not be followed by the clearly primary -ation. However, according to Hayes' (1981) rules for English stress, a long-vowel verbal suffix such as -ize should not cause any stress shift on its stem (cf. Kiparsky 1982 for an explication in terms of Strict Cyclicity). So stress considerations are compatible with primary status for -ize, and such changes as vowel shortening (satirize) would suggest that -ize can indeed be considered primary.

A more interesting case is the suffix sequence -istic. Unmistakably, -ist is secondary (see section 1 above) and -ic is primary. Words like nationalistic, idealistic, relativistic, are therfore prima facie counterexamples. However, already Aronoff (1976) has observed that the relationship between -ist and -istic is not so direct as it might seem. There is in fact reason to set up -istic as a unitary level 1 suffix of its own. The most obvious reason is that there are words in -istic which have no source in -ist but are derived directly from a noun base. For example, cannibalistic, characteristic, are from cannibal, character, not from the nonexisting *cannibalist, *characterist. Similarly, semantic considerations show that stylistic, artistic, ritualistic, folkloristic are the adjectives to style, art, ritual, folklore, not to stylist, artist, ritualist, folklorist.

The one really problematic case is -ability. Aronoff (1976) argues that -able is both primary and secondary, citing a convergence of phonological, morphological, and semantic criteria. Yet at least some forms whose -able is secondary by those criteria do occur with -ity, e.g. analyzability. We cannot argue that -ability has become a suffix in its own right, like -istic, for then we could not explain why a noun in -ability always presupposes a corresponding adjective in -able; also an adjectival base in -able is required by unanalyzability (recall that un- is added to adjectives). We rather have to suppose that the -able in question is assigned at level 1, with -able marked extrametrical.[6]

Thus, -ability remains as the only type 1 case for which some ad hoc treatment is required. In any case, even if it should turn out that it and perhaps other cases cannot be eliminated by independently motivated reanalyses, it does seem that type 1 violations are truly exceptions in that they are restricted to specific pairs of suffixes. What we do not find is systematic exceptions, e.g. suffixes which consistently systematically function as primary for phonology and secondary for morphology, or vice versa.

The situation is quite different with type 4. It involves not just a few specific affix combinations, but all of the secondary prefixes in combination with any of a large number of primary suffixes (27a). Moreover, compounds (27b) and lexicalized phrases (27c) work in the same way as secondary prefixes:

(27) a.

ungrammaticality	bilaterality
untruth	extraterritoriality
pre-fabrication	hydroelectricity
underestimation	decongestant
renegotiable	arch-ducal
reburial	micro-parasitic
polysyllabicity	vice-consulate
extrametricality	vice-presidential
non-denumerability	self-consistency

b.

set theoretical	wind instrumental
root parasitic	cross-sectional
twenty-fifth	lord mayoral
folk etymological	lieutenant-colonelcy

c.

three-dimensional	double helical

Any explanation of these words must account for the fact that they in some sense "blend" two existing words: ungrammaticality is licensed by the existence of both ungrammatical and grammaticality.

Still, not all conceivable such blends are acceptable. The cases in (27) remain marked exceptions and countless parallel formations such as (28) do not occur, as would be predicted by level ordering:

(28)

*unequalize	*symphony orchestrate
*non-fictionalize	*Music Departmental
*chairpersonify	*outboard motorize
*sheet metallic	*freak accidental
*witch doctoral	*white elephantine

The most recent account, and the one based on the most comprehensive review of the facts, is found in Selkirk (1982, 100-106). Her proposal is that un- and other prefixes in words like (27a) have dual membership in the class of primary and secondary affixes. There is no question of any level ordering violation in these words if the prefixes in question can be introduced also at level 1.

Having to allow secondary prefixes to function optionally as primary prefixes would certainly be unfortunate because it would nullify the advantages of level-ordering for prefixes. The fact is that secondary prefixes do not behave optionally like primary prefixes in any other respect. Morphologically, they always precede the true primary prefixes: there are no words with the opposite order, such as *inantireligious, *correanalyze, whereas the secondary prefixes do occur in different mutual orders: outreanalyze vs. reoutwit. Dual membership would predict that secondary prefixes could be attached to roots as primary prefixes can, but words like *anticeive, *misgest, are actually impossible. Phonologically, secondary prefixes like un- and non- do not optionally assimilate according to the pattern of the primary prefixes (*ullimited, *norrenewable), nor do the secondary prefixes de-, pre-, re- (as in redesign, reanalyze) optionally show up with a short vowel like the primary prefixes be-, re- (as in recommend, reduce); re[s]ign 'sign again' re[s]olve 'solve again' are not optionally pronounced with [z] like re[z]ign 'quit,' re[z]olve 'clear up, determine.' Secondary prefixes allow a common stem to be factored out in conjunction, e.g. pre- and post-war, over- and underestimate, but primary suffixes do not: *sub- and transmit, *en- and untangle, *de- and emplane. Crucially, this factoring is still allowed where the secondary prefixes according to Selkirk's proposal are functioning as primary prefixes: mono- and polysyllabicity, bi- and multilaterality, over- and underestimation.

Besides these descriptive weaknesses, the dual membership solution leaves a number of generalizations unexplained. Why is the stem + suffix combination always an actual word? Why do all secondary prefixes have dual membership?[7] Why do compounds (27b) and lexicalized phrases (27c) work the same way? On the dual

membership solution they have to be dealt with either in a completely different way from the prefix cases, which seems unfortunate because they otherwise look entirely parallel to them, or else by giving compounds also dual membership in level 1, which multiplies all the above difficulties by a large factor.

Williams (1981) suggested that some of these cases could be dealt with by allowing semantics to be independent of word-formation. This is a notion which the Bracketing Erasure Convention does not allow us to adopt. In any case it does nothing to explain why level-ordering violations occur only in such a narrow range of cases, and on the other hand does not extend to formations like ungrammaticality, where the problem would still remain why un can be attached to a noun just in case that noun is derived from an adjective that accepts un-.

Strauss (1982) suggests that the level-ordering constraints are applicable only to prefix or suffix sequences, not to combinations of prefixes and suffixes. I think there is a kernel of truth in this idea. However, as stated it is no more than a descriptive generalization, which accounts neither for the absence of convincing cases of type 3, nor for the restrictions on type 4 that we shall see below.

Although as far as I know nobody has proposed this, one might consider solving the problem by invoking a "loop" which would allow forms from level 2 to feed back into level 1 (Mohanan, 1981). On this solution, ungrammatical would be formed at level 2 and then returned to level 1 to get -ity. This would be a severe compromise of level-ordering. It would not explain the restriction to type 4 cases, nor the fact that the portion after the prefix (e.g. grammaticality) is always a real word. Like the dual membership solution, because it derives the words in question at level 1, it wrongly predicts that they should be capable of receiving further level 1 affixes (*irreanalyzable).

What all these attempts have in common is that they extend or weaken the morphology so that it will directly generate the problematic words. Let us instead explore the possibility that they are indirectly generated by a process of reanalysis in the morphology.

The solution I wish to propose involves three assumptions:

1. A form of the Projection Principle holds in the morphology. It stipulates that subcategorization requirements of affixes must be met at every level.

2. Reanalysis of morphological bracketing is freely permitted at any point in the derivation, subject to the above "Projection Principle." Ungrammaticality is then derived in

the following way. The noun grammatical$_A$ + ity$_N$ is formed at level 1. At level 2 un is prefixed. Reanalysis of the resulting string [un[grammatical$_A$ + ity$_N$]$_N$]$_N$ as [[un + grammatical$_A$]$_A$ + ity$_N$]$_N$ is permitted, since the requirement that -ity be attached to an adjective is still satisfied, and forced by the requirement that un be attached to an adjective.

3. Because of Bracketing Erasure at the end of each level, only the structure assigned at a given single level will ordinarily be available for reanalysis to operate on. This blocks cases like (28) from being derived. The marked cases such as ungrammaticality are then distinguished as exceptions to Bracketing Erasure. If the bracketing assigned to grammaticality at level 1 is retained into level 2, then the above principles permit ungrammaticality.

In this way the Projection Principle, free reanalysis, and the possibility of marked exceptions to Bracketing Erasure, interact to admit a limited class of apparent level ordering violations.

It follows that level ordering violations of types 1 and 2 (with suffixes or prefixes in the "wrong" order) are excluded. There is no way at all to derive them by the proposed mechanism. Types 3 and 4, involving a combination of prefix and suffix, can arise, but only under the specific circumstances that permit satisfaction of the Projection Principle. In this sense our solution responds to the intuition that the reason ungrammaticality is a word is that both ungrammatical and grammaticality are words. But it sets stringent limits on the occurrence of such "blends." The need for the Projection Principle to be satisfied after reanalysis (at level 2) entails that the level 2 affix (e.g. un in ungrammaticality) be non-category-changing. Otherwise the reanalyzed form will violate the subcategorization requirement of the level 1 affix (e.g. -ity). For example, cases such as those in (29) not only do not exist, but, it seems, are not even possible additions to the vocabulary of English:

(29) *denatural, *deforestry, *degaseous

This is so in spite of the fact that they too could be superficially taken as blends of denature and natural etc. The reason why they are impossible is that the Projection Principle blocks reanalysis. We cannot get *denatural by reanalysis of [de$_V$[[nature$_N$al$_A$]$_V$]$_V$ to [[de[nature]$_N$]$_V$al$_A$]$_A$ because in the resulting structure -al is not attached to a noun as its subcategorization requires.

The need for the Projection Principle to be satisfied before reanalysis, at level 1, excludes other potential level ordering violations, such as *irresourceful, *insuccessful, since in subcategorizes for adjectives. Of course, they are excluded a fortiori if we accept the principle that the output of every layer of derivation must be a lexical item, since *irresource, *insuccess are not lexical items.

Thus, the reason type 4 violations are so common in English is that nearly all level 2 prefixes in English are non-category-changing, and therefore permit reanalysis. To the extent that they are not, they also do not allow reanalysis, as for example the de- that turns nouns into verbs. Thus the words in (29) are impossible while those in (27) can be derived by marking them as exempt from Bracketing Erasure. The absence of type 3 cases in English is attributable to the scarcity of appropriate affixes which could bring them about. What would be required is a combination of level 1 category-changing prefix and level 2 non-category-changing suffix. The prefixes that come into question, be- and en-, which can make verbs from nouns, appear to go only on nonderived nouns (becloud, behead, empower, enthrone); if this is part of their subcategorization, reanalysis is precluded.

A further feature of our solution in that it localizes the lexical idiosyncrasy that differentiates (27) and (28), i.e. [± BEC], in the item derived at level 1. In other words, that ungrammaticality is admissible is a fact about grammaticality, or more generally about -ity, not about ungrammatical or about un-. This predicts that grammaticality will occur reanalyzed with other secondary prefixes (e.g. semi-grammaticality) while ungrammatical will not necessarily occur reanalyzed with other primary suffixes (*ungrammaticalize). In general, it is certainly true that reanalysis is characteristic with -ity and certain other suffixes (-(ic)al, -ation) while it rarely happens with others, such as -ize, -ify, -ous, -(at)ory.

NOTES

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[2]It is possible that what is here shown as level 2 should be divided into two separate levels, as argued in Allen (1978) and, in a different was, in Kiparsky (1982). Since the issue is a complex one and the point will not matter for our purposes I shall simply proceed on the assumption that English has two levels only.

[3]There are some apparent derivatives from non-lexical categories which are problematic for this proposal. In iffy, (s)hewolf, yes-man we probably have a hypostatized noun as in no ifs, ands or buts, it's a he!, tired of his yeses. No-man's land, back and forth illustrate the large class of lexicalized phrases and idioms, where nonlexical categories are of course expected (though even in these they are omitted in some circumstances, as in John's devil-may-care attitude). More difficult are cases like somewhere, anywhere, somebody, anybody . But, to repeat, this particular point is a supervenient feature of the theory anyway.

[4]Contrary to what I maintained in Kiparsky (1982).

[5]Cf. Lieber (1980), Selkirk (1982), Marantz (1981).

[6]Another apparent case would be baptismal, exorcismal, catechismal, where primary -al is added to what looks like secondary -ism. But the fact that bapt-, exorc-, catech- are not lexical items forces this -ism into level 1 anyway, in which case there is no level-ordering violation here. Possibly this primary suffix -ism is really -ize + m, with the -m of enthusias + m, poe + m, spas + m, -plas + m, triggering level 1 shortening before clusters. Then we could have bapt + ize + t (+ ic)——baptist(ic), parallelling enthusiast(ic), poet(ic).

[7]Selkirk suggests that the three prefixes ex-, step- and non- belong to level 2 only and do not admit level ordering violations. But they seem to work the same way as the others, cf. exterritoriality, step-parental, noncompositionality.

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