

WORD-FORMATION AND PHONOLOGY

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1. INTRODUCTION

If phonology deals in sounds – their production, arrangement, alternations, relative prominences, and so on – one might expect the ideal phonological process to refer only to phonological entities: features, segments, tones, syllables, metrical structure, and the like. One would not expect morphological information to play any role in determining whether or how the phonology operated. Why should the consonant cluster at the end of the verb *collápe* attract stress to the final syllable while the similar clusters at the end of the third person form *édit+s* or the noun *lárýnx* do not? Why should the strings of syllables in *còndensátion*, *còmpensátion*, and *Pennsylvánia*, which are phonologically nearly identical as far as the characteristics that determine stress go, result in a secondary stress falling on the second syllable of *còndensátion* but not on the second syllables of the latter two words? The phonologies of languages in general and of English in particular, abound in cases like these, where the morphological make-up of a word has a considerable influence on its pronunciation. Word formation, in particular, has strong effects on English phonology: the presence of a secondary stress on the second syllable of *còndensátion* has everything to do with there being main stress on the corresponding syllable of its base, *condéense*. To take another example, the preantepenultimate stress and string of three unstressed syllables in adverbs like *significantly*, *húmorously*, and *pérsónally*, otherwise very unusual in English, is obviously related to their derivation from the innocuously antepenultimately stressed adjectives *significant*, *húmorous*, and *pérsónal*. We will look in more details at cases like these and others in this chapter.

Reasoning along the same lines, if morphology deals in meaningful units and their arrangement, we could imagine that the ideal system, from the morphology's standpoint, would result in the same phonological event always being associated with a given morpheme. There should be no allomorphy caused by the requirements of the phonological system. Why should the plural morpheme in *cats* be [s] but [z] in *dogs*? Why should the stresses in *phótogrâph* fall on the first and third syllables of the stem, but on the second syllable in *photógraphy*, resulting in such wholesale allophony in the vowel qualities and, for North American speakers, in the /t/ as well? Yet again, languages are replete with phonologically mandated alternations of morphemes. Indeed, in languages with concatenative morphology, much of the phonology seems to be triggered by the combination of sounds put together by morpheme combination.

Finally, if morphology were to have its way, we would not expect the phonology ever to place limits on what combinations of meaningful units the morphology could

put together. Yet in numerous well-documented cases taken from diverse languages, there are instances where morphological processes cannot even occur if a certain phonological output would result, or, to look at it another way, where the morphology must make reference to phonological properties, properties frequently not present in the underlying representation.

There is, therefore, an inherent tension between the goals of the morphology and of the phonology. And there is an interaction between them which must be modeled in any theory, derivational or constraint-based. In this chapter, we will look at some of the major processes of English in which morphological effects can be seen in phonological rules, and in which phonological effects can be seen in morphology. Clearly we cannot hope to cover all such interactions, and the reader is encouraged to consult the many detailed treatments of English phonology-morphology relationships that have appeared in the literature. I have tried to refer to a cross-section of them here, but my bibliography is only meant as a starting point and leaves out more significant pieces of scholarship than it is able to mention.

2. EFFECTS OF LEXICAL CATEGORY, MORPHOLOGICAL STRUCTURE, AND AFFIX TYPE ON PHONOLOGY

In English, the most striking and pervasive effects of morphology on the application of phonological processes can be seen in the stress system. English *stress rules* are sensitive to

- (a) the morphological category of the word being stressed – for example, verb vs. noun;
- (b) whether or not the word has an affix – for example, suffixed adjectives are stressed like nouns while unsuffixed ones are stressed like verbs;
- (c) the type of affix involved – some affixes affect stress, others are ‘stress-neutral’; this explains for instance why the addition of the adverb-forming suffix *-ly* noted above can result in stress four syllables from the end of the word;
- (d) whether the word is related to an independently occurring word – the so-called cyclic effect, which in part explains the difference in stress between *condensation* and *Pennsylvania*.

2.1 Effects of lexical category and of morphological complexity

The basic metrical system of English favors moraic trochees, much like that of many languages (Hayes 1995). One of the last two syllables of a word is stressed, and alternating syllables before the stressed one also receive stress, resulting in a phonologically pleasing alternating pattern of weak and strong syllables:

- (1) a. *purple, aqua, crimson, fuchsia, magenta, sienna*
b. *maroon, overt, polite, marine, robust*
c. *amaryllis*

The adjectives above have stress on the penultimate syllable (1a) unless the final syllable is extra-heavy, that is, contains two consonants or a long vowel (1b). When the word gets long enough, as in (1c), a secondary stress appears two syllables back from the righthand stress, as in the first *a* of *amaryllis*. There aren't very many morphologically simple but long adjectives in English to fill out the (1c) examples, but there are dozens of other monomorphemic long words in English that show us this rhythmic repeating strong-weak pattern, such as the place names: *Mississippi, Colorado, Shendandóah, Carolina*.

Verbs, like unsuffixed adjectives, are stressed on last syllable if it is heavy, otherwise on penult. The (a) forms in (2) below have long vowels or diphthongs in the ultima, while the (b) forms have the two consonants needed to make a syllable heavy after final consonant extrametricality is taken into account. The forms in (c) end in a single short vowel plus a single consonant, so they are stressed on the penult.

- (2) a. *obey, atone, arrive*
b. *molést, usurp, tórmént,¹ collápsé*
c. *astónish, édit, devélop*

Verbs too show an alternating pattern when they are long enough to require additional stresses:

- (3) *démonstrate, réconnize, mánist, expérimént*

However, observations made first in Chomsky and Halle (1968; henceforth *SPE*) will show us how morphology intervenes.

First, the lexical category of the word matters in English.² While verbs and unsuffixed adjectives show the quantity-sensitive trochaic pattern we have been observing, *SPE* argues at length that nouns in English do not show this final/penultimate stress pattern, but rather have all the action shifted one syllable to the left, so that stress appears on a heavy penult (forms in 4c) or, if the penult is light, on the antepenult (4a, b). The weight of the final syllable becomes largely irrelevant, as the forms in (4b) show.³

¹ The secondary stress on this form is due to its initial syllable being heavy.

² Some views of phonology are sufficiently restrictive as to refuse to categorize a process as phonological if it must mention specific lexical categories. See Bermúdez-Otero and McMahon (in press) for discussion.

³ An added complication is that long vowels in the final syllable of a noun do attract stress (*SPE*: 77-79; Hayes 1982).

- (4) a. *aspáragus, jávelin, América*⁴
 b. *expérimént, lábyrinth, témpést, hárvést, lárýnx*
 c. *agéndá, uténsil, verándá, aróma, appéndix*

Morphology also intervenes in another way: adjectives containing a certain group of suffixes are stressed according to the noun pattern rather than pattern for verbs and underived adjectives. The adjectives in (1) are all underived – they contain no suffix. *SPE* shows that derived adjectives in English do not show this final/penultimate stress pattern, exhibiting instead the penult/antepenult behavior of the nouns.

- (5) a. *innoc+ent, signific+ant, ómin+ous, magnánim+ous, pérsón+al, municip+al, prim+itive*
 b. *malign+ant, momént+ous, autúmn+al, àdjectív+al, expéns+ive*

Notice in particular that the suffixes *-ent/-ant* end in two consonants, but those consonants do not attract stress as they do in the simple adjectives *ovért, robúst*. So the mere presence or absence of a suffix may affect the phonology of stress. *SPE* (38ff) notes a similar affix-dependency for nouns. While, as we've seen, a heavy penult normally attracts stress in a noun, those nouns derived with the affix *-y* as in *industry, énergy, módesty, and gálaty*, skip the heavy penult and place stress on the antepenult.⁵

2.2 Cohering and non-cohering affixes

If the English stress system did not already seem intricate enough, it turns out that it involves one more major complication. Not only lexical category and the simple presence or absence of an affix affects English stress. Like many other languages, English has two different kinds of suffixes (and prefixes), often referred to as *cohering* and *non-cohering*.⁶ The adjectival suffixes *-ous* and *-al* and the others

⁴ While stress in English is largely rule governed, there are cases where the stress rules strictly limit but do not uniquely predict the correct output. For instance, many vowel-final nouns in English receive stress on the penult even when it is light (Nessly 1977). Thus, while *América* and *Pámela* have the generally expected penultimate stress, vowel-final *spaghétti, Colorádo, and Mississippí* show the sub-regularity of penultimate stress.

⁵ Some treatments of English stress treat noun-forming *-y* and adjectival suffixes like *-ent, -al, -ous*, and even the multi-syllabic *-ative* and *-atory* as 'extrametrical', that is, that they are ignored in the syllable count. Extrametricality should not be confused with being non stress-affecting or non-cohering (see immediately following section, especially example (6)), as they do affect position of stress in the base to which they are added and have multiple other effects on the syllabification and segmental phonology of their bases.

⁶ A welter of overlapping but not entirely equivalent terms exists to refer to the bipartite division of affixes. *SPE* refers to them as *stress-affecting* and *stress-neutral*, and uses the juncture symbols + vs. # in attaching them to bases. Whitney (1889), in his discussion of Sanskrit, uses the terms *primary* and *secondary*. Work after Siegel (1974) often uses the terms *class 1* and *class 2*, while Lexical Phonology and Morphology calls them *level (or stratum) 1* and *level (or stratum) 2* (Kiparsky 1982). One often finds reference to *stem-level vs word-level* affixes (based on the idea that cohering affixes

illustrated in (6) are cohering – that is, they interact with the rest of the word in determining its phonology. Note that adding those suffixes can result in the main stress falling in a different place than it does in the unaffixed word:

- (6) *móment* *moméntous*
áutumn *autúmnal*
ádjective *àdjectív*

The presence of the suffix may also result in the laxing of a vowel, according to the rule of *Trisyllabic Laxing*, which requires vowels three syllables or more from the end of a word to be lax, so long as the following syllable is unstressed:

- (7) *o#men* *óminous*
mali#gn *malignant*
li#ne *línear*
compe#te *compétitive*
pe#nal *pěnalty*

And a vowel-initial cohering suffix can provide the nucleus to which a stem-final sonorant consonant will attach as onset. When the suffix is absent, that sonorant must become the nucleus of a syllable itself. (*SPE*: 85-86).

- (8) *disastr-ous/disaster, hindr-ance/hinder, cycl-ic/cycle, rhythm-ic/rhythm*

To summarize, in the so-called cohering suffixes, the phonology is sensitive to the presence of the suffix. However, English has many non-cohering or 'neutral' suffixes as well. These do not seem to have any effect on the position or degree of stress. The non-cohering suffixes of English consist of virtually all inflectional suffixes,⁷ plus a subset of the derivational ones. I list some of the more common neutral derivational suffixes in (9), using the criterion of whether the suffix is taken into account when assigning stress.

- (9) *-able, -er (agentive), -en, -ful, -hood, -ish, -ism, -ist, -ize, -less, -like, -ment, -ness, -ly, -wise, -y (adjective-forming)*

In (10) are some of the major stress-affecting suffixes.

seem able to attach to bound stems as well as to independent words while non-cohering affixes attach only to words). Cohering affixes are said to be in close juncture, while non-cohering ones are in open juncture.

⁷ Kiparsky (1982) makes the point that some inflectional suffixes have allomorphs that are added at level 1 and have phonological (cohering) effects on their bases: *keep/kept, hide/hidden, child/children*.

- (10) *-age, -al, -an, -ant, -ance, -ary, -ate, -ic, -ion, -ify,⁸ -ity, -ory, -ous, -y*
(noun-forming)

We saw in (2) that verbs are typically stressed on an extra-heavy ultima or on the penult. However, inflectional suffixes do not affect the syllable count nor cause verbs to be stressed as if they ended in two consonants. The same is true of a stress-neutral suffix like verb-forming *-ize*:

- (11) *astónishing, astónishes, édits, dévelòps, Àfricanize, particularize*

English also has a general rule that tells us which of a number of stresses in a word will be the main stress – that is, which of the feet contains the head of the metrical structure: it is the rightmost stress that has at least one syllable after it.⁹ In other words, the very last syllable of words with more than one stress is not usually the one that receives the main stress.¹⁰ Only a final foot that branches gets to contain the head syllable of the word. So, in the following monomorphemic words with alternating stresses, the last stress wins out as main stress in (12a) because the last stressed syllable has another syllable following it. In (12b), however, the second-to-last-stress emerges as the main stress and the final stressed syllable receives only secondary stress:

- (12) a. *Mississippi* b. *Pánamà*
 Thèodóra *Théodòre*
 Càrolina *Cároline¹¹*
 Ticònderóga *níghtingàle*

In the examples in (13), a stress-affecting suffix counts for making a syllable non-final and thus eligible for the main stress.

- (13) *dialèct* *dialéctal*
 ánecdòte *ànecdótal*
 óriènt *òrièntátion*
 Pàraguày *Pàragúayan*
 mánifest *mànifestátion*

⁸ Raffelsiefen (2004) argues that *-ify* is not really stress-affecting. Rather, it selects already-existing stems with stress that may happen to fall in a different place than in the underived adjective. Thus, for instance, she argues that *solidify* is based on the (stressed) stem of *solidity* rather than the word *sólid*. See section 7 for further discussion.

⁹ This generalization was first noted, I believe, in *SPE*. It has been restated and refined repeatedly in subsequent years.

¹⁰ There are several suffixes, such as *-ése*, which receive main stress in contradiction to this large generalization. Other sub-regularities as well as this one, such as the tendency of word-final verb stems to be stressed (*injéct, conféss*) are discussed at some length in Liberman and Prince (1977.)

¹¹ The example is relevant, of course, only in the pronunciation where the final syllable is unreduced [əjn].

However, the stress-neutral suffixes are not visible to this rule – they do not count as adding a final syllable and their presence therefore does not result in the preceding syllable receiving main stress.

- (14) *dialècthood, ànecdòte-like, mánifestly, òriènting*

Similarly, these neutral suffixes are not relevant in determining the position of the rightmost stress (that is, the rightmost foot) – words containing them have stress in the position it occupies in the word they are derived from, even if that results in unstressed closed syllables, sequences of unstressed syllables (lapses), or rightmost stresses falling more than three syllables from the end of the word. Compare the position of stress in the words in (15a), their unchanged derivatives with stress-neutral affixes in (15b), and their derivatives with stress-affecting affixes in (15c).

- (15) a. *rígíd* b. *rigidness* c. *rigidity*
 órigín *órigínless* *óriginal*
 módern *módernism* *modérnity*
 hóspítal *hóspítalize* *hòspítality*

Turning to phonological phenomena other than stress, we notice that the neutral suffixes cannot rescue an otherwise unsyllabifiable stem-final sonorant consonant.¹²

- (16) a. *hínder* b. *hindering* c. *hindrance*
 rhythím *rhythím-y* *rhythmic*
 méter *métering* *metrical*

And they do not provide the syllable count needed to trigger Trisyllabic Laxing.

- (17) a. *me#ter* b. *me#tering* c. *mètrical*
 na#tion *na#tionhood* *nàtionál*
 o#men *o#menlike* *òminous*
 spi#ne *spi#nelessness*

Neutral suffixes also do not trigger the rule of velar softening.

- (18) a. *pirate, pírac+y* b. *meat, meat#y*

We have now seen that English phonology must have access to the morphological structure of a word, its lexical category, and the distinction between

¹² Indeed, Booij (1977, 1995) argues that, at least for Dutch, which shows a similar bifurcation in its affixes, the effect that an affix has on syllabification is the main criterion on which to decide which class it falls into. Affixes that don't interact in the basic syllabification of a word are considered to fall outside the phonological word. Such affixes show a mismatch between their morphological structure (one morphological word) and their phonological structure. For more discussion of 'co-present' and possibly conflicting morphological and phonological structures, see Inkelas (1994).

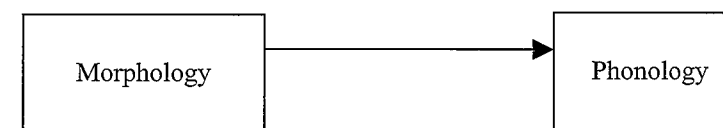
two kinds of affixes. In this way, morphology may interfere in the normal workings of phonology, creating clashing stresses (*condensation*), strings of unstressed syllables (*originless*), heavy syllables with no stress on them (*rigidness*), non-primary rightmost stresses followed by another syllable (*dialecthood*), syllabic sonorants before vowels (*hindering*), and other otherwise mysterious complications in the sound patterns of the language. We turn now to interactions of the opposite kind, where morphology seems to be required to take phonological factors into account. In section 6 we will return to discuss another kind of morphological influence on phonology – the so-called *cyclic effect* seen in *condensation*, where some aspects of the pronunciation of a word are carried over into words formed from that word.

3. MORPHOLOGY LIMITED BY THE PHONOLOGICAL FORM OF THE BASE OF AFFIXATION

The literature contains a number of cases where phonology influences the ability of morphology to act as it otherwise would if unfettered. Hargus (1993: 48-52) contains an excellent summary and evaluation of the most convincing cases of this kind, though she does not talk about any English examples at length. In one common type, a suffix has different allomorphs depending on the length of the base, the base's stress pattern, or the segment in which the base ends. Thus in German (Hall 1990), one deverbal suffix has the allomorph *-erei* when added to verb stems with final stressed syllables, while *-ei* is added to other verb stems. Perhaps the most often-cited case of affixal sensitivity to phonology is that of the affixation of *-al* to verbs to form nouns. Siegel (1974) discovered that this *-al* (not to be confused with the adjective-forming *-al* found in *autumnal*) can only be added to verbs with final stress. Thus we find *arrival*, *bestowal*, *referral*, *avowal*, *renewal*, and so on, but not **édital*, **énteral*, or any other non-finally stressed verb plus *-al*.¹³ Another thoroughly documented case is that of *-ize* (Marchand 1969, Orgun and Sprouse 1999, Raffelsiefen 2004), which can only be productively affixed to items with non-final stress. In both these cases, the interest for the phonology-morphology interface is clear. Stress is a derived, largely predictable phonological property, not present in underlying forms. If we did not have to deal with such cases, the simplest theory of how phonology and word formation interact would be for them to have a single interface. Word formation would assemble all the morphemes, after which phonology would deal with the result.

¹³ Hargus (1993) argues that *-al* affixation is too lexically unpredictable to serve as a clear example of morphology dependent upon phonology. For instance, *arrival* exists but **derival* does not. While I continue to think that final stress is a necessary, if not sufficient, condition for *-al* affixation, the case of *-ize* is more extensively documented. Siegel also finds stress-dependent behavior for deverbal *-ful* (*forgetful*), which attaches to verbs with final stress, and syllable counting behavior for de-adjectival *-en*.

(19)



In such a model, which is basically that of *SPE*, there is no obvious way for a morphological rule to have access to derived phonological information such as the position of stress. Such models may be called *non-interactionist*.¹⁴ An *interactionist model*, on the other hand, proposes that some affixes can be added, followed by some phonological operations, followed by additional affixation:

(20) *arrive* → *arrive* → *arrival*

One of the most widely adopted views of morphology-phonology interaction in the 1980's and early 1990's was *Lexical Phonology and Morphology* (LPM) (Kiparsky 1982, Mohanan 1982, Kaisse and Shaw 1985, Hargus and Kaisse 1993 and many others.) LPM adopts Siegel's interactionist view that morphological and phonological operations can be interspersed, again with stress assignment potentially occurring before some morphological affixation. We will discuss LPM and its problems in section 2.1.4.

In a non-derivational model like Optimality Theory, one can use constraint ranking to allow phonological considerations like those disfavoring clashing or lapsing stresses to outweigh the generally productive ability of the morphology to form new words. Raffelsiefen (2004) provides an interesting way of looking at the tension between morphology and phonology. She asks us to consider the lexically stressed suffixes *-ée*, *-ése*, and *-éer*. Each of these suffixes not only receives stress, as we might expect of a suffix containing a tense vowel, but must be marked in the lexicon to receive main stress.¹⁵ When *-ée*, *-ése*, or *-éer* are added to bases that end in unstressed syllables, no problem arises with respect to the resulting stress pattern. Forms like *examinée*, *visitée*, *mountainéer*, and *médicalése* do not have adjacent, hence clashing stressed syllables. However, the phonology finds a different solution for each of these three suffixes when the morphology attempts to coin words on bases with final stress.

For *-ése*, the solution is a repair: stress is shifted off the final syllable of the base to a preceding syllable:

¹⁴ See Odden (1993) for a proposal about how one might replace the interactionist models current in the heyday of *Lexical Phonology and Morphology* and return to a non-interactionist model that maintains, nonetheless, the segregation of lexical from postlexical phonology.

¹⁵ Recall that normally a final syllable does not receive the main stress in English. Certain morphemes and other strings, such as the *ón* of *ballóon* and *póntóon* must be marked to receive main stress in contradiction to this generalization.

- (21) Taiwán+ése → Tàiwanése
 Japán → Jàpanése

The result violates a general family of constraints called *paradigm uniformity* constraints. The iambic stress pattern of the base is not maintained in the derivative. But at least the morphology is permitted to create the new word. Within Raffelsiefen's analysis, it is better to move the stress than to allow adjacent stresses. *CLASH dominates PARADIGM UNIFORMITY (PU) [STRESS]. The constraint that forces the phonology and morphology to compromise and create some form, M-PARSE (Prince and Smolensky 1993), also dominates PU [STRESS].¹⁶

- (22) Ranking for *-ése*: *CLASH, M-PARSE >> *PU[STRESS]

For *-éer*, however, the result is a gap. No adjustment is made by the phonology, and the morphology suffers by having no word formed at all. Raffelsiefen uses the tool of Google searches to discover what kinds of new words English speakers can form productively. Her searches turned up virtually no words of the form **batoneer*, that is, *-éer* derivatives formed on bases with final stress. Raffelsiefen concludes that different suffixes in English invoke different constraint rankings. For *-éer*, M-PARSE is dominated both by the phonologically motivated *CLASH and by the morphologically motivated PU, so no compromise is reached and no pronounceable form emerges at all.

The factorial typology would predict we might also find cases where PU [Stress] wins out and *CLASH is violated, and Raffelsiefen argues that this ranking is instantiated for *-ée*. Finally-stressed bases are permitted to combine with this suffix, resulting in outputs with clashing stresses but where the derived form maintains the stress of the base. She finds many coinages like *selectée*, and *retirée*. In these cases, the morphology is not inhibited by the phonology, with the result that outputs which would not occur in morphologically simple words are readily found in derivatives.

4. LEXICAL PHONOLOGY AND MORPHOLOGY AND ITS ILLS

One of the most attractive features of the LPM model was its unification of apparent generalizations about the phonology of cohering suffixes, their interaction with morphology (especially their triggering of *cyclic rule* application), and their linear order. LPM adopts and elaborates the *level ordering hypothesis* (also known as the affix ordering generalization) of Siegel (1974). This hypothesis claims that cohering, stress-affecting (+-boundary) affixes (called level 1 affixes in LPM) will occur close to the root, while non-cohering, stress neutral (#-boundary) affixes,

¹⁶ One goal of Raffelsiefen's (2004) article is to support the original M-PARSE explanation for phonologically induced gaps over the revision to OT proposed by Orgun and Sprouse (1999). These authors have proposed that the EVAL(UATION) module of OT be supplemented with a CONTROL module, which contains inviolable constraints. If there is no way to satisfy the constraints in CONTROL, the 'null parse' results. This means that the morphology fails to parse the morphemes into a coherent, pronounceable word and a gap appears in word formation.

called level 2 affixes, will always occur outside the cohering ones. In other words, level 1 affixes cannot attach to a word to which a level 2 affix has already been attached. We can illustrate this claim with the schematization in (23), where A_C stands for a cohering affix and A_{NC} for a non-cohering affix.

- (23) $A_{NC} \# A_{NC} \# \dots \# A_C + A_C + \dots + [\text{root}] + A_C + A_C \dots \# A_{NC} \# A_{NC} \# \dots \#$

Thus, according to Siegel, Kiparsky (1982) and other LPM work, the non-existence of words like **happi#ness+al* or **sing#er+ous* comes from the fact that they contain a word formed with a non-cohering affix (*#ness*, *#er*) to which a cohering affix (*+al*, *+ous*) has been affixed. There is nothing wrong with these words as far as the part of speech of the base to which the final affix is added, since *-al* and *-ous* do attach to nouns (*person+al*, *danger+ous*). Affix ordering permits words like *person+al+ity*, since both *+al* and *+ity* are level 1 suffixes. The word *danger+ous#ness* is also fine, since it contains a level 1 suffix followed by a level 2 suffix. And words with strings of level 2 suffixes are also fine: *seamlessly*, *seamlessness*. The correlation with phonology is that all the affixes starting from the stem outward to the first non-cohering affix should form part of the visible input to level 1 lexical phonological rules, while all of the affixes starting from the first non-cohering affix outward will not be the trigger or target of any such rule, and will only undergo postlexical rules, the ones that apply between words.¹⁷

In (24) I present a diagram of the workings of the LPM model, modified somewhat from the one found in Kiparsky (1982: 133).

- (24)

	MORPHOLOGY		PHONOLOGY
Level 1 (stem level)	+boundary inflection and derivation; zero-derivation of nouns from verbs	↔	stress rules, trisyllabic laxing, velar softening, sonorant syllabification, etc.
Level 2 (word level)	# boundary derivation and compounding, zero-derivation of verbs from nouns, most inflection		compound stress
	syntax		postlexical phonology

In this model, morphological operations occur one affix at a time. Each time an affix is added at level 1, the form is passed to the level 1 phonology, which applies to the string as it is currently concatenated. The form is then passed back to the morphology at that same level, over to the phonology again, and so on until all level 1 affixes for that word are added. (Hence the ↔ symbol between the level 1

¹⁷ Borowsky (1993) achieves this result by ordering all phonological rules at level 2 (the word level) before all morphological operations at level 2.

morphology and phonology.) The cyclic application first introduced in *SPE* results from this interleaving of phonological and morphological operations at level 1. Then the form passes on to level 2. In English, it appears that all the cyclic phonological rules apply at level 1.

To illustrate the segregation of morphological operations into levels and the concomitant applicability of certain phonological rules only to strings created at that level, consider a point about the zero-derivation of nouns from verbs versus that of verbs from nouns made in Kiparsky (1982). As is well known, when nouns are derived from verbs with final stress, they preserve that stress as a secondary prominence but add a penultimate, primary stress of their own, as befits a noun. Thus we find noun/verb pairs such as *cónvict* from *cónvict*, *pérvèrt* from *pérvèrt*, and *tórmènt* from *tórmènt*. In a derivational theory such as LPM, one would say that nouns are zero-derived from verbs at level one, and are thus subject to another cycle of the stress rules after that affixation occurs. However, Kiparsky argues, the zero-derivation of verbs from nouns takes place at level 2. Since the stress rules of English do not apply at level 2, the stress does not change in denominal verbs like *to páttèrn*, even though, as we noted above, primary verbs ending in two consonants receive final stress. Thus we could say that deverbal $-\emptyset$ is a level 1, cohering suffix while denominal $-\emptyset$ is a level 2, non-cohering suffix.

Classical LPM was probably the last model of phonology-morphology interaction to enjoy a wide consensus (Noyer 2004). However, it has been recognized for some time that it embodies at least one strong claim about word formation that is probably not correct, certainly not for English, namely the affix ordering hypothesis. Problems with any theory of the level ordering of affixes had been recognized as early as Aronoff (1976). Most well-known, at least among phonologists, are cases where affix ordering proves to be too strong a theory, ruling out combinations that actually occur such as *#ment+al* (*governmental*) and *#iz+ation* (*neutralization*). As we have mentioned *-ment* and *-ize* are stress-neutral, as witnessed by a form like *góvèrnmènt*, with stress in the same position as its source verb and no stress on its heavy penult (compare the underived noun *appèndix*), and *márgínálizè*, with stress four syllables from the end of the word. But *-al* and *-ation* are stress-affecting. The unpredicted existence of syntactic phrases inside of compounds, and the existence words with sub-compounds inside co-compounds and of words with co-compounds inside sub-compounds, discussed for Malayalam by Mohanan (1982), form another class of difficulties for the affix ordering hypothesis, as do bracketing paradoxes like *un#grammatical+ity*, and *re#organiz+ation*. These and many other cases have demonstrated that the affix ordering hypothesis undergenerates.¹⁸

Equally interesting and less often discussed is Fabb's (1988) demonstration that the affix ordering hypothesis is too weak and overgenerates. Fabb notes that affix

¹⁸ Within LPM, loops permitting a return to an earlier level of affixation were one major proposal for accounting for unexpected orderings and compound types; also helpful was reduction of the number of levels posited for a language, so that many affixation and compounding processes were available at every level. However, none of these LPM proposals was really satisfactory, and as far as I know, none could deal with the results of Fabb (1988) discussed shortly. See Spencer (1991: 397-420) for a discussion of the many proposals for dealing with bracketing paradoxes.

ordering restrictions account for only a small percentage of the sequences of affixes that simply don't occur in English. He lists 43 common affixes in English. If there were no affix ordering hypothesis, we might expect around 600 grammatical combinations of these affixes, if we simply made sure that affixes that selected for a particular part of speech were combined only with that part of speech, and that the particular stress requirements of the affixes like deverbal *-al* were met. With affix ordering, we can pare that number down to an expected 459 combinations. But English words actually contain only about 50 pairs of suffixes! The main reason for this is that 28 of the common suffixes – more than half – never combine with another suffix. Six suffixes combine with only one suffix; for instance *-ic* only attaches to unsuffixed stems or words (*comic*, *metallic*) or to the suffix *-ist* (*modernistic*). Six other suffixes are 'semi-productive': noun-selecting *-al*, for instance, combines with three cohering and non-cohering affixes *-ion*, *-ment*, and *-or*. Only *-able*, deverbal *-er*, and *-ness* show no selectional restrictions beyond part of speech. I am unaware of a response to Fabb's work within the LPM model.

The inevitable conclusion seems to be that the affix ordering hypothesis must be rejected, at least for English,¹⁹ and with it, that part of Lexical Phonology and Morphology that rests upon it. I suspect that the enduring contributions of LPM will lie rather in its recognition of a set of fundamental characteristics of lexical rules and a largely complementary set that inhere in postlexical rules.²⁰

In contrast to their rejection of the affix ordering hypothesis, both Fabb (1988) and Aronoff and Sridhar (1987) continued to believe in another tenet of level ordering, namely that the *word-boundary* (#) and *morpheme boundary* (+) affixes could be sorted into two coherent groups on the basis of their phonological behavior, just as had been claimed in *SPE* and LPM. The +boundary suffixes were available to rules of stress assignment – both those assigning stress, that is creating foot structure; and those choosing which of these would be the primary stress, that is, the head foot); they were available for syllabification so that the vowel-initial ones could bleed *Sonorant Syllabification* (*hinder*, *hinder#ing*, but *hindrance*); and syllabification rendered their content visible to Trisyllabic Laxing so that they could provide sufficient material to place a vowel three syllables from the end of the word. I am not aware of many discussions that place this claim under the scrutiny that the affix ordering generalization has received. However, Raffelsiefen (2004) presents evidence that the division of affixes into two clear groups is too strong a claim. We return to her proposal in section 7.

¹⁹ I do not know if arguments like Fabb's go through for languages with highly productive agglutinative suffixation, such as Turkish.

²⁰ Kaisse and Hargus (1993) summarizes the findings of the contributors to the volume *Studies in lexical phonology* and contains a discussion of the counterexamples to the predictions of LPM that had been amassed through 1990, when the conference on which the volume was based took place. They conclude that though almost every claim of LPM runs into counterexamples, the overall predictions of the theory continue to be valuable.

5. MORE RECENT DEVELOPMENTS OF LEXICAL PHONOLOGY AND MORPHOLOGY

With the arrival of *Optimality Theory*, much work in phonology in the last decade has simply turned to matters which are ancillary to the concerns of Lexical Phonology and Morphology.²¹ As Hammond (2000) points out, few students in the United States are exposed to more than a cursory introduction to the results of that theory, and the question of whether Lexical Phonology is defunct is certainly worth asking. However, the answer seems to be 'no,' or at least 'not exactly'. In one response to earlier difficulties, Giegerich (1999) proposes to keep the basics of LPM while replacing its *affix-driven stratification* with a stratal organization that relies on the base to which affixation applies. Roots, which do not belong to any lexical category, are listed in the lexicon along with a list of the *root-level affixes* that can attach to each one. This listing accounts for the relative non-productivity and non-compositional semantics of such morphology. Once a root is converted to a word by having a lexical category label assigned to it, it enters the *word-level morphology* and can receive the more productive, semantically compositional affixes. Since affixes are not restricted to a single stratum, they can show both stem- and word-level properties and ordering. Hammond comments that the critical process of conversion to word is really not well explained in Giegerich's model – how, why and when does this happen, and what accounts for the fact that some bases become nouns while others become verbs or adjectives? Nonetheless, the idea of *base-driven stratification* may be worth pursuing.

Lexical Phonology and Morphology also survives in newer versions where it is married with Optimality Theory. Work by Kiparsky (2000), Bermúdez-Otero (1999, forthcoming,) and Rubach (2000), among others, uses ranked and violable constraints in conjunction with a division among stem-level, word level, and postlexical strata. Constraints can be ranked differently at each stratum, and the output of each stratum is used as the input to the next. Kiparsky (2000) goes so far as to say that on the stem level, every stem is a cyclic domain. Thus, presumably, there could be a new evaluation of candidates every time a stem-level suffix was added. However, an extended treatment of English morphology-phonology interactions within *Stratal Optimality Theory* has not yet appeared, to my knowledge.

²¹ Noyer (2004), points out that various critical parts of the LPM theory are incompatible not only with classical monostratal Optimality Theory but also with the theory of Distributed Morphology (DM; see for instance Embick and Noyer 2001). He explains that LPM's inclusion of a lexical morphological and phonological module, which operates before syntactic structure is available, makes no sense within DM. In DM, the inputs to the syntax are not fully formed words but abstract morphemes whose assembly into both words and phrases is performed by syntax and post-syntactic morphology. Nonetheless, Noyer regrets the loss of the ability to characterize the *lexical syndrome*, that is the segregation of characteristics of lexical vs. post-lexical rules. I do not know of any treatments of English morphology-phonology interactions in DM.

6. HOW DO RELATED WORDS AFFECT EACH OTHER? THE CYCLE, TRANSDERIVATIONAL EFFECTS, PARADIGM UNIFORMITY AND THE LIKE

One of the major preoccupations of phonologists at least since *SPE* has been the question of how to capture the influence that the pronunciation of one word can have on other words related to or derived from it via word formation or inflection. Indeed, some form of this preoccupation goes back to the Neogrammarians, under the rubric of *analogical sound change*.²² Perhaps the earliest influential modern treatment is that of Kurylowicz (1949). The topic returns us to wondering in what ways morphology – in this case, the relation of one word to another – can intervene in the otherwise purely sound-oriented basis on which phonology would prefer to operate.

The cycle of *SPE*, especially when put together with Brame's (1974) restrictions on when new word-internal cycles can be motivated, provided a constrained method of capturing some of these interactions. To oversimplify a bit, Brame argued that a morphologically complex word can undergo a second cycle of rule application only if it contains an independently occurring word that contributes its full meaning to the larger word. In Brame's most celebrated example, Arabic, /fihim#na/ 'he understood us' contains the third person verb /fihim/ (with a zero 3p. masc. sg. affix) and thus maintains traces of the word-initial stress of the surface form *fihim*, in this case by preserving the initial vowel rather than deleting it, emerging as *fihimna*. However, /fihim+na/ 'we understood', does not contain the independent word 'he understood'; it does not contain any independent word but only the bound stem /fihim-/. Therefore, it undergoes only one application of stress assignment, receiving only penultimate stress, and its initial vowel must therefore be elided, yielding *fhimna*. The cases under which one word can influence the pronunciation of another, then, are relatively constrained and formally easy to state within a cyclic, derivational theory.²³ Cases in which a base-derivative relationship exerts an influence on pronunciation are solely ascribed to the cycle.

However, starting in the early 1990's, for reasons largely orthogonal to morphology-phonology concerns, many phonologists turned away from rules and derivations to Optimality Theory. Most versions of OT involve only one evaluative step – potential output candidates are evaluated simultaneously for their satisfaction of constraints on pronunciation or perceptibility (markedness constraints) and for their satisfaction of the requirement to resemble their underlying representations as closely as possible (faithfulness constraints.) There are no intermediate representations which can form the input to a second round of cyclic rule application. Though, as we have noted, there are versions of Stratal OT that maintain the gross architecture of the derivational LPM theory and can therefore recapitulate some results of a level 1/level 2/postlexical division, most approaches to base-derivative resemblances in OT have either relied upon output-output constraints that

²² See Lahiri (2003) for a recent introduction to the concept of analogy in linguistics.

²³ However, as we shall see shortly, not every case where we might expect cyclic effects necessarily exhibits those effects. Sometimes complex words are stressed as if they were simplex.

enforce resemblances among the pronunciation of related words; or they have employed alignment constraints that enforce a match-up of phonological boundaries (such as feet and syllables) with morphological boundaries. An early instantiation of the latter approach can be found in Kenstowicz (1995). His analysis encodes the effect of the stem-suffix boundary on stress in Indonesian with a constraint requiring the right edge of a stem to coincide with the right edge of a foot. The high ranking of this constraint results in different stress patterns for morphologically simple and morphologically complex words.

Benua (1995, 1997) pioneered the use of output-output correspondence constraints to capture cyclic phenomena with a *non-stratal OT*. In Benua's *Transderivational Correspondence Theory*, a morphologically derived surface form such as *còndensátion* is more faithful if it closely resembles the base on which it is formed, in this case, *condéense*, which has a full vowel and a stress on the syllable *-dense*. One of her most accessible examples deals with the nickname pair *Larry/Lar*. The truncated form, pronounced [lær] in dialects where the long, source form is pronounced [læ:ri], violates an otherwise general restriction against tautosyllabic [æ:ri]. The pressure for the truncated form to resemble its base outweighs the phonological markedness constraint. McCarthy (in press) contains a lucid comparison of various OT treatments of the analogical influences one form can have on another. He points out that Benua's *Base Priority Principle* disallows influences from derived forms to base forms, just as the phonological cycle did. On the other hand, *Uniform Exponence* (Kenstowicz 1996) and *Anti-Allomorphy* (Burzio 1996), which require consistent realization of morphemes in all their phonological properties, allow influence in both directions. McCarthy argues that both kinds of correspondence constraints are needed.

Steriade (1999) introduces another allomorphy-minimizing, paradigm uniformity principle, *Lexical Conservatism*: "Newly coined forms are penalized if they do not closely resemble already existing forms." She points out that the English level 2 affixes generally obey lexical conservatism much better than level 1 affixes, though they often do so at the expense of phonological well-formedness. Thus we recognize *invalidism* as being related to *invalid* via the addition of a level 2 suffix because it maintains the stress of the stem in isolation. The string of four unstressed syllables that results is the price the phonology pays for the success of the morphology in maintaining identity between base and derivative. The apparent level 1/level 2 distinction, she argues, is an artefact: so-called level 2 forms are just forms based on *impoverished paradigms*, where there is no phonologically preferable form on which to base a new derivative.

How does one handle the somewhat opposite fact that cyclic effects do not always occur even where one might expect them to? Pater (2000) is one of the most developed accounts of English stress and cyclicity written recently within Optimality Theory. He juxtaposes the following cases, where the examples in (25a) and (b) show an effect of the base on the derived form, while those in (25c) and (d) show no such effect.²⁴

²⁴ Pater bases his transcription of non-reduced (secondarily stressed) vs. reduced vowels on Kenyon and Knott (1953) and, where there is disagreement, on Webster (1981) as well. For a few of the second

(25)

a. <i>condéense</i>	b. <i>còndensátion</i>	c. <i>infórm</i>	d. <i>informátion</i>
<i>exhórt</i>	<i>èxhòrtátion</i>	<i>trànsporté</i>	<i>trànsportátion</i>
<i>contést</i>	<i>còntèstátion</i>	<i>consúlt</i>	<i>cònsultátion</i>
<i>impórt</i>	<i>impòrtátion</i>	<i>sègmént</i>	<i>sègmentátion</i>
<i>àugmént</i>	<i>àugmèntátion</i>	<i>trànsfórm</i>	<i>trànsformátion</i>
<i>àuthéntic</i>	<i>àuthènticity</i>		

In the (b) cases, preserving some stress on the syllable before *-ation* results in a stress clash; we find adjacent stressed syllables. We know that phonologies, including that of English, prefer to alternate stresses rather than tolerating or creating clashes. Pater speculates that as words become more lexicalized, familiar, and established, the pressure for the base they contain to influence their pronunciation reduces and they become more likely to be treated as the phonology would have liked to treat them all along. Thus he asks us to compare the more frequent, everyday word *information* with *exhortation*. In *information*, the second syllable reduces, so that *information* is stressed like the underived words *Pennsylvania* or *gorgonzola*. The foot structure [infor][má]tion is more optimal, phonologically speaking, than in [in][fòr][má]tion would be.²⁵ But [èx][hòr][tá]tion is chosen over [èxhor][tá]tion because only *exhortation* is lexically marked as subject to a special high-ranked constraint called *Ident(ity)-Stress-S₁*. Words which show the cyclic effect of stress preservation are lexically marked with a diacritic that makes them subject to this output-output constraint, while those, like *information*, which do not preserve stress, have no marking and thus do not override the constraint against clash in order to maintain the stress of their bases. A high-ranked identity constraint like *Ident-Stress-S₁* is cloned from the general *Ident-Stress* constraint of the language. But the general constraint is ranked below the phonological markedness constraint *Clash, so that *informátion* emerges as the optimal form.

7. DO THE COHERING AFFIXES FORM A COHERENT SET? SPLIT BASES, SUBCAT^{WORD} AND PHONETICS IN MORPHOLOGY

At the end of section 4, we asked whether the traditional division of suffixes into two groups could be maintained. We are now ready to understand a recent challenge to this claim raised in Raffelsiefen (2004).

Because she works within a version of Optimality Theory in which different affixes invoke different constraint rankings, Raffelsiefen's equivalent to a coherent grouping of stem-level versus word-level affixes would be a group of affixes which cause the forms to which they attach to be evaluated by one ranked set of constraints

syllables of the words in (25d), Webster permits a secondary stress to appear in an alternate pronunciation, while Kenyon and Knott cite only a reduced vowel pronunciation.

²⁵ I adopt here the common metrical notation that uses square brackets to show the grouping of syllables into feet. The brackets do not indicate phonetic transcription.

versus a second set which call up another ranking of those constraints. But, as we saw earlier in the discussion of *-ése*, *-éer* and *-ée*, she argues that in fact every affix has its own individual constraint ranking and that there are no coherent sets. She compares at some length ranking of the constraints which control *-ize* affixation with the ranking controlling the affixation of another verb-forming suffix *-ify*. The former suffix is usually classified as stress neutral, the latter as stress-shifting. (*fluid*, *fluidize* *fluidify*).

Consider first the verb-forming suffix *-ize*, which can attach productively to nouns (*Clintonize*, *skeletonize*) and adjectives (*randomize*, *marginalize*). The productivity and semantic compositionality of *-ize* formations suggest it is word-level (level 2) as does the fact that it can be added to antepenultimately stressed bases like *skéleton* and *márginal* without inducing a stress-shift to repair the sequence of unstressed syllables. On the other hand, *-ize* is able to select pre-existing stems, rather than words,²⁶ as a base, a clear stem-level (level 1) characteristic, if this will allow it to avoid stress clash (26a) and other unfortunate phonological results such as repeated identical onset consonants (26b).

- (26) a. *sùblimize* based on *sùblimátion* rather than *sùblime*
immunize based on *immunólogy* rather than *immúne*
- b. *máximize* (**máximumize*, cf. *rádiumize*)
áppetize (**áppetitize*, cf. *párasitize*)

If no source which can avoid clash is available, no word is coined. Thus **Búshize* is all but unattested in Google searches, while *Clíntonize* gets over 100 hits – this despite the fact that the base *Bush* is much more commonly encountered in contemporary searches than the base *Clinton*.

Now consider the behavior of *-ify*, standardly seen as a stress-affecting + boundary affix (*SPE*). Raffelsiefen argues that *-ify* does not gratuitously attach to stems any more than *-ize* does. It does so only to avoid other ill-formed phonological results, and only when a suitable stem already exists in a related word in the speaker's lexicon. Thus *týpify* with the lax initial vowel preferred by Trisyllabic Laxing can be coined because *týpical* existed first within the paradigm. *fluidify*, with a stress configuration that avoids a *LAPSE violation could be coined in 1857 due to the prior existence of *fluidity*, first attested according to the *OED* in 1603. But when there is no plausible source for a form that satisfies Trisyllabic Laxing, speakers coin forms with tense vowels: *ste#elify*, *sto#nify*, *gro#ssify*, etc. And when there is no source with a stress shift that avoids a violation of *LAPSE, a gap results: *rándom+ify*, *privat+ify* *tunnel+ify*, etc. yield no output whatsoever, since there is no **rándomity* or other form with stress on the second syllable to supply a stem. Thus, argues Raffelsiefen, neither *-ify* nor *-ize* are genuine stress-shifters. Both require a

²⁶ Raffelsiefen formalizes this ability as the domination of SUBCAT^{WORD}, a constraint that requires word formation to follow Aronoff's (1976: 21) injunction that affixes should attach to words, not stems. For Raffelsiefen, a stem used as a base of word formation is a surface form, critically a form with stress assigned to it.

source to which to match their stressed syllables. Therefore they are stress-neutral. Yet they are also cohering, if judged by other criteria. Furthermore, both are phonologically interactive with their bases in different ways. *-ize* ranks *LAPSE as relatively unimportant and thus does not seek out bases with stress near the end of the word, but it ranks *CLASH so highly that it attaches to bound stems or leaves gaps in word formation where no suitable stem exists. It ranks TRISYLLABIC LAXING low (*ra#diumize*). The affix *-ify*, on the other hand, ranks TRISYLLABIC LAXING fairly high (*týpify*) and cannot violate *LAPSE at all. Raffelsiefen's claim, which may or may not turn out to be right, is that virtually any ranking of constraints supplied by the factorial typology may be found for an affix. Of course, in order for this argument to go through, one must accept independent rankings called up by different affixes, a controversial proposal. If she is correct, though, the second major claim of level ordered phonology will also lose its force. Not only will level ordering fail to predict the linear order of affixes, it will also fail to predict their phonological behavior.

Raffelsiefen is not the only author to note that the pre-existence of a phonologically suitable word may be necessary in order to permit a new coinage. Steriade (1999) introduces a similar phenomenon which she calls the split-base effect and which is closely related to the principle of lexical conservatism which we discussed above.²⁷

While similar in concept, the split-base effect differs from Raffelsiefen's proposal in that Steriade thinks a word can have distinct semantic, morphological and phonological bases. Thus in the triad *remédy* (vb.), *remédial*, *remédiable*, Steriade would argue that the verb *remédy* is the morphological base of *remédiable*, since *-able* requires a verb as its base, but that *remédial* is the phonological base of *remédiable*, since an output based on the phonology of *remédial* better satisfies *LAPSE. Raffelsiefen, in contrast, does not think that *-able* can take anything but a verb as its base, and argues instead that both the morphological and phonological base is the verb *remédie*, with *remédiable* formed by violating SUBCAT^{WORD} to choose the already-stressed stem *remédi* as the base. This disagreement indicates the difficulty of determining just what can form a base exerting influence on a derivative, given our current state of understanding. Both authors are clearly on the right track, as they predict that the form *párodiable* will have to suffer the lapse of four unstressed syllables because there is no existing word, be it **paródiat* or **paródiat*, which could form a model for the phonologically more pleasing **paródiat*.

Steriade (2000) proposes a more radical influence of paradigm uniformity on phonology than what we have considered so far. Her claim is that derivational morphology is powerful enough to coerce a derived word to agree even in phonetic details with other members of its paradigm.²⁸ Her English example involves the rule

²⁷ Steriade notes that the split base effect was independently proposed by Burzio (1997).

²⁸ Steriade's definition of a paradigm is "a set of words sharing a morpheme (e.g. {*bomb*, *bombing*, *bombard*, ...}) or a set of phrases sharing a word (e.g. {*bomb*, *the bomb*, ...})." The reader may notice that this definition is considerably more flexible than that used traditionally. For instance Spencer (1991: 11-12) defines a paradigm as "the set of all the *inflected* [emphasis mine – EMK] forms which

of North American English known as Flapping. Flapping is, at the very least, an automatic, allophonic process, of the sort that derivational theories argue applies late in derivations – postlexically within the LPM model. According to Steriade, the process is actually not even what would traditionally be called phonological at all. It distributes a non-contrastive and continuous timing value rather than a binary feature, and is thus is phonetic.²⁹ Drawing on work by Withgott (1983), Steriade points out that the first /t/ in *capitalistic* is flapped, matching the flap in its base *capital*. However, the first /t/ in *militaristic* is not flapped, matching the aspirated [t^h] in its base, *military*, where the aspiration is the regular outcome before a stressed vowel, as in *-ary*. Steriade believes the carry-over of non-flapping from *military* to *militaristic* means the length of the *t* of the base is encoded in the lexicon, where it can be copied onto a derivative.

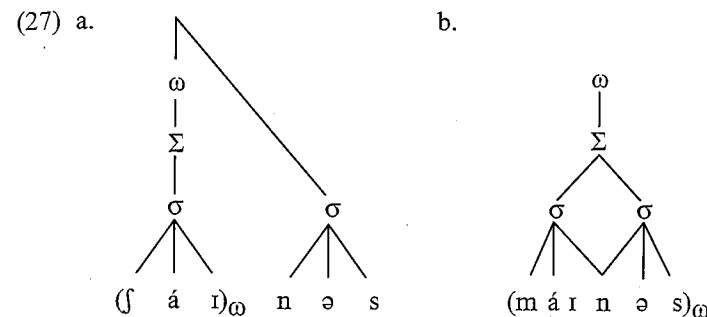
However, Bermúdez-Otero and McMahon (in press) and Davis (2004) independently point out another way to look at these facts, citing the relevance of Jensen's (2000) interpretation of Withgott's discovery. Jensen had argued that all that is going on here is the maintenance of foot structure – a phonological, not a phonetic construct – from base to derivative. The aspirated [t^h] in [mili][taristic] is just the regular pattern of phonetic interpretation for this foot structure as seen in underived [Médi][terranean] and [Návra][tilóva]. Davis agrees that *capitalistic*, with its flap, does indeed result from a paradigm uniformity effect with *capital*, but again, it is the foot structure of *capital* that is the basis of analogy, not the flap itself.

Raffelsiefen (in press) also challenges the idea that phonetic features implicated in similarities between base and derivative necessarily mean that phonetic features are in the lexicon. Instead, she argues, these similarities may be due to the phonology acting in its *boundary-delimiting function* – that is, helping to mark the beginnings and ends of morphemes. Consider, for instance, the pair *shyness* vs. *minus*. These words do not rhyme. The diphthong in the first syllable of *shyness* is longer than that in *minus* and the *n* which begins the suffix *-ness* is longer than that in morpheme-internal position in *minus* (Umeda and Coker 1974: 5). One might argue that paradigm uniformity is responsible: the diphthong of *shyness* wants to be as long as that of the base *shy*. But in that case, where does the effect on the *n* of *-ness* come from? Raffelsiefen argues that it is not Paradigm Uniformity that is enforcing the odd phonology of *shyness* but rather an alignment constraint. As we mentioned in section 6, such constraints favor structures where the phonology and morphology line up to give the same parsings – for instance, where vowels that end morphemes also end the syllables of the morphemes they belong to, and where consonants that begin morphemes do not belong to the syllables of preceding

an individual word assumes [or even] ... some specifiable subpart of the total paradigm." Obviously the question of what forms can influence one another's pronunciation and thus be the subject of Paradigm Uniformity constraints is a difficult and complicated one, which is unlikely to be easily resolved. See also McCarthy (in press) and several of the other papers in that same volume, (Downing et al. (eds.) 2004) and in Lahiri (2003) for recent views on the subject.

²⁹ Steriade's goal is to argue that the division of processes into phonological and phonetic is ultimately misguided and that phonetic detail figures into the proper understanding of phonological patterns. This is a fairly radical proposal, though Steriade is certainly not alone in championing it. It will probably be several years before the dust settles on this debate.

morphemes. For Raffelsiefen, then, the prosodic structures of the two words differ, and the length in the [aj:] of *shyness* comes from its being final in a prosodic word. The lengthening of the [n] of *shyness* is due to its being solely syllable initial, while the [n] is ambisyllabic in *minus*:



where

ω = prosodic word

Σ = foot

Now all the details of vowel and consonant length can be assigned on the basis of prosodic structure, within the phonetics or the postlexical phonology.

8. CONCLUSION

Phonology can get in the way of word formation, causing gaps in derivation where no suitable compromise between the goals of morphology and pronunciation can be found, and inducing allomorphy where morphology would prefer uniformity. Phonology can also aid morphology, applying differently in derived and underived forms; helping to delimit morphological boundaries with syllabifications and foot structures that are phonologically sub-optimal; stressing one part of speech differently from another; and so forth. Word formation responds in kind, getting in the way of phonology by concatenating phonologically displeasing strings; subverting the realization of well-formed strings of sounds in order to maintain easily reconstructed relations between base and derivative; and causing non-cohering affixes to be unavailable to the phonology, again in aid of maintaining base-derivative resemblances. Whatever model we choose to describe these interactions, it cannot be an impoverished one, for the relation between word formation and phonology is complex.

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