

Arguments for morpholexical rules¹

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INTRODUCTION

Lieber (1980) provided a theory of the organization of the lexicon which has been extremely influential within current theories of morphology. However, one of her central suggestions, concerning the nature of phonological rules in the lexicon, has been largely ignored. Lieber (1980, 1982) considers allomorphic variation induced by relationships which are not true phonological rules, in that they refer to lexical or morphosyntactic features but which none the less seem to be stable in phonological terms. These constitute the bulk of morphologically conditioned alternations, particularly those which have the prime function of signalling morphological relationships. Such rules have been dubbed ‘morpholexical’ rules in the structuralist literature, and Lieber adopts this term, giving it a specialist technical interpretation within the Lexicalist theory she develops.

Lieber (1981 b) defines morpholexical rules as redundancy rules taking the form of correspondences defined over listed lexical entries. Without such rules morphologically conditioned alternations can be handled in standard accounts of generative grammar solely by the use of triggering diacritics (e.g. ‘minor rule features’) or by phonological rules sensitive to purely morphological features. This is because it is a fundamental tenet of such theories that all alternants are derived by phonological rule from a single underlying form. Lieber’s argument is that it is sometimes necessary to list the alternants in the dictionary, rather than deriving all but one of them by rule in the phonology, because in some cases word-formation rules need to have access to the phonological shape of non-basic alternants at a stage prior to the phonology.

As Lieber (1982) points out, the various different proposals for handling allomorphy of this kind all share certain assumptions, the most significant of which is that the allomorphic variation is defined by generative processes

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which operate after morphological processes. This is not true of recent proposals within *Lexical Phonology*, but even within that theory Lieber's observations are in many cases pertinent. Lieber refers to all such theories as 'Readjustment' or 'R' theories, after the Readjustment component of Aronoff's (1976) model of word-formation. If, as Lieber has argued, it is the case that some rules of morphology must have available to them the segmental composition of the allomorphic variants they concatenate then it is possible to argue that R theories are inadequate. For such a theory can only refer to morphemes in terms of their abstract (i.e. non-segmental) morphosyntactic feature composition or in terms of the segmental composition of the base alternant, not the derived alternant.

Lieber's argument will be valid, of course, only on the assumption that all morphological processes precede all phonological operations, as on standard models. This assumption is not made in *Lexical Phonology*, so that Lieber's arguments have to be reassessed in that light. At the same time, there are certain technical flaws in Lieber's reasoning elsewhere. It might appear, in fact, that there is after all no need to posit novel devices such as morpholexical rules, whose formal properties are unclear and whose operation may be difficult to constrain. However, I present three cases of allomorphic relationships which can be fairly easily stated phonologically, and which therefore cannot be characterized as Allomorphy Rules in Aronoff's (1976) sense, but in which clear-cut morphological generalizations are totally obscured unless those relationships are stated as morpholexical rules.

In Section 1 I discuss the arguments of Lieber and of Marantz (1982) in support of the morpholexical rule, against the background of *Lexical Phonology*. I conclude that although Lieber's arguments are non-demonstrative, given the assumptions of *Lexical Phonology*, Marantz's arguments from the interaction of morpholexical rules with Reduplication are conclusive (provided we accept Marantz's views on the nature of Reduplication). Section 2 presents the three arguments. Section 2.1 discusses the case of Velar Softening in Spanish conjugation, showing that a virtually exceptionless generalization about the inflectional system is unstable unless the stem allomorphs related by Velar Softening are available in the lexicon and related by morpholexical rule. Section 2.2 shows that a case of analogical levelling in Czech conjugation cannot be stated in other than an *ad hoc* fashion unless reference can be made to stem allomorphy before inflexion. Finally, the most detailed and complex argument is presented in Section 2.3 in which I show that the facts of nominal inflexion in Czech are bound to violate just about the only exceptionless rule in the language if stem allomorphy is handled by any kind of generative phonological rule.

The third section is a detailed discussion of the relationship between morpholexical rules, lexical representations, and the mechanics of morphological selection. I show that inattention to technicalities in this area invalidates some of Lieber's claims about morpholexical rules. In particular,

it is necessary to assume a variety of diacritic features governing selection, some of which have the function of labelling morpholexical classes. This is a function which Lieber claims is rendered otiose by the device of lexical listing plus morpholexical rules. I suggest that such features can be used to trigger morpholexical rules, if the latter are regarded as quasi-generative redundancy rules written in phonological format, operating over monomorphemic roots. Such rules can then be accommodated to the Stratal Ordering hierarchy as Stratum 0 rules. The final section presents some speculations on the relationship between the proposals advanced here and recent debate over the nature of morphophonology.

1. MORPHOLEXICAL RULES

The arguments provided by Lieber (1980) and Marantz (1982) in favour of morpholexical rules all hinge on a conflict between phonological rules and representations and morphological organization. In each case it is shown that a purely phonological account of allomorphy renders statement of a morphological generalization impossible. It is then shown that the morphological generalization in question can only be stated if it has access to the allomorphy induced by the putative phonological rule. This can only be achieved on standard, i.e. *SPE* (Chomsky & Halle, 1968) assumptions if the allomorphic variation is coded in the lexicon before morphemes are concatenated. The strongest versions of such arguments also have a lemma showing that some kind of generalization will be missed if the allomorphy is coded before the morphology by, for instance, minor rule features which then trigger later phonological rules; that is, additional arguments are adduced to the effect that an R theory is in principle unable to handle the data.

Even within the standard model, cast-iron arguments for morpholexical rules are very difficult to construct. This is because of the considerable expressive power of global derivational devices such as minor rule features. However, within the Level (Stratal) Ordering theory of Lexical Phonology (Kiparsky, 1982, 1985; Mohanan, 1986; Halle & Mohanan, 1985), it becomes even more difficult to construct such arguments. This is because the whole point of Lexical Phonology is to deny any simple linear ordering between phonological and morphological processes. To discover that a morphological process appeals to the result of a phonological rule is simply to discover that the phonological rule must be allowed to apply in a stratum before that at which the morphological process applies.

Nonetheless, it is still possible in principle to construct arguments for morpholexical rules, since it is possible to find interactions between phonology and morphology which do not depend on Stratal Ordering relations. The three cases I present below are all of this type. Before I discuss them, however, I shall devote some attention to the strongest arguments

which have been presented to date in favour of morpholexical rules, those of Lieber (1982) and Marantz (1982).

1.1. *Lieber's arguments*

Lieber (1980, 1982) argues that facts of morphological selection cannot be adequately described if phonological processes are constrained to take place after all morphological processes, even in a theory such as that of *SPE* or Aronoff (1976) in which readjustments of an essentially arbitrary nature are permitted. In Lieber (1982) an example from Warlpiri is presented which cannot be handled on a standard R theory even in principle.

The essence of the argument is this. There is a Reduplication process which copies the first two syllables of a verb to the left regardless of the morphological constituent structure. Warlpiri has tense prefixes which appear in different allomorphs depending on conjugation class. Lieber points out that it is impossible to represent a given tense form (say, PAST) by means of a morphosyntactic diacritic attached to the root and spelled out by a post-morphological phonological rule. This is because the Reduplication process must have access to the precise segmental structure of the tense morpheme. Therefore, tense affix allomorphy must be coded in segmental terms directly in the lexicon. It cannot be derived by a readjustment rule on the interface between morphology and phonology.

1.2. *Marantz's arguments*

Marantz (1982) discusses the interaction of phonological rules and reduplication processes. He points out that we observe cases in which a phonological rule appears to over-apply to reduplicated forms. A velar palatalization rule in Dakota, for instance, turns initial /k/ into /č/ as in (1) (Marantz, 1982:457). In (2) this process seems to have applied where its structural description is not met, since the second occurrence of the root is not preceded by the trigger.

- (1) k^há 'to mean' nic^há 'he means thee'
 k^ʔú 'to give' nič^ʔú 'he gives to thee'
- (2) -nape kičosčoza 'he waved his hand to him' (from *koza* 'to wave')

Example (2) can be understood if we assume that the reduplication process applies after Velar Palatalization. At the same time Marantz presents a case of under-application. A rule of Ablaut turns /a/ to /e/ before certain morphemes, including the phrase-final morpheme /ʔ/, as in (3). However, in (4) we see that when the final syllable is reduplicated it fails to undergo Ablaut.

- (3) (a) *háska* 'to be tall'
 (b) *č^hā-kj iyúha háske-ʔ* 'all the trees are tall'
 (4) (a) *č^hā-kj háska-ska-ʔ* 'the trees are tall'

Marantz observes that to explain this phenomenon it is necessary either for morphological rules such as Reduplication to be interspersed amongst the phonology, or for the allomorphs induced by the phonology to be made available in the lexicon prior to morphological processes such as Reduplication. (The argument hinges on Marantz's demonstration that Reduplication is a form of affixation and hence is a morphological, not phonological process. I simply accept Marantz's arguments here for the sake of this discussion.) In either case Dakota violates standard assumptions.

Marantz provides a set of criteria for distinguishing morpholexical rules. These are of value as rules of thumb, though from the discussion below it should be clear that they are neither necessary nor sufficient in themselves for establishing a relationship as morpholexical. Marantz says that a rule will be morpholexical if it does not apply to all morphemes meeting its structural description, and if its conditioning environment has to be stated in morphological rather than purely phonological terms. This is essentially a characterization of Allomorphy Rules (Aronoff, 1976). However, it seems that some putative phonological rules which cannot be described as Allomorphy Rules in Aronoff's sense nevertheless have to be analysed as morpholexical. Marantz points out that it will not do to define troublesome cases of over-application to reduplicates as due to the operation of Allomorphy Rules, since this will not explain under-application. (However, there are grounds for regarding all Allomorphy Rules as a species of morpholexical rule.)

1.3. *Reduplication and Stratal Ordering*

Lieber's argument from Section 1.1 is somewhat sketchy, and since her paper predates the development of Lexical Phonology it fails to consider a solution within that framework. Even without consulting the primary literature on Warlpiri it should be clear that Lieber's argument is non-demonstrative as it stands. In principle, it is possible to say that all tense prefixes are added in Stratum *n* while Reduplication applies in Stratum *n*+1. Thus, for the argument to stick it would have to be accompanied by a detailed lemma to the effect that such an organization is impossible for Warlpiri. Since Lexical Phonology is a relatively well-worked-out theory whose rich empirical consequences have been widely explored, the *onus probandi* in this case would lie on Lieber's shoulders. Lieber has not, then, provided us with a watertight argument for morpholexical rules, after all.

The situation is somewhat different in Marantz's case. Marantz rejects the

solution to the Dakota ordering paradox which intersperses morphology amongst the phonology, on the grounds that this would 'loosen constraints on the organization of grammar' (1982:458). Obviously, lexical phonologists would regard this as a weak objection, for an intermingling of this kind is at the heart of the Stratal Ordering hypothesis. Furthermore, Stratal Ordering can handle over-application very simply. All one need show is that Reduplication is a Stratum n process in Dakota and that Velar Palatalization applies before Stratum n .

However, Marantz's point about under-application is still valid. Affixation of the phrase-final morpheme $-\text{ʔ}$ is fed by Reduplication (see (4)), so it must apply in Stratum n or beyond. Suppose for the sake of argument that it occurs in Stratum $n+2$. If Ablaut is constrained to apply no later than Stratum $n+1$ then we can account for (4). But in that case affixation of $-\text{ʔ}$ in Stratum $n+2$ would fail to trigger Ablaut in (3). If Ablaut applied in Stratum $n+2$ it could be fed by ʔ -affixation. But then we would expect it to apply to the reduplicated form in (4). Notice that the /a/ of the reduplicated /ska/ in (4) is now in a derived environment by virtue of ʔ -affixation. Ablaut is thus not blocked by the Strict Cycle Condition (SCC) (Kiparsky, 1982:154). The same results are obtained if all the processes apply in the same stratum, but constrained by extrinsically imposed ordering.

Now let Ablaut be constrained to apply before Reduplication, say in Stratum $n-1$. In the derivation of (4) Ablaut fails, correctly, to apply to the root /hąska/. Consequently, the unablaunted variant is Reduplicated in Stratum n . Subsequent affixation of $-\text{ʔ}$ has no effect in Stratum $n+2$ because Ablaut may only apply in an earlier stratum. However, this assumption leads immediately to difficulties with (3), for it predicts that Ablaut can never be triggered by /ʔ/. Thus this ordering (Ablaut–Reduplication– ʔ -affixation) is completely ruled out (again the argument is unaffected if the ordering is extrinsic).

There may be a way in which a Stratal Ordering theory could cope with these data. If we assumed that ʔ -affixation preceded Reduplication in the Stratal Ordering, then we could say that Ablaut is fed by ʔ -affixation as in (3) but bled by Reduplication. We would then have the problem of affixing $-\text{ʔ}$ to the reduplicated form of (4). This would necessitate the operation of a 'loop' (see Mohanan, 1986; Halle & Mohanan, 1985). This, however, would be a completely *ad hoc* solution, particularly when it is realized that Reduplication has amongst its several functions the realization of such derivational or lexical relationships as verbal aspect (or Aktionsart), while the $-\text{ʔ}$ affix marks the end of a syntactic phrase. To say that $-\text{ʔ}$ is affixed before Reduplication would therefore be distinctly odd.

It is worth pointing out in this connexion that Shaw (1985) provides an explicit account of Dakota within a Lexical Phonology framework. Although she is primarily concerned with stress rules, she gives a fairly complete model

of Dakota, using three strata. Reduplication applies in the first, while Ablaut and Velar Palatalization apply in the third. I am unable to see how such an organization can account for any of the data Marantz adduces. (Shaw herself never refers to Marantz's paper.)

My conclusion from the scant discussion of morpholexical rules in the literature is that Marantz has provided one set of cases which are very difficult to understand except by recourse to the notion of a morpholexical rule. However, in general it is extremely difficult to substantiate the central claim required of any proof of the existence of such rules, namely that there are morphological processes which must have access to derived allomorphs before any phonological rule proper can apply. Even Marantz's sophisticated and elegant discussion hinges on an assumption which is not uncontroversial, namely that Reduplication is a form of affixation. Thus, though I believe that Marantz's arguments are valid, it is understandable that some scepticism remains about the existence of morpholexical rules.

What must be shown by the proponent of morpholexical rules is that there are allomorphic relationships which can be stated in phonological terms but are such that both the basic and the derived allomorph have to be available in the lexicon and accessible to straightforward morphological processes such as simple affixation. For this it is necessary to show that some word-formation process crucially refers to the phonological shape of such morphemes by selecting the non-basic allomorph on the basis of essentially phonological criteria. Moreover, it has to be shown that the phenomenon of selection cannot be accounted for by assuming the intermingling of phonology and morphology assumed in Lexical Phonology. In the next section I present three such arguments.

2.1. *Velar Softening in Spanish*

Velar Softening in (Latin American) Spanish replaces underlying /k, g/ with /s, x/ before front vowels (/i, e/ in Spanish) (cf. Harris, 1969). Not all words which have velars in this position exhibit softening, however, whether in derived or underived environments. This suggests that the rule is lexically conditioned. Not surprisingly, the rule is not blocked by pauses, nor does it apply across words, and so it cannot be viewed as a postlexical rule in the sense of Mohanan (1982).

Velar Softening (VS) applies conspicuously in derived environments. For example, we have alternations like (5):²

[2] I use Spanish orthography for the examples except that I write *k* or *s* for orthographic *qu*, *c* and *s*. Examples between slashes are underlying phonemes or non-surface forms of words or morphemes. An accent indicates stress.

- (5) *konduk* 'drive' *kondus* + *ir* 'to drive'
 konduk + *sion* 'driving'
proteg 'protect' *protex* + *er* 'to protect'
 protek + *sion* 'protection'

However, Harris (1969: 173 ff.) points out that VS has a number of exceptions. In some cases Harris analyses a /k/ which fails to soften as deriving from underlying /k^w/ (in accordance with history and orthography). This ploy is dubious, however, since /k^w/ is not part of the surface phonemic inventory of Spanish (though the cluster /kw/ does occur). Thus Harris is proposing a process of absolute neutralization. This is a serious objection in cases such as *sexa* 'eyebrow' vs. *kexa* 'complaint', in which the *k/s* contrast occurs internally to roots and cannot in principle alternate. Furthermore, there are cases in which a velar softens before some affixes but not before others. Harris speculates that this may be connected with the fact that the affixes which do not trigger VS appear to be # boundary affixes while those which do trigger it appear to be + boundary affixes. Finally, the expected allomorph fails to occur in 1st conj. pres. subj. forms. E.g. the verb root *sak* 'take out' gives the forms *sake*, *sakes*, etc. for the predicted **sase*, **sases*. Harris proposes that we derive these by adding the subjunctive endings (which begin with a front vowel in this conjugation) to the verb root + the 1st conj. theme vowel and subsequently deleting the theme by a rule ordered after VS. A similar solution would presumably have to be sought for the 1st sg. preterite form *saké*.

On the assumption that VS is a cyclic phonological rule we can explain some of these facts at once. For example, VS will not apply to roots such as *kexa* by virtue of Strict Cyclicity. Nor will it apply before # boundary affixes provided it is limited to the + stratum. The verbal person/number desinences attach only to stems and not to lexical representations. They must presumably be + boundary affixes. This means that we must adopt some solution such as Harris's for the aberrant subjunctive and preterite forms.

There are certain problems with this approach, however. In the case of pairs such as *atakar* 'to attack' and *atake* 'an attack' it presupposes an *ad hoc* # boundary protecting the velar: *atak* # *e*. Moreover, there are cases of apparent *k/s* alternation which cannot be handled if VS is a cyclic rule. Harris draws attention to alternations such as *vos* 'voice' *vokal* 'vocal' and suggests that the underlying form of *vos* is /voke/. A rule of final -*e* deletion applies after VS to derive the output *vos*. But such a derivation must be ruled out on the assumption that the final -*e* is part of the root, for it would violate strict cyclicity. This means that we will still be left with the need for some mechanism to account for the original alternation. The analysis of VS as a cyclic rule is also suspect to the extent that it relies on Harris's analysis of subjunctive forms, for the theme vowel deletion rule crucially appealed to is suspect. To see why we must consider Spanish verbal inflexion in greater detail.

Spanish verbs come in one of three conjugations, only the first being fully productive. They have characteristic vowel extensions (called 'theme vowels'), that for the 1st conj. being *-a-*, that for the 2nd and 3rd surfacing variously as *-e/i/je-*. These extension themes are switched in the pres. subj., however, where we find the 1st conj. with *e* and the 2nd/3rd conj. with *a*.

In all three conjugations the theme vowel is completely missing on the surface before the 1st sg. pres. indic. desinence *-o*. Notice that this ending is common to all conjugations and that it is a back vowel. Some 2nd/3rd conj. roots end in velars. These soften before the front theme vowels. However, they also generally soften unexpectedly before the *-o* desinence. Thus we have paradigms such as (6)

- (6) *dirixir* 'to direct', pres. indic. *dirix + o*, *dirix + es*, ...

In the pres. subj. we find again that VS applies unexpectedly before a back vowel as in (7)

- (7) *dirix + a*, *dirix + as*, ...

These facts can be explained on the assumption that the front theme vowel is present underlyingly in these forms but that it is deleted after VS when it precedes a back vowel. Provided we can accept the existence of a rather restricted rule of theme vowel deletion we will have a phonological explanation for these facts. Such a rule would have to have access to some morphological diacritic marking the theme as such, for there are verb roots ending in vowels (e.g. /ka/ 'fall') which would be incorrectly deleted by a purely phonological rule.

However, a closer examination of the data casts doubt on the theme-deletion analysis. Consider a verb such as *kondusir* again. This has a morphologically conditioned peculiarity in that its 1st sg. pres. indic. root is not *konduk* but *kondusk*. It is one of a small number of verbs which exhibit this alternation. Unlike other 3rd conj. roots, however, this subclass cannot have a front theme vowel before the 1st sg. desinence, for then we would predict the form *kondusso* (or, after degemination, *konduso*) rather than the observed *kondusko*. The problem is compounded by the fact that the unusual root allomorph also happens to be the pres. subj. stem. Thus the subjunctive paradigm is *konduska*, *konduskas*... Yet, again, we would expect here *kondusa*, etc.

This patterning is actually the result of a more general phenomenon. There are quite a few verbs which have 1st sg. pres. indic. stems which are different from the stems for the rest of the paradigm. For example, we have from *venir* 'to come' *vengo*, *vienes*, etc., from *kaer* 'to fall' we have *kaigo*, *kaes*, etc. The interesting fact is that with the exception of just four verbs, the irregular 1st sg. pres. indic. root is identical to the root used for the pres. subj. In other words, the exceptionality of *kondusko* is actually part of a wider generalization which can be stated only in morphological terms, namely that both regular and irregular verbs all have the same athematic root in 1st sg.

pres. indic. and in the pres. subj. paradigm. This generalization equally accounts for the absence of *k/s* alternation in forms such as *sake, sakes*.

A further source of disquiet is the postulation of two extension vowels for verbs in the subjunctive, one the conjugation class theme, the other the mood marker. For no verb in Spanish ever surfaces with two consecutive vowels outside the root. This means that another otherwise exceptionless morphological generalization has to go by the board if we accept the primacy of phonology. Viewed from the standpoint of the language learner, it is questionable whether it makes sense to posit morphological structures for which there is no evidence in the form of alternations, which go counter to the morphological patterning of the language, and for which the only conceivable evidence is Velar Softening (I know of no other morphophonemic rules which rely on the subjunctive having two extension vowels).

These considerations considerably diminish the confidence we can place in the decision to treat VS as a cyclic rule of the standard kind. By Marantz's criteria, VS in Spanish is a morpholexical rule. It is not triggered by all affixes which meet the phonological description of the rule, nor do all stems which do meet the rule's description undergo it. We may add to this the observation that not all alternations can be accounted for if we assume that the rule is part of the cyclic phonology. In the current framework we may say that there is a rule of VS defined over phonological representations which relates allomorphs of diacritically marked morphemes. This rule is only defined over roots, however, and does not apply as part of the regular phonological cycle.³ For otherwise we could not use our ML rule to relate roots in derived environments (e.g. verb inflexion) and non-derived environments (e.g. the *vos/vok* allomorphy of the word for 'voice').

Whatever the original phonological motivation for VS, distribution of softened and unsoftened allomorphs must be stated in terms of morphological diacritics. This allows us to simplify the phonological component. For instance, we no longer have to postulate underlying segments foreign to the surface phonemic inventory such as */k^w/*. At the same time it allows us to capture a robust morphological generalization about the distribution of root allomorphs through verb paradigms, relegating idiosyncrasy to the lexicon and with the morphology, where it belongs, expressed in the form of diacritic features. Finally, it also means we need not be too troubled about the fact that VS is actually very difficult to state as a phonological rule. This is simply a reflexion of the fact that the process is becoming morphologized. There is no NECESSITY to state ML relationships as phonological rules of the standard kind. Indeed we would expect such relationships to become less and less like

[3] In many respects this represents an argument for regarding VS as a 'via-rule' (cf. Vennemann, 1972; Hooper, 1976). However, this does not mean that I would accept Hooper's analysis of Spanish morphology.

phonological rules until we end up with relationships defined over segments, or even groups of segments, as the morphologized relationship moves closer to partial suppletion.

Spanish VS, then, is a case of relationship which has (most of) the characteristics of a phonological rule but which must be considered a morpholexical rule. Moreover, we have arrived at this conclusion by a combination of phonological and morphological reasoning.

2.2. Czech palatalizations⁴

Palatalization is an all-pervasive phenomenon in the morphophonemics of Slav languages, and Czech is no exception. A variety of phonological and morphophonological contexts condition a complex variety of mutations in which velar and dental obstruents become palato-alveolar, alveolar or dental fricatives and affricates.

There are two underlying velar obstruent phonemes in native Czech words, /k/ and /x/ (orthographically *ch*). Original /g/ became /h/ (orthographically *h*), a voiced laryngeal fricative. The sound /g/ appears, however, in some recent loans. All obstruents are voiceless in word-final position, though the voiceless congener of /h/ is /x/. Certain morphophonemic environments can be characterized as palatalizing. Velars are never found in such environments, invariably undergoing the following substitutions: k/h → c/z or č/ž, x → š. I shall concentrate mainly on the behaviour of /k/ in this discussion, though similar observations apply *mutatis mutandis* to /h(g) x/.

Czech is a highly inflected language and its paradigms, both nominal declension and verb conjugation, exhibit much irregularity, possibly more than other Slav languages. The first example of a morpholexical rule comes from conjugation, the second from declension.

2.2.1. 1st Velar palatalization in consonant stem verbs. Czech verbs inflect for person, number and tense (amongst other categories) and fall into several conjugation classes. Very broadly we can distinguish consonant stem verbs from vowel stem verbs, the latter consisting of a root and a vowel extension. As an example of a consonant stem verb we may take *nést* 'to carry', whose root is *nes*. This conjugates according to (8a) in its present tense. (8b) is the past tense form (masc. sg.).

[4] The facts of Czech morphology can be found in any grammar of the language, e.g. Šmilauer (1972). Kopecký *et al.* (1976) provides a particularly useful tabulation for reference. A convenient English-language summary is to be found in De Bray (1980). In transcription I follow Slavistic custom: c = [tʃ], č = [tʃ̣], š = [ʃ], ž = [ʒ], ř = [ʀ]. This represents Czech orthographic practice. Other features of Czech orthography are: vowel length is indicated by an acute accent (or sometimes a circle over u as in ů); y and i represent the same sound except that i though not y palatalizes a preceding dental (t d n r).

- | | | |
|---------|-------------|-----------|
| (8) (a) | Sing. | Pl. |
| | 1. nes + u | nes + em |
| | 2. nes + eš | nes + ete |
| | 3. nes + e | nes + ou |
| (8) (b) | nesl | |

In (9) we see a verb which is essentially identical to *nést* except that it has a vowel extension *a*, *kopat*, ‘to dig’.

- | | | |
|---------|----------|--------|
| (9) (a) | Sing. | Pl. |
| | 1. kopu | kopem |
| | 2. kopeš | kopete |
| | 3. kope | kopou |
| (9) (b) | kopal | |

As in other Slav languages, verb roots suffer palatalizations of some antiquity. Velars /k, h, x/ palatalize to /č, ž, š/, the so-called 1st Velar Palatalization. This occurs before front vowels, so that we have paradigm (10) for the verb *péct*, ‘to bake’.

- | | | |
|----------|----------|--------|
| (10) (a) | Sing. | Pl. |
| | 1. peku | pečem |
| | 2. pečeš | pečete |
| | 3. peče | pekou |
| (10) (b) | pekl | |

Notice that in (10a) velar palatalization only takes place before the front vowel /e/.

Another common and ancestral palatalization, traditionally called ‘Iotation’, affects coronal consonants. For example, it transforms underlying /s/ into /š/ in the paradigm of *psát*, ‘to write’ (the alternation between *ps-* and *pis-* is irrelevant to the present discussion).

- | | | |
|----------|----------|--------|
| (11) (a) | Sing. | Pl. |
| | 1. pišu | pišem |
| | 2. pišeš | pišete |
| | 3. piše | pišou |
| (11) (b) | psal | |

It will be noticed that Iotation occurs before the back vowels /u, ou/ in addition to the front vowels. This anomaly is accounted for by Rubach (1984), working on a related language, Polish, in terms of a rule which inserts a /j/ between the root and desinences (see also Spencer, 1986). The verb *psát* has a vowel extension, *-a-*, as can be seen from the past tense, (11 b), and past participle, *psaný*. Therefore, in contradistinction to a form such as *nesu* (which is essentially the underlying form of the word), the word *pišu* will have

an underlying form (12). (I follow the example of Rubach, 1984, in writing URs of words between double slashes in derivations.)

(12) //pis + a + u//

A rule of J-insertion can now apply (which I shall not formulate) which inserts /j/ before the first of two consecutive vowels in a verb form. The first of the vowels is then deleted by a rule of Vowel Truncation. It is the inserted /j/ which triggers Iotation, to be deleted by a general rule deleting /j/ after palatals and palato-alveolars.

(13) pis + a + u
 pis + j + a + u
 pis + j + Ø + u
 piš + j + u
 piš + Ø + u
 /pišu/

Whether this is a justifiable analysis for Czech or any other Slav language is not a question of immediate concern. The point is that there is a mechanism in a generative treatment of Slavonic verb morphophonology for accounting for opaque palatalizations before back vowels.

A difficulty arises when it is noted that the verb *pěct*, in common with a number of other such verbs in Czech, has doublet forms. Thus the 1st sg. and 3rd pl. may also be *peču*, *pečou* respectively. This is easy to understand from a morphological point of view: we are simply dealing with a case of paradigm levelling. However, the problem is that there is absolutely no satisfactory way to generate the palatalized forms on the assumption that the /k ~ č/ alternations are phonological. It is not possible to appeal to a J-insertion analysis for there is no reason to believe that any vowel extension ever appears in the paradigm of this verb. In any case it would be impossible to decide which vowel extension it would be: Czech verbs take at least three such vowels in underlying form depending on their conjugation class membership. Since in all its other forms *pěct* belongs to a consonant stem class which has no vowel extension, there is no way to decide which vowel should trigger J-insertion. In other words, there is no way to account for the appearance of forms such as *peču* alongside *peku* except to appeal to an optional analogical levelling of the paradigm. But this means that the two root allomorphs, *pek* and *peč*, will have to be listed separately in the lexicon and the latter marked as an optional choice for 1st sg./3rd pl.

We could try patching up the phonological account by assuming that the forms *peču*, *pečou* were derived from velar stems to which a special diacritic triggering 1st Velar Palatalization had been attached. While this would work in the purely mechanical sense of generating the right surface data it would make very odd claims. First, the environment for the application of the rule

generating *peču*, solely a diacritic feature, would be entirely different from the phonological environment of the rule generating *pečeš*. Second, we would not have captured the obvious morphological fact that this is a case of levelling. On the contrary, given the formal disparity between the diacritically triggered subrule and its phonologically conditioned companion, it would look like a very curious case of morphological dissimilation. On the morpholexical approach we would simply replace a partly phonological statement governing the selection of velar/palatalized allomorphs with a more general, completely morphological statement, as required.

2.2.2. *2nd Velar Palatalization in nouns.* Czech nouns are assigned to one of three gender classes, masculine, feminine and neuter, partly on the basis of phonological shape and in part arbitrarily. There are two numbers, singular and plural, and six cases marked by word-final inflexional affixes, nominative, vocative, accusative, genitive, dative, instrumental and prepositional. These affixes are different in the two numbers, and while the masculine and neuter declensions share many desinences, those of the feminine gender tend to differ from those of the other genders.

Nominal stems come in two basic types, which determine subclasses amongst the declension classes defined in terms of gender. These are ‘hard’ stems (non-palatalized) and ‘soft’ stems (palatalized). Oversimplifying somewhat, the hard stems take [+back] vowel allomorphs of inflexional affixes while the soft stems take [–back, –low] or [–back, +high] allomorphs. Some consonants (e.g. /c j ř/ are inherently palatal. Others are inherently non-palatal (e.g. /k n/) while others are phonologically hard but morphologically ambiguous (e.g. /s l/). Stems ending in ambiguous consonants of this kind are assigned to hard or soft declensions lexically, and sometimes to both.

Some allomorphs of some case affixes may only be found attached to a soft stem and some only attached to a hard stem. For instance, the prepositional plural allomorph *-ich* co-occurs solely with soft stems, while the allomorphs *-ech*, *-ách* co-occur solely with hard stems.

Paradigms (14) illustrate these facts:

(14) (a) <i>úhel</i> ‘corner’ (hard stem)				
(b) <i>uhel</i> ‘coal’ (soft stem)				
	(a)		(b)	
	sg.	pl.	sg.	pl.
nom.	úhel	úhly	uhel	uhle
gen.	úhlu	úhlů	uhle	uhlů
dat.	úhlu	úhlům	uhli	uhlům
acc.	úhel	úhly	uhel	uhle
voc.	úhle!	úhly!	uhli!	uhle!
prep.	úhlu	úhlech	uhli	uhlích
instr.	úhlem	úhly	uhlem	uhli

The word *uhel* 'coal' may optionally be declined hard. The *e*/zero alternations are irrelevant to the present discussion.

Since some soft stems have ambiguous consonants we cannot in general say that the inflexional affix allomorphs are selected on a phonological basis (unless we are willing to countenance unmotivated abstract underlying phonemes such as palatalized /ʃs/ or palatal glides which never surface). In any case, the existence of doublets such as *uhel* which may be declined hard or soft militates against the assumption that the alternation is phonological. Thus the affixes cannot select stems in general purely on the basis of their final consonants. Rather, it is the stem which selects hard or soft affixes, on either a phonological or a morpholexical basis.

There is one exception to this general picture. The prepositional plural affix appears in two allomorphs with masculine and neuter nouns, hard *-ech* and soft *-ich*. Curiously, however, hard stems ending in a velar NEVER select the hard allomorph, even though they select hard allomorphs in (almost) all other case forms. (The other exception is the prep. sg. case, which behaves rather like the prep. pl. in some words, though without the same regularity.) In this case we observe one of two phenomena and sometimes both. Either the velar is palatalized: /k/ → /c/, /h, g/ → /z/, /x/ → /š/ or a different hard affix allomorph is chosen, *-ách*, as in (15)

- (15) (a) *zvuk* *zvuc* + *ích* 'sound'
 práh *praz* + *ích* 'threshold'
 filolog *filoloz* + *ích* 'philologist'
 hrách *hraš* + *ích* 'peas'
 (b) *plech* *plech* + *ách* 'metal foil'
 (c) *dok* { *doc* + *ích* } 'dock',
 { *dok* + *ách* }

All the examples of (15) are masculine gender. In this declension soft stems take the ending *-ich* while hard stems take the ending *-ách*. Velar stems are treated as hard stems in this declension, however, and in cases other than the prepositional invariably take the hard ending.

Irrespective of whether we say that affixes select stems or stems select affixes we now have a problem. Velar stems are hard stems and generally have hard endings. However, in one case they may select a soft ending. At the same time the soft ending conditions selection of the soft allomorph of the hard stem, the morphological reflex of what was once a regular phonological process. Pre-theoretically, we can summarize these observations by saying that velar stems for some reason cannot take the *-ech* ending. This is replaced either by *-ách* or by *-ich*. In the latter case the affix, being a soft affix, selects a soft allomorph of the stem.

Suppose we assume a cyclic rule of palatalization, call it P. Could we use such a rule to account for the alternations observed and still capture the facts of morphological selection in terms of hard and soft stems and affixes? For

simple affixation there are two possibilities: either the affix selects the stem (as assumed by Lieber; cf. Lieber, 1981a: 15), or the stem selects the affix.

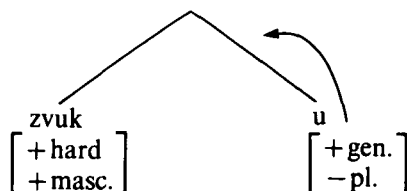
Let us consider the first possibility first. In our Czech example, this will mean that nominal stems are listed with a morpholexical feature specification for the feature [hard]. This feature will be assigned arbitrarily to some stems (e.g. the word *kost* 'bone' which is unexpectedly marked [−hard]) and by lexical redundancy rule to others (e.g. stems ending in inherently 'hard' consonants such as *zvuk* 'sound' or *úhel* 'corner'), while some entries, which can be declined soft or hard, will be given a dual representation, e.g. *uhel* 'coal', in which an optional [−hard] specification may override the otherwise default specification [+hard]. Some affixes will have subcategorization frames specifying a [+hard] stem (e.g. the affixes *−ech* and *−ách*) while others will have subcategorization frames specifying a [−hard] stem (e.g. the affix *−ích*).

Let us consider the derivation of two words, *zvuku* 'sound (gen. sg.)' and *zvucích* 'sounds (prep. pl.)'. The relevant stems and affixes are listed in (16):

- (16) (a) *zvuk* [+hard, +masc]
 (b) *−u* [+gen., −pl.]: [[+hard, +masc] —]
 (c) *−ích* [+prep., +pl.]: [[−hard] —]

The derivation of *zvuku* is completely straightforward. The desinence *−u* selects a hard masculine stem and the feature set defining case and number percolates to the top of the word tree as in (17) (following Lieber).

(17)

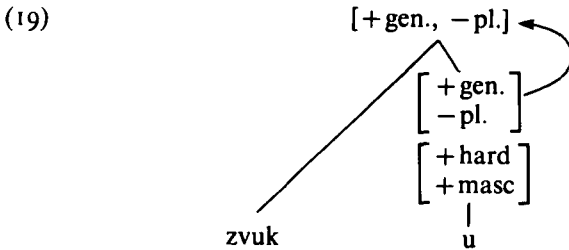


The derivation of *zvucích*, however, seems to be blocked. For the ending *−ích* is subcategorized by soft stems, yet *zvuk* is a hard stem. We therefore need some kind of lexical rule which relabels the stem *zvuk* precisely when it is followed by a prep. pl. affix. Otherwise we would obtain the incorrect form *zvukech* or *zvukách*. Once the appropriate ending is chosen, however, we may assume the operation of our cyclic phonological rule, P, palatalizing /k/ before the affix.

Now suppose that it is stems which are subcategorized by affixes, i.e. the stem selects the affix. Then the lexicon will contain representations (18)

- (18) (a) *−u* [+hard, +masc., +gen., −pl.]
 (b) *−ích* [−hard, +prep., +pl.]
 (c) *zvuk* [−[+hard, +masc.]]

(18c) tells us that *zvuk* is subcategorized by hard masculine affixes. Again, derivation of *zvuku* is unproblematic. The stem selects the appropriate ending given the word-level specification for a hard-stem masc. gen. sg. noun. The case/number features trickle to the head (the stem) and guarantee that the gen. sg. ending is selected, while the lexically specified features of the subcategorization frame in (18c) ensure that it is the hard masculine allomorph of the gen. sg. desinence that is selected. The final representation is illustrated in (19), after percolation of morphosyntactic features.



In order to derive *zvucích*, however, accommodations must again be made to a subcategorization frame, this time that of *zvuk*. We must assume a lexical rule which alters the specification of [hard] from [+hard] to [−hard] just in case the stem bears the feature specification [+prep., +pl.]. This will guarantee that *-ích* is selected, and again we may assume subsequent operation of our cyclic palatalization rule, P.

The difficulty with both these proposals is the following. In each case we are postulating lexical redundancy rules which have the effect of changing subcategorization frames within paradigms. Such rules serve no other purpose than to fix up the otherwise deficient rule system. They merely describe the problem (in a rather complex fashion) without solving it. For if rules are admitted into linguistic theory which alter subcategorization frames (or their equivalent) in this way then the device of subcategorization is no longer able to be subjected to empirical test. We lose, in effect, all the explanatory value we gained by setting up lexical representations, morpholexical features (or their notational equivalents) and so on. In particular, in the present case we lose sight of the essential facts, which are (i) *-ích* selects only soft stems; (ii) *-k* stems are hard; (iii) *-k* stems are replaced by their palatalized allomorphs in certain cases/numbers (notably the prep. pl.); (iv) palatalized stems are (inherently) soft. But to state these facts we need to be able to say that the following steps occur in the order stated: (i) palatalized (i.e. soft) allomorphs of *-k* stems are selected when the word is in the prep. pl.; (ii) soft stems combine with *-ích* in the prep. pl. In other words both hard- and soft-stem allomorphs must be available to the affixation process. But this is to say that a phonologically defined alternation must be defined prior to the affixation processes. For Lieber and Marantz this means that the

relationship between the hard and soft allomorphs must be an ML relationship.

I have couched this discussion in terms of the subcategorization frames of stems or affixes. However, the same argument is valid irrespective of the means by which selection is achieved. For any grammar that captures the phonological conditioning of morphological selection there will be an ordering paradox: a hard stem will have to select a soft affix because a later phonological rule will soften the stem, or a soft affix will have to select a hard stem so that the phonological rule can then soften it. It is now clear that the Czech case poses serious problems for any model of Lexical Phonology. Following Kiparsky (1982: 134) we can capture selection, not in terms of subcategorization but equivalently in terms of contextual restrictions on affixation. In other words, the morphological rule of affixation will concatenate hard affixes with hard stems and soft affixes with soft stems. But again in the case of the prep. pl. of velar stems the system will break down. This time a completely arbitrary rule overriding the contextual restrictions will have to be introduced, solely in order to allow for the operation of a phonological rule (P), which then undoes the effects of this irregular selection to ensure that the final shape conforms to the morphological generalization. Notice that this problem is entirely independent of Stratal Ordering or even of cyclicity.⁵

3. THE NATURE OF MORPHOLEXICAL RULES AND MORPHOLOGICAL SELECTION

In the slender literature on ML rules there has been only limited discussion of the formal nature of such rules. Lieber (1981b: 164) characterizes them as pairwise correspondences between allomorphs (though she does not discuss the perfectly reasonable possibility that they should be regarded as correspondences between sets of n-tuples). I shall perversely illustrate Lieber's formalism by means of an ML rule she herself never actually writes. Lieber (1982: 34) discusses a 'minor rule' accounting for a small class of nouns in English which end in a voiceless fricative in the singular and the corresponding voiced fricative in the plural (e.g. *knife/knives*). This correspondence is also sometimes observed in Noun/Verb conversion (e.g. *houses/to house*). Lieber would presumably account for this with an ML rule such as (20).

[5] Similar objections apply to Anderson's (1982) Extended Word-and-Paradigm theory of inflexion. In this theory inflexional morphology is regarded as part of the phonology, much as in *SPE*. If an EWP approach were then to try to capture the morphological selection facts the phonological rule introducing inflexional affixes would have to be sensitive to the (morpho)phonological shape of the stem. But again, if the phonological rule of palatalization is to be invoked this conditioning would have to be ignored in order for the stem *zvuk-* to select the 'wrong' allomorph, just as would be the case with a Lexical Phonology treatment.

$$(20) \quad X \begin{bmatrix} +\text{cont} \\ +\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} \sim X \begin{bmatrix} +\text{cont} \\ +\text{ant} \\ -\text{son} \\ +\text{voice} \end{bmatrix}$$

Rule (20) is meant to indicate that for allomorphs ending in a voiceless anterior fricative there are allomorphs ending in the voiced congener. The rule is to be interpreted as a lexical redundancy rule (cf. Lieber, 1981b) which means that a higher premium is placed by the Evaluation Metric on lexical entries respecting (20). Unfortunately, this seems to rule out the function of ML rules in formalizing 'minor' relationships such as the Fricative Voicing allomorphy of English noun stems, since it would imply that the majority of stems would conform to the redundancy relation rather than a minority.

Lieber is at pains to establish that ML rules such as (20) obviate the need for diacritic features indicating morpholexical class membership, such as [+irreg. pl.] or [+3rd conjugation]. It is possible to deduce that a given root belongs to the class by simply noting that it has an allomorph conforming to (20). This claim presupposes a specific attitude to the notion of 'lexical entry', which Lieber is not fully explicit about (though she does discuss the question in some detail in Lieber, 1980, ch. 2, Section 1). As a result it is not clear how the relatedness of allomorphs is represented in the grammar by virtue of the ML rules.

Of greater interest is the fact that this also presupposes a particular theory of morphological selection. The plural affix, for instance, has to have access to the appropriate allomorph of an entry such as *KNIFE* (namely/naiv/). Lieber (1982: 35) comments:

(The plural *-s* would have its own lexical entry and would be marked to attach to the voiced continuant final allomorph where one occurred.)

Lieber is assuming a theory in which an affix such as *-s* is provided with a subcategorization frame specifying which stems it may concatenate with (in this case noun stems). However, the subcategorization frame must consist of more than just an indication of the feature set for voiced fricatives. If this were included in the frame, *-s* would be unable to attach to regular stems ending in non-alternating unvoiced fricatives such as *fife*. Clearly, the feature on the subcategorization frame must capture the information that the voiced stem is selected if there is also a voiceless allomorph. But the machinery developed by Lieber does not make provision for this. All the lexicon contains is lists of allomorphs and rule (20).

Morphological selection, then, must be able to distinguish between listed allomorphs related by (20) and allomorphs not so related. There are two very similar ways of capturing such a 'global' relationship (ones to which other solutions will be formally equivalent). The first is to attach some kind of diacritic to the lexical entry as a whole and write a special rule assigning the

selecting morpheme to the correct allomorph within that entry. The other is to attach a diacritic to at least one allomorph of the lexical entry and mark the selecting morpheme to select such allomorphs. Since the second solution is the more direct let us explore this. The voiced allomorph is 'derived' in an obvious sense, so let us mark that allomorph with a diacritic. Since that allomorph participates in other morphological processes let us refer to the diacritic as [PL]. The lexicon will then contain entries such as (21).

- (21) (a) FIFE: faif
 (b) HIVE: haiv
 (c) KNIFE: naif naiv]_{+PL}

Rule (20) will have to be modified as in (22). The lexical entry for *-s* can now be given as (23).⁶

$$(22) \quad X \begin{bmatrix} +\text{cont} \\ +\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} \sim X \begin{bmatrix} +\text{cont} \\ +\text{ant} \\ -\text{son} \\ +\text{voice} \\ +\text{PL} \end{bmatrix}$$

- (23) s:[N([+PL])—]

By customary principles of disjunctive ordering *-s* will be blocked from attaching to /naif/.

The morphological facts are somewhat more complex than is suggested by this. Some voiced allomorphs are used in conversion (e.g. /hauz/) while others are not (e.g. /naif/). In rare cases we find a voiced root allomorph used in conversion but not for the plural (e.g. /pruf/, /prufs/, /pruv/). This means that we need a redundancy rule in the lexicon telling us that in general a voiced allomorph used in conversion is also the plural stem (though not necessarily vice versa). Suppose the conversion rule is (24), where [V] is a

[6] It could be argued that the subcategorization frame for *-s* should be (i), where...represents the feature set defining fricatives.

(i) [X ([...([+voice])—)]

The first expansion of (i) would then be (ii)

(ii) [X [...[+voice]—]]

accounting for /waiv/ and /haiv/. The second expansion would be (iii), accounting for /faif/.

(iii) [X [...[−voice]—]]

The third expansion would be simply [X —], accounting for all stems ending in other than a fricative.

This solution would fail for entries such as *PROOF* (see below), which have a voiced allomorph but whose plural is formed on the voiceless allomorph. Note, too, that in general phonological solutions such as this would be excluded if there were, say, a variety of English in which, in addition to cases such as 'wife' there were examples in which the voiced allomorph were basic and the voiceless one derived, and such that *-s* selected the voiceless allomorph. While not common, phenomena such as this are attested. Therefore, if such a relationship were demonstrably morpholexical we would have shown an absolute need for the featural solution proposed here.

diacritic identifying the stem used for conversion. (It is immaterial to the argument whether this is a process of conversion or zero affixation.)

(24) $N([+V]) \rightarrow V$

Then we can assume redundancy rule (25).

(25) $[+V] \rightarrow [+PL]$

The lexical entries given in (21) can now be supplemented as in (26).

- (26) (a) FIFE: faif
 (b) HIVE: haiv
 (c) KNIFE: naif ~ naiv]_{+PL}
 (d) HOUSE: haus ~ hauz]_{+V}
 (e) PROOF: pruf ~ pruv]_{+V, -PL}

Rule (25) is to be interpreted as a structure-building rule. By virtue of the Elsewhere Condition it will be overridden by the $[-PL]$ marking in (26e). Rule (25) creates a new lexical entry, (26d').

(26) (d') HOUSE: haus ~ hauz]_{+V, +PL}

Returning to our ML rule, we notice a good deal of redundancy. One example of this is in the specification for the phonetic feature [voice] in the phonological matrices for examples (26c, d, e). Given widespread assumptions about underspecification (cf. Kiparsky, 1985; Archangeli, 1984) we can assume that the feature [voice] is underspecified in lexical representation and set up redundancy rule (27).

(27) $[0 \text{ voice}] \rightarrow [+ \text{voice}] / \left[\left\{ \begin{array}{c} [+PL] \\ [+V] \end{array} \right\} \right]$

Rule (27) captures in a direct fashion the fact that the voicing of the final fricative is the exponent of plurality (or verbhood) on these stems. In effect, it is a minor phonological rule couched as a pre-phonological (and pre-morphological) redundancy rule. It can replace the ML rule (20) in conjunction with a lexical entry for a stem like *house* having an archiphoneme final fricative, as in (28), unspecified for voicing.

(28) hauS

This machinery is forced on us (*pace* Lieber) by the need to ensure correct allomorph selection by affixes such as *-s*. We have divorced the morphosyntactic features governing such selection from the phonological exponence of the morphosyntactic categories concerned. Hence the need for (27) establishing the link between the two. At the same time we solve the conceptual problem inherent in viewing ML rules as redundancy rules which code minor relationships. Since only diacritically marked entries are related by the minor rule there is no spurious implication that this is somehow the general case.

The discussion thus far has assumed that when an affix such as *-s* attaches

to stems to induce ‘minor rule’ allomorphy, only one such minor phonological rule is involved. In general, however, a given morphosyntactic category may be associated with a variety of phonological exponents within the stem category. The past participial morpheme *-en* in English (as opposed to *-ed*) has a number of phonological effects depending on the class of strong verb stem to which it attaches. In some cases it attaches to an allomorph different from the base but identical to the past-tense stem allomorph (*break/broke/broken*). In other cases, it attaches to a different allomorph again (*drive/drove/driven*). In yet other cases it attaches to the base allomorph distinct from the past tense (e.g. *take/took/taken*). In other words, not only must the *-en* affix be subcategorized for the stems which it selects (as opposed to those it does not such as *swim/swum*), but also each such stem must be marked with another feature specifying which phonological alternation occurs. Otherwise, we will have no way of capturing the fact that the past participle of *drive* is *driven* and not, say, **droven*. It is not sufficient merely to list all the allomorphs and write redundancy rules such as (20) indicating that the relationships represent a phonological subregularity of some sort.

This means that it is not sufficient simply to say that the [+PL] feature triggers a rule such as (27). It will only trigger that rule if the stem belongs to the appropriate class of alternating stems. Thus, in the general case, despite Lieber’s claim, we must also mark the lexical subclass with a feature (say [FV]) to indicate that it undergoes rule (27), Fricative Voicing.

A morpholexical feature such as [+FV] acts as the diacritic trigger for a phonological redundancy rule. The fact that it is the voiced allomorph of such stems which is the exponence of plurality must now be captured by another redundancy rule. There will be as many such redundancies as there are different phonological exponents of the category concerned (i.e. at least three in the case of past participial allomorphy). We must therefore rewrite (27) as (29) and add (30) to the lexicon.

$$(29) \quad [0 \text{ voice}] \rightarrow [+ \text{voice}] / \left[\overline{+ \text{FV}} \right]$$

$$(30) \quad [0 \text{ PL}] \rightarrow [+ \text{PL}] / \left[\overline{+ \text{FV}} \right]$$

Notice that the need for (29, 30) is forced on us by our observation that selection has to be governed in a principled manner and that phonological exponents of morphosyntactic categories are not in general in a 1:1 correspondence with those categories. Does this suffice to represent all the information required in the lexicon? We have distinguished between the voiced and unvoiced allomorphs of stems such as /naif/ (Rule (29)) and we have assigned each allomorph to its appropriate morphosyntactic category (Rule (30)). But we have still to distinguish between alternating stems (/naif/) and non-alternating stems (such as /faif/ or /haiv/). Lexical entries for these three items will now look like (31) (where /F/ is an archiphoneme unspecified for voicing).

- (31) (a) FIFE: faif
 (b) HIVE: haiv
 (c) KNIFE: naiF ~ naiF
 |
 [+FV]

Entry (31c) is uniquely distinguishable from (31a, b) configurationally, in that it is possible to tell by inspection of the lexical entry as a whole that it alone of the three represents an alternating stem. This means that there is no need to set up yet another diacritic morphological feature distinct from the morphophonological trigger [FV] simply to distinguish KNIFE from FIFE. In this (weak) sense we can substantiate Lieber's claim about the redundancy of diacritics. But it remains true that we need the morphophonological and the morphosyntactic features simply to achieve observational adequacy. (Strictly speaking, we would also have to have a rigorous definition of the notion 'lexical entry', of the kind that would tell us whether 'peace' and 'appease' are related by rule (29).)

The arguments from English Fricative Voicing are predicated on the assumption that this particular case of allomorphy must be handled (as Lieber says) by means of an ML rule. As I have pointed out, it is very difficult to prove that a rule must apply before any morphological operation whatever. Although Lieber cites Fricative Voicing as an argument that ML rules are needed, it does not, in fact, constitute such proof. Given that both morphosyntactic and morphophonological features are needed anyway, we could just as easily regard the diacritic [FV] as a common-or-garden rule feature which triggered Fricative Voicing only after morphological operations such as morphological conversion or affixation of *-s*. In that case, we would be dealing with an ordinary cyclic rule triggered not just by morphology but also by a diacritic. If Fricative Voicing were demonstrably an ML rule then what was said about the need for diacritics would still follow. To complete the argument, we must show that the reasoning applied to Fricative Voicing is also valid when applied to cast-iron cases of ML rules.

Let us return to the case of 2nd Velar Palatalization in Czech prepositional plurals. I established, in effect, that the Czech lexicon must contain the entry (32) for the word *zvuk*.

- (32) SOUND: zvuk ~ zvuc

How do we ensure that it is the *zvuc* allomorph that is selected by the prep. pl. desinence? In the present case we could simply write into the subcategorization frame for *-ich* the information that it selects the palatalized allomorph if there is one. This could be achieved by means of entry (33).

- (33) *ich*: [[N X $\left(\left\{ \begin{array}{c} c \\ z \\ s \end{array} \right\} \right) \text{---}]$

This is to be interpreted to mean that *-ich* selects a Noun stem and that if that stem ends in /c/, /z/ or /s/ then that stem is selected, otherwise any stem is selected. This means that by virtue of the disjunctive ordering interpretation of the parenthesis notation the allomorph *zvuc* should bypass the allomorph *zvuk*.

Unfortunately, not only is (33) extremely cumbersome, it is also inadequate. For it is not simply that *-ich* selects stems with a certain phonological form, it selects stems belonging to the morpholexical category 'soft'. This is in the general case an arbitrary category. Recall that the word *uhel* 'coal' is a vacillating stem, while *úhel* 'corner' is a hard stem. Stems ending in certain phonemes such as /l/ or /s/ have to be marked lexically since there is no longer a phonological distinction of palatalization for these sounds to distinguish hard and soft stems. This means that *-ich* must actually have a subcategorization frame which appeals to the feature [hard]. A redundancy rule will then mark phonemes such as /c/ inherently [−hard]. A stem such as *uhel* ending in soft /l/, however, will have to be lexically marked as such. This means that (33) has to be replaced by (34). In (35) we see the lexical entry for *uhel*. Rule (36) states which phonemes are hard and which soft.

- (34) *ích* [N[−hard]—]
 (35) COAL: *uhel* [−hard]
 (36) p b f v m t d n r k g ch h → [+hard]
 c č š ž ř ď ť ň j → [−hard]
 l s z → [±hard]

Given (36) it might appear that all we need in the lexical entry for *zvuk* is what is provided in (32), since the *-c* allomorph will be marked [−hard] and *-ich* will correctly select that allomorph. But this is inadequate, for there will be nothing on this assumption to prevent *-ách* (which selects [+hard] stems, including *-k* stems) from selecting the allomorph *zvuk*. Indeed, in the case of stems with doublets such as *dok* (*dokách*, *docích*) something of this sort actually happens. This means that there is no alternative to lexically marking the *-c* stem allomorph with a feature [+prep. pl.] to guarantee correct selection.

An even more intriguing problem arises with *-h* and *-g* stems such as *prah* 'threshold' and *filolog* 'philologist' (see discussion of examples (15)). For /z/ is ambiguous with respect to hardness, as can be seen from (36). This means that although the entry for, say, *prah-* may contain both allomorphs as shown in (37), *-ich* will be unable to select the correct allomorph given subcategorization frame (34) because neither allomorph is marked [−hard]. The *-h* allomorph is redundantly marked [+hard] while the *-z* allomorph has to remain unspecified and in the normal course of events would eventually be

specified [+hard] by default rule. A -z stem is only REGULARLY soft when it is an allomorph of an -h/g stem.

(37) THRESHOLD: *prah praz*

The only solution in this case is to devise a feature system which captures explicitly the fact that the -z allomorph is the soft (more specifically the 2nd Velar Palatalization) variant of the -h allomorph. We do not wish to write redundancy rules which imply that all velar stems have 2nd Velar Palatalization alternants in the prep. pl., for some take a different affix (e.g. *plech–plecháč* ‘metal foil’). It is not even clear that all velar stems actually have a 2nd Velar Palatalization allomorph in any but the most hypothetical sense. For instance, there seems to be no form of the stem *plech-* showing 2nd Velar Palatalization alternations. However, it might be possible to make some use of phonological redundancy in such cases. In view of the low functional load on 2nd Velar Palatalization alternants (this alternant only appears in highly restricted inflexional contexts), it might be possible to write morphological rules (or subcategorization frames for affixes) which select the palatalization allomorph if it exists, otherwise a different affix is used. But while this would work for *plech*, it would probably not avail in cases such as *dok* where we have doublets. This is particularly true of a word such as *manášek* ‘puppet’. This has doublet forms in the prep. pl. (*manášcích*, *manáškách*) but also in the nom./voc. pl., in which it either takes the human masc. ending -i (which takes the 2nd Velar Palatalization allomorph, *manášci*) or the non-human ending -y (in which case the basic allomorph shows up, *manášky*).

This is not to say that further research will necessarily fail to show that arbitrary diacritics can be dispensed with in such cases, merely that no such demonstration can as yet be provided. It would be interesting to see clear-cut cases in which there was absolutely no option but to select morphologically related alternants on the basis of non-phonological information.

This discussion of Czech completes the argument. We can regard ML rules as Stratum 0 phonological rules. The facts of morphophonological alternation and morphological selection necessitate a system of diacritics along the lines suggested for English plural allomorphy. While it is not possible to prove categorically that Fricative Voicing (or any other rule of English) has to be a Stratum 0 rule, it would certainly not be impossible to regard many of the morphophonemic alternations of the language as ML rules, given that there do exist irrefutable instances. Following from Marantz’s suggestion we might pursue the idea that all phonological relationships which are morphologically conditioned and which admit of surface phonological exceptions should be regarded as ML rules.

4. CONCLUDING REMARKS

I have shown that there are cases in which a rule which apparently belongs to the phonological component must be regarded as a type of lexical redundancy rule defined over listed allomorphs if generalizations about morphological selection are to be captured. Because of the considerable expressive power of generative theories of morphophonology, which include devices such as alphabetic diacritics, interaction between morphological operations and phonology, and even a 'loop' which destroys linear ordering relations between different morphological levels, it is extremely difficult to find examples which cannot be reanalysed in more traditional terms in an observationally adequate way. However, in the examples discussed in Section 2 it is impossible, even with these additional devices, to capture the relationships without assuming that the specific phonological shapes of certain alternants are available in the lexicon and accessible to word-formation processes.

Morpholexical rules of the kind proposed here have the virtue of permitting the grammar to generate the data while at the same time capturing rather directly the idea, originating in structuralist theories of morphophonemics, that morphophonological processes can be regarded as partial exponents of morphological relationships. Indeed, it is worth speculating that all phonological rules which need non-phonetic (morpholexical) conditioning diacritics should be regarded as morpholexical rules in the sense defined here. This would open up the possibility of constraining the formal power of the lexical phonological system.

The question of the place of morphophonological alternation in the grammar has been the subject of much debate from a variety of perspectives. In addition to the proposals of Natural Generative Phonologists (e.g. Hooper, 1976; Hudson, 1980), and the extensive literature within the Lexical Phonology framework, there has been detailed discussion of the problem by adherents of Natural Morphology, most notably Dressler (1985). While it is not possible to provide a detailed comparison of Dressler's approach with the present proposals (that would require a monograph-length treatment), some preliminary remarks are in order.

Dressler (1985) distinguishes Phonological Rules (PRs), Morphological Rules (MPRs) and Allomorphy Rules (AMRs). He provides a lengthy set of criteria for distinguishing between these types but is at pains to stress that the criteria are not deterministic. That is, there are no necessary and sufficient conditions for appurtenance to one or another class, only probabilistic tendencies. This in itself strongly suggests that Dressler's typology is valid, if at all, only with respect to general typology.

PRs are automatic rules which are conditioned solely by phonological form. They correspond in large part to the rules of the post-lexical phonology (especially in the sense of Booij & Rubach (1987), who distinguish between

post-lexical rules, operating after the syntax, and post-cyclic rules, non-cyclic rules operating in the lexicon). MPRs are rules with the format of phonological rules which operate over domains defined phonologically and morphologically, whose outputs are characterized in terms of phonemes (as opposed, say, to extrinsic allophones) and which in general are neutralizing. Such rules are similar to the cyclic rules of Lexical Phonology, particularly in the variant of the theory which countenances Structure Preservation (see Kiparsky, 1985: 92 ff. for discussion of this notion). Some AMRs are reminiscent of Aronoff's (1976) Allomorphy Rules, though they are not restricted to particular morphemes as Aronoff's rules are. Furthermore, they often take the form of phonological rules whose conditioning environments happen to include non-phonetic diacritics. This, however, is also true of many MPRs.

Detailed comparison between MPRs and AMRs on the one hand and ML rules on the other is not easy. One important technical obstacle to comparison is the role played by underspecification in the theory proposed here (see Section 3 and also Spencer, 1986, for preliminary remarks about underspecification in the formalization of ML rules). Dressler does not really address this problem. Second, comparison is hampered by the descriptive licence Dressler permits himself. For instance, in the chapter describing palatalizations in Polish we find a rule of Surface Palatalization (P7) which is billed as an MPR, and which includes a symbol in the environment glossed as 'mostly with' a particular class of affix and a negative specification in the environment to prevent the rule applying to velar fricatives. Neither of these devices would be allowed in the essentially phonological format of ML rules I am assuming here. It would appear, however, that AMRs are much more like (cyclic) phonological rules than ML rules, for ML rules will be context-free or triggered solely by morpholexical diacritics, while AMRs appear to be context-sensitive rules with phonologically defined environments. In other words, Dressler has not taken the step of separating morphophonemic selection from the statement of allomorphy, as is done here.

My conclusions regarding the relationship between the proposals made here and Dressler's theory, then, are that there may well be very interesting parallels, but it is difficult to say whether or not similarities are anything other than superficial resemblances.⁷

Finally, it is worth asking how a theory which includes ML rules relates to the various versions of Lexical Phonology currently under development. I have referred to ML rules as 'Stratum o' rules. However, this is not to imply that such rules are constrained to apply at Stratum o by stipulation. Rather, this is a direct consequence of the fact that such rules are triggered by

[7] It is intriguing to note that only two recent contributions to the theory of morphophonology are missing from Dressler's otherwise compendious bibliography: Lieber (1982) and Marantz (1982).

morpholexical features on lexical entries. Such rules could not therefore apply on genuine cycles for two reasons. ML rules have no conditioning other than morpholexical triggering diacritics and thus could not be fed by morphological operations. Therefore, on the assumption that a rule must apply if its structural description is met, all ML rules will apply at the level of roots, Stratum 0. If for some reason an ML rule failed to apply at Stratum 0 it would be prevented from applying on a later cycle by Strict Cyclicity. This follows since, if we continue to assume that a phonological or morphological rule may not introduce diacritics of its own onto morphemes, an ML rule applying in the cycle would always be applying in a non-derived environment, contrary to the Strict Cycle Condition. The only exception to Stratum 0 application might be in the case of ML rules which are not applicable until (post)-syntactic word formation processes (see below).

Booij & Rubach (1987) argue for a more compartmentalized variety of Lexical Phonology in which the lexical phonology proper is formed from two blocks, the cyclic and the post-cyclic rules. ML rules, then, would fit neatly into this typology. They would form a separate block of 'pre-cyclic' rules (though again their assignment to this block could be a consequence of their mode of operation and would not have to be stipulated). Since the theory of Booij & Rubach will in any case include a variety of pre-cyclic rules applying to roots, namely Aronovian Allomorphy Rules, this proposal amounts to little more than a slight extension of their model.

In more general terms, the introduction of ML rules (particularly if they are to replace all phonological rules with morphological conditioning) together with a more sophisticated theory of morphological selection along the lines advocated by Lieber, has the advantage of increasing the 'modular' character of morphophonology. All idiosyncratic morphophonological information is coded in lexical entries, and not introduced by rules. Since morphological concatenation must respect morphophonological selectional requirements ('subcategorization frames'), these lexical idiosyncrasies will be projected through derivations. Since the phonological changes giving rise to allomorphy are separated from allomorph selection, this will even be true in the case of word-formation processes which seem to take place in syntax or post-syntactically such as cliticizations, compounding and phenomena such as noun incorporation. Under current models of Lexical Phonology it is difficult to know what to do about allomorphic variation with a clearly lexical character but which is defined over words which appear to be formed outside the lexicon (see Jenkins, 1984, for pertinent discussion of this problem in Greenlandic Eskimo). In the present theory, stems which are incorporated by such 'post-lexical' word-formation processes will be listed with their allomorphic variants. All the word-formation process then needs to do is to choose the allomorph for lexical insertion which meets selectional requirements.

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