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1. Introduction

In this paper I will discuss interdependencies between morphology and phonology within the framework of Lexical Phonology. Since Lexical Phonology is not a homogeneous theory and has undergone several modifications in the past, it will be necessary to start with an outline of the concept. Topics to be considered at this stage are: On which theoretical background is Lexical Phonology (henceforth LP) based? Which are its basic characteristics? Which of them are commonly accepted by scholars and which are subject to critical debate?

My discussion will then focus on the question of how the domains of phonology and morphology are organized within different LP models. This section is the main part of the paper and it is devoted to two different aspects of ordering: (i) procedural vs. spatial ordering; (ii) the feeding sequence of rules. Whereas (i) implies the notions of cyclicity and strata, (ii) is concerned with the issue of morphology-phonology interaction. Since it is generally assumed that phonological and morphological processes do not apply simultaneously - although Booij and Lieber (1993) point out cases of simultaneity of morphological and prosodic structure in LP - there must be a particular order in which they apply. They are usually claimed to be in a feeding relation, although there is no consensus in which sequence this feeding of rules applies. Additionally, it has to be discussed, to which extent the concept of cyclicity has to be taken into account, when dealing with rule ordering. I will present and compare the most prominent approaches to this matter.

2. The Conception of Lexical Phonology

2.1. Background

The concept of Lexical Phonology was historically derived from generative phonology, especially from the assumptions made in *The Sound Pattern of English* (Chomsky and Halle, 1968, SPE). In SPE it is suggested that

[. . .] the generation of a sentence starts with a syntactic deep structure. From this a surface structure is generated by means of transformational rules. This surface structure consists of morphemes in their underlying phonological form. These forms are then subject to phonological rules, which ultimately specify the pronunciation of those morphemes. In this model morphology as such plays no role: the order of morphemes is determined by syntactic rules and the different shapes assumed by morphemes are accounted for solely by phonological rules” (Spencer, 1991: 99).

Whereas LP retains the notions of underlying phonological representation (UR) and surface form, both the view that morphology is subordinate to phonology, and that morpheme order is generated by syntax have been challenged. The fact that phonological rules can apply cyclically is accounted for by stipulating that morphological processes can trigger cyclic phonological rules.

The concept of cyclicity is based on the assumption that one and the same rule can apply more than once in a derived environment: “Having applied a set of cyclic rules, we then expand the string over which the rules apply (for instance, by adding another affix), and then apply the whole rule set to the new string” (Spencer, 1991: 107). Crucial to this notion is the *Strict Cycle Condition (SCC)*, i.e. a rule cannot return to a cycle already passed by. Therefore cyclic rules can only apply to the same substring once, but are able to make changes to the whole elaborated string in a following cycle. Strict Cyclicity was introduced by Mascaró (1976).

Another important step in the development of LP was the integration of Siegel’s (1979) Level Ordering into the theory of phonology by Kiparsky: “Each level is associated with a set of phonological rules for which it defines the domain of application. ... [T]he output of each word-formation process is

submitted within the lexicon itself to the phonological rules of its level” (qtd. in Spencer, 1991: 109). This leads to the general model of LP:

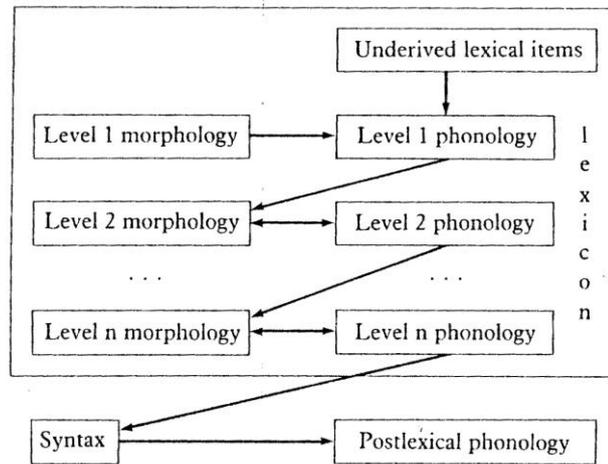


Fig. 1: Kiparsky's (1982a) Lexical Phonology (qtd. in Spencer, 1991: 110)

2.2. Characteristics of Lexical Phonology

The approach of LP is characterized by its attempt to organize both morphology and phonology within an interactive framework, which consists of two sections: (i) the lexicon, where words are stored or created (ii) the post-lexical domain, where phrases or sentences are created. These sections are separated in such a way that no processes on the post-lexical level have access to information confined to the lexical level. The distinction reflects thus that some phonological rules (on the lexical level) are closely connected to morphological rules whereas postlexical ones have no influence on word formation at all.

In addition to this division, the lexicon itself is divided into several *strata*, or *levels*, which are ordered hierarchically. Each stratum contains, in an interacting relationship, a set of morphemes and a set of phonological rules. In this way, the hypotheses of cyclicity and level-ordering are combined in one model. As will be shown later in this paper, such a combination is not as unproblematic as it seems at first glance. But before considering this issue, I would like to go a bit deeper into the matter of level-ordering.

The model presented in fig.1. is quite general in that it does not specify how many strata there should be. This is because the number of strata proposed has been varying ever since LP was developed. Proposals range from two to four strata, and the case is not yet decided though many scholars prefer a two-strata model. There are also different sets of terminology at hand when dealing with affixation in the context of LP. In SPE Chomsky and Halle suggest that there are two kinds of boundaries between morphemes (and also words): *weak (#)* and *strong (+) boundaries*, which they imagine as underlying functional elements. A ‘#- boundary’ is claimed to exist between a morpheme and a *neutral affix*, i.e. it does not affect stress or change the pronunciation of the base. If there is a *non-neutral affix* attached to a base, a ‘+- boundary’ exists between the two elements. The two different kinds of affixes are also often referred to as *primary* (non-neutral) and *secondary* (neutral) affixes, or *stratum 1 (s1)- / stratum 2 (s2)- affixes*. The idea of boundaries has also been rendered by the concept of *open and close junctures* between morphemes.

All this different terminology reflects two different kinds of approaches, one attributing morpho-phonological alterations to affixes and the other to boundaries (SPE), whose actual existence has been doubted by most scholars. Generally the concept of boundaries has been dismissed in LP, though Sproat (1993) presents empirical data concerning /l/- allophony in English, which could be interpreted as support for the boundary hypothesis. Eventually, Libben (1990) offers very strong evidence that the concept of boundaries is not stored in the brain, and thus is not psychologically real.

Apart from the concept of boundaries, the use of brackets has been proposed, a concept which is frequently encountered in LP. In Lexical Phonology “[. . .] the boundary symbols are replaced by a direct representation of constituent structure, a ‘labelled bracketing’” (Spencer, 1998: 112). In the course of word- formation, a monomorphemic item extends gradually, which is mirrored in the bracket structure. Additionally, information is claimed to be encoded, which indicates for example, which part of speech is being processed. On leaving a stratum, morphological and phonological rules have no more access to internal structure of a word, because a *Bracket Erasure Convention* states that “[i]nternal brackets are erased at the end of a level” (Spencer, 1998: 113).

2.3. *Theoretical Common Denominator in Lexical Phonology*

Since there is much controversy of how the theory of LP could be modified in order to cope with problems still unresolved, it will be necessary to briefly sum up the assumptions which most scholars would agree with as a kind of common denominator for the following discussion of ordering problems. In doing so, I am following Kaisse and Hargus (1993), which is an introduction to several articles discussed at a workshop held by LP scholars. According to this publication, common assumptions concerning LP are:

(1)

1. the distinction between lexical and post-lexical rules
2. “languages may have word-internal phonological domains which are derived from morphological structures in various ways but do not necessarily correspond to either morphological or metrical phonological structures.”
3. hypothesis (2) is regarded as superseding the level ordering hypothesis (LOH)
4. “languages do not allow postlexical rules, be they syntactic or phonological, to refer to word-internal structure”
5. The bracket erasure convention (BEC), which formerly assured (4) is now being replaced by different conceptions, such as pre-compilation.

(cf. Kaisse and Hargus, 1993: 2)

Furthermore, there have been attempts to specify, as a kind of rule typology, characteristics of lexical and post-lexical rules. Although many rules fit into this typology, there are still many exceptions, and the borderline between the two kinds of rules is not always as clearly defined as the following table seems to suggest:

(2)

LEXICAL	POSTLEXICAL
a. word-bounded	not word-bounded
b. access to word-internal structure assigned at same level only	access to phrase structure only
c. precede all postlexical rules	follow all lexical rules
d. cyclic	apply once
e. disjunctively ordered with respect to other lexical rules	conjunctively ordered with respect to lexical rules
f. apply in derived environments	apply across the board
g. structure-preserving	not structure-preserving
h. apply to lexical categories only	apply to all categories
i. may have exceptions	automatic

(Kaisse and Hargus, 1993: 16f.)

The characteristics listed above cannot be interpreted as fixed rules, which is also indicated by the last item allowing exceptions. Although these hypotheses hold true in many cases, counter-evidence has been presented especially for those characteristics that contain constraints on rule ordering, such as a; b; d; e. The following part of this paper will be a detailed discussion of the arguments which have been raised in this controversy.

3. Organizing Lexical Phonology

3.2. Rule Sequence inside a Stratum

The standard assumption of LP with regard to rule ordering has always been that morphological rules trigger phonological ones, as is illustrated in fig. 2:

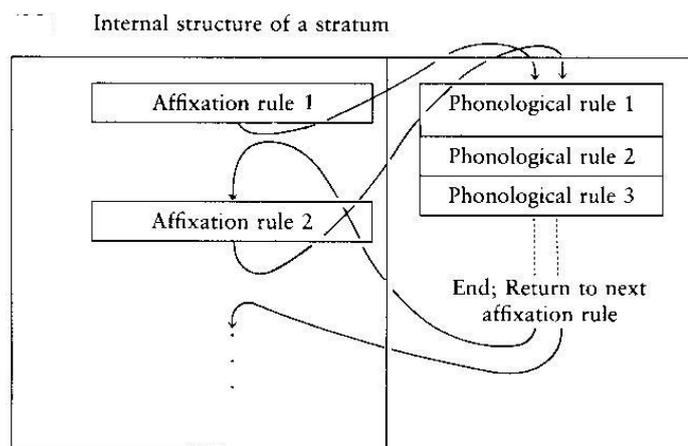


Fig.2.: Goldsmith (1990: 238)

The point that is neglected in this figure is that of multiple affixation processes: what order of rules is established, when two affixes of the same stratum occur in one word, e.g. the s2- affixes *-less* and *-ness* in \cap home_N-less_A-ness_N? In these cases rules are ordered *intrinsically*, within their stratum. (cf. Katamba, 1993: 116-7). Two universal principles can be observed: (i) *feeding* and (ii) *bleeding* relationships between rules. In case (i), it is obvious that the rule that feeds the other occurs first (as the N-Adj-N alternation in 'homelessness' serves to show). Rules that do not feed each other, as in (ii) are ordered *disjunctively*, i.e. "[. . .] either one rule applies, or the other, but not

both. Thus, the Elsewhere- Condition guarantees that the more specific rule will pre-empt the more general” (Spencer, 1998: 110).

3.1. *Objections to Strata Ordering*

Although the concept of lexical strata arranged in a hierarchical order seems to be a very elegant and straight- forward way of constructing a theory of morphology, there are still some arguments against it. These objections are usually referred to as *Bracketing Paradoxes*, which means that “[the] attachment of stratum 1 affixes seems to presuppose the presence of stratum 2 affixes, or when stratum 2 affixation needs to see the internal bracketing of a word, that is only available at stratum 1” (Katamba, 1993: 144). It will be necessary to discuss some examples of bracketing paradoxes first.

The fact that the English prefix *un-* occurs at stratum 2 and attaches to adjectives (respectively to verbs, e.g. undo, unlock, etc.) but not to nouns. In the following example however, *un-* seems to be prefixed incorrectly:

(3)

stratum 1: [[govern]VERB able] ADJ
 ↓
 [governable]ADJ ity NOUN
 (→ governability NOUN)
 stratum 2: [ADJ[un [[governability]NOUN]

(Katamba, 1993: 145)

The *un-* prefix in this case appears to attach to a noun, which is a fact that cannot be accounted for in terms of LP assumptions. It seems to be a violation of characteristic (2a). It could instead be argued that *un-* attaches to [governable]ADJ but this would lead to a s1-s2-s1 sequence, which also is not permissible. Examples (4) and (5) present further data, which are problematic for the strata- model:

(4)

read-abil-ity	reli-abil-ity	sell-abil-ity
depend-abil-ity	spread-abil-ity	elect-abil-ity

(Katamba, 1993: 148)

The sequence of affixes is s2 - s1, which is contrary to the prediction of LP. Although there are two different *-able* suffixes, one belonging to s1 and the other to s2, it is clearly the latter which applies in this case (\cap read $\sim \cap$ readable).

(5)	Close Juncture (s1)	Open Juncture (s2)
	cathóli[s]ism	cátholi[k]ism
	Buddhism	Indiana-ism
	communism	Indian-ism (from Indian)
but	archaism, mannerism, hebraism	

(cf. Goldsmith, 1990: 261-2)

The examples above indicate that the *-ism* suffix appears to be a primary affix in some cases, while in others it is secondary. According to LP, each affix should uniquely belong to one stratum only. Goldsmith argues, that there are two distinct *-ism* suffixes with semantic differences: stratum 1 *-ism* indicates a philosophy, “in a broad sense”, whereas stratum 2 *-ism* is used in a mannerism sense. The paradox however consists of the fact that “archaism”, “mannerism” and “hebraism”, although used in the mannerism sense, take the s1-suffix *-ism*. The data presented in (5) have also been adduced to raise the question, if strata should be organized according to affixes or according to roots. Katamba, like most LP scholars, convincingly defends the notion that “[. . .] it is not the inherent characteristics of the root that determine whether it alternates before a given suffix. Rather, alternation is imposed on roots (and bases generally) from outside by affixes” (Katamba, 1993: 135). However, the paradox described above remains unexplained.

3.2. Relaxing Linearity Constraints

In order to cope with bracketing paradoxes, there have been several attempts to modify the strata model. Halle and Mohanan (1985) have proposed a model consisting of four strata and a *loop*:

- Stratum 1: Stratum 1 derivation; irregular inflection
- Stratum 2: Stratum 2 derivation
- Stratum 3: Compounding
- Stratum 4: Regular Inflection

(qtd. in Katamba, 1993: 149)

The approach is based on the principle of modularizing in order to loosen the strong constraints imposed by a two- strata model and to achieve more flexibility. Different kinds of word-formation are set on distinct strata: irregular inflection and non-neutral derivation occur at s1, neutral derivation at s2, compounding is assigned to s3 and regular inflection to s4. The loop links s3 with s2, in order to enable returning to a stratum which has previously been passed. This modification provides an answer to paradoxes that affect compounding, such as described below:

(6)

- | | |
|---------------|---------------|
| a) boy-friend | ex-boy-friend |
| b) teach-er | head-teacher |

(Katamba, 1993:149)

In (6a) compounding feeds s2- derivation, whereas in (6b) s2-derivation feeds compounding as predicted. This phenomenon led Halle and Mohanan to propose the loop. However, even this modified model cannot account for the paradoxes described in (4) and (5). In addition to this, expanding the number of strata to four indicates that too many processes (regular/irregular derivation, regular/irregular inflection, compounding) are overloading the model. It has also been claimed that LP is at least convincing when considering compounding. The necessity of the loop has therefore often been interpreted “as an admission that level ordering is not the right way to approach the problem of morpheme ordering” (Spencer, 1998: 115).

4. Implications for Rule Ordering

The attitudes towards hierarchical level ordering are parted: while some scholars believe that the LOH can be modified in the course of future research, so as to account for the remaining problems (cf. Katamba, 1993: 151), the majority of scholars, among them Rubach, Halle and Kiparsky, use either relaxed constraints on strata ordering or have distanced themselves from the LOH (cf. Spencer, 1998: 115-6). However, as will be shown in the following paragraphs, relaxing or dropping the notion of strata weakens the position of morphology within LP considerably. It might even be argued, that by removing

this pillar, a common approach to phonology and morphology is no longer existent. The implications that follow from concepts, which do not depend on strict strata ordering anymore, must therefore be critically evaluated, in order to find out if the advantages outweigh the disadvantages.

4.1. *Noninteractionist Approaches*

Although standard LP is dependent on the notion that morphology and phonology are organized in an interacting relationship, one consequence of giving up the LOH, was to assume that morphology and phonology do not interact. Rather, it has been stipulated, that they apply successively, so that all morphology precedes all phonology. Odden (1993) “provides an interesting empirical argument against interactionism using data from Maltese. An ordering paradox arises in an interactionist analysis, which can be avoided if all morphemes can be concatenated before any phonological rules apply” (Kaisse and Hargus, 1993: 4). Odden’s approach, however, is very much reminiscent of the noninteractionist model of SPE, as the following figure illustrates:

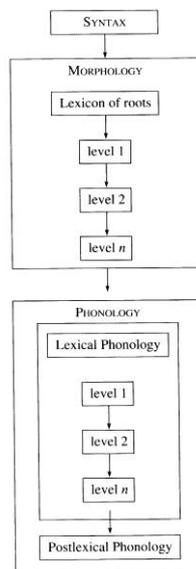


Fig.3.: Odden (1993: 113)

It is therefore questionable, if returning to the SPE model, from which LP started, can offer a suitable solution to those problems still unanswered.

Rather, it seems to be a step back, and evidence for the noninteractive hypothesis comes from very special problems in Maltese and Kimatuumbi.

Eventually, even Odden concedes that interactive models as in fig.1. “might still be right, even if there is no evidence for it in the realm of information access” (Odden, 1993: 142).

4.2. Interactionist Approaches

Apart from the claim presented above, that phonology may not precede any morphology, most scholars have maintained the notion of interaction between morphology and phonology, but with significantly different perspectives. There are basically three positions:

(7)

1. Lexical phonological rules may precede morphological rules.
2. Two levels of word- formation are assumed: *stem level* and *word level*; stem-level phonological rules are cyclic, word-level phonological rules are non-cyclic.
3. A stronger version of 2. has been proposed: Not only are word-level phonological rules non-cyclic, they also precede word-level morphology

(cf. Hargus, 1993: 46-7)

From the listing of these hypotheses follows that virtually every possible position has been taken, and the controversy has not yet been settled. Let us now consider the suggestions described above in some detail. Hypothesis (7.1.) has been adopted by Pesetsky (1985) and includes the notion that lexical phonology is cyclic in the unmarked case. That means that normally morphology precedes phonology while admitting that there are exceptions with the reverse being true. This concept is at least a bit unspecific, in that it recognizes exceptions on the one hand, but does not identify any regularities among them on the other hand.

A much more restrictive view (7.2.) on rule sequence has been taken by Kiparsky (1985), in that he suggests the following morphology- phonology interaction:

stem-level (cyclic): phonological rules before morphological rules

word-level (non-cyclic): morphological rules before phonological rules

(cf. Hargus, 1993: 46)

This model is even not restrictive enough in the opinion of Borowsky (1993), who, in agreement with (7.3.), not only proposes that phonological rules precede morphology at the stem level but also at the word-level:

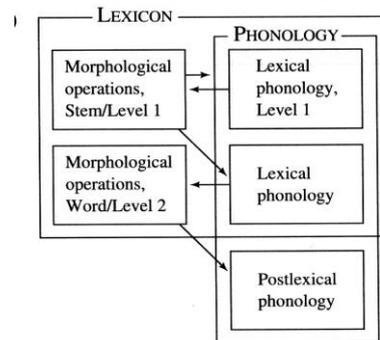


Fig. 4.: Borowsky (1993: 200)

In addition to that he argues that it cannot be decided whether or not the word level is cyclic, “[. . .] since [. . .], at least for English, there is no evidence that there is any lexical phonology beyond this one cycle at word level [. . .]” (Borowsky: 1993: 201). Unfortunately, it is not possible to discuss the arguments and examples adduced to defend the different to morphology-phonology interactionist approaches. At least, it seems that the majority of data supports an interactionist model, contrary to the assumptions of Odden (1993) and other proponents of noninteractionism, as can be seen by the numerous examples described in Hargus (1993). According to her, evidence, though not always uncontroversial, comes from cases in English, Finnish, Lappish, Hebrew, German, Dutch and some other languages (cf. Hargus, 1993: 49;54). Eventually, the discussion is not yet settled, but interactionism is quite strongly supported by this publication.

5. Conclusion

In this paper, I have outlined the development of Lexical Phonology, its fundamental principles, and its shortcomings. By doing this, the focus has always been on the different theoretical methods and concepts, which have been designed and modified, in order to combine morphology and phonology in a consistent system. This was due to the fact that I wanted to know more about interface between these two linguistic domains. The first step, was to consider the strata-ordering hypothesis, which is basically a conceptual approach to combine morphological and phonological rules in a spatial-oriented model. Although certain sequence problems can thus be avoided or solved in a quite elegant way, strata ordering has had to face serious problems, as shown in 3.1. and 3.2., which led to different kinds of approaches. Scholars have tried to either relax constraints on strata ordering or to drop the hypothesis altogether, as described in 4. However, this implies complications with regard to sequence ordering: should all phonology follow all morphology? Different proposals have been discussed, but it could only be argued that this noninteractionist position is not very probable. Which of the remaining three positions should be favored, is still not easy to say, and controversy among scholars continues.

Eventually, I would argue that dropping the LOH, leads to a slightly subordinate position of morphology as opposed to phonology. However, since psychologists suppose that memory is generally structured as a form of network, why should the lexicon consist of hierarchical strata? Maybe, such an approach is prone to oversimplifying, for the sake of theoretical conceivability.

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