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GERMAN WORD STRESS AND LEXICAL PHONOLOGY

by

Helmi Braches
Übersetzer-Diplom, Germersheim, 1964

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
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The two main research aims of this thesis are firstly, to examine and characterize German word stress within the framework of metrical phonology, and secondly, to develop a model of lexical phonology for German, which incorporates the results of the metrical description.

In the literature, German stress has so far usually been interpreted as falling on the rightmost heavy syllable of a word, and the relevant studies are briefly discussed. However, the metrical description presented in this thesis suggests that German is in fact governed by different stress patterns. The pattern found in native vocabulary is quantity sensitive in metrical terms and governed by left dominant metrical structures, while non-native vocabulary produces right dominant word trees. A significant difference is also that stress assignment in numerous non-native derivations does not depend on syllable quantity, but is always word-final, suggesting that in those instances stress is an inherent feature.

It is proposed that the division into native and non-native vocabulary in German shown to exist with regard to stress assignment, corresponds to a division into native and non-native morphological operations. A model of the lexicon is developed in which these two types of morphological material are processed at two different levels. It is proposed that within each level, a non-native and a native level, derivation and metrical structure assignment take place cyclically, but, in accordance with the principles of lexical phonology, level-internal morphological information is not passed
on to the next level. This phenomenon supports the hypothesis that in German different stress patterns exist, since they are restricted to the cycles of morphological operations at the specific level.
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I wish to express my sincere thanks to Dr. Thomas A. Perry, for supervising this thesis. I am grateful for his guidance and advice at every stage of the project, as well as throughout my time as a student in the Linguistics Department. I would also like to thank the other members of my supervising committee, Dr. Richard C. DeArmond and Dr. Neville J. Lincoln, for thorough readings of the thesis and for valuable comments and suggestions.

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And last, but not least, I would like to thank my husband, Fred Braches, for encouragement and support.
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1.0 INTRODUCTION

The purpose of this thesis is two-fold: firstly, to provide a phonological description of stress phenomena in German, and secondly, to examine and interpret the processes responsible for these phenomena in the light of modern phonological theory. That these two objectives are stated and dealt with separately is due to the complexity of German stress, which, as will be shown, is governed by three different stress patterns. This is in contrast to what has generally been stated in the literature to date.

Chronologically and logically it seems appropriate to start this investigation with a brief overview of the analyses of German stress available to date, which is the object of chapter 2. The post-structuralist era in phonology has also produced a few studies on German word stress, the most extensive of which are the work of Kiparsky (1966), Wurzel (1970 a, b, 1980), and Giegerich (1985). While the discussion of these studies is brief, it will point out the assumption shared by these authors that German word stress works essentially like English stress, as well as the problems associated with this approach.

Chapter 3 will present a metrical characterization of German stress, based primarily on Hayes' (1981) theory. The choice to examine metrical theory separately from the framework of lexical phonology has been made for several reasons. In the first place, as mentioned above, since the description presented here is so different from the generally held view, it seems necessary to give it adequate attention and space. Secondly, it
seems indicated to develop a counterproposal to Giegerich's metrical phonology of German, which is based on the hypothesis that one type of metrical tree captures all incidents of stress assignment in German. However, as will become apparent in chapter 3, an unbiased interpretation of the German data will produce three different types of metrical structures, reflecting different stress patterns: a native pattern, where the main stress falls on the root syllable and generates left dominant metrical feet and tree structures, a non-native pattern where the main stress always falls on the final syllable, resulting in right-dominant word trees, and another non-native pattern with generally penultimate or antepenultimate stress which can best be described as "Latinate". Such a proposal may seem to contradict the principles of economy in linguistic theory, where a major concern is to develop the simplest, and therefore the most general, rules to characterize processes and phenomena. However, due to borrowing, most European languages have mixed stress patterns today, and it is not too far-fetched to assume that German has competing stress patterns. It must therefore be accepted that the facts of German phonology are not simple in this particular sense.

The third reason for dealing with metrical structure assignment first is that the insights gained in this exercise point to the motivation for some of the assumptions made in developing a model of lexical phonology for German. This model is presented in chapter 4.

At the core of lexical phonology stands the idea that morphological and phonological processes are effected at hierarchically ordered levels,
and that information regarding the internal morphological structure assigned at a certain level is inaccessible to the next level (cf. Kiparsky 1982; Kaise & Shaw 1985). This concept provides the explanation for the existence of different stress patterns in German: if derivation takes place at different levels, then the assumption is plausible that in German the phonological processes accompanying derivation are specified for a particular level as well and are in fact restricted to it, resulting in level-specific metrical rules. It will be shown that in the case of German, both morphology and phonology suggest a division into a non-native and a native level.

As the basic idea of lexical phonology implies, morphological and phonological processes are closely interrelated, and the discussion in chapter 4 will therefore be concerned with German morphology as well. The model of the lexicon developed here incorporates certain concepts of Lieber's (1981) proposal, in particular Lieber's idea that roots and stems are listed in the permanent lexicon. This assumption allows a new interpretation of the phenomenon of German umlaut, which, although not related to stress assignment, has been included in the discussion since it constitutes an important part of the proposed model of German lexical phonology.

The proposed organization of the lexicon for German as developed in chapter 4, with its stems listed in the permanent lexicon and its division into two levels of derivation, provides a maximum of explanation of morphological and phonological processes, and, contrary to what might be
expected with the existence of three stress patterns, will let German phonology emerge as an ordered, economical system.
2.0 STATE OF THE ART - A Review of Recent Theories about German Stress

This discussion includes studies on German stress from the last two decades, or the period since the arrival of generative phonology. It seems appropriate to choose this period since all the major studies on the subject date from that time. Kiparsky, whose monograph "Über den deutschen Akzent" first appeared in 1966 and thus predates Chomsky & Halle's "Sound Pattern of English" (1968), works entirely in a generative/transformational framework, and so does Wurzel, whose studies frequently refer to SPE (Wurzel 1970 a, b, 1980). Although the theoretical framework on which the studies on German by these two authors are based has been superseded to a certain extent by more recent phonological theory, they seem to have achieved the status of classics in German phonology, and should therefore be considered, at least briefly, in a discussion on German stress. Giegerich's "metrical phonology", as the title suggests, represents a departure from the SPE era and is largely based on Liberman & Prince's 1977 and Hayes' 1981 work. Chronologically between Kiparsky's and Wurzel's publications and Giegerich's book are two other studies, minor in scope: Austin's 1976 paper, following and expanding on Kiparsky, and Benware's 1980 paper on non-native stress, which does not follow any formal theory at all.

2.1 Kiparsky

Kiparsky distinguishes between rules determining the main stress in stems, rules which under certain conditions assign the main stress to prefixes, rules which produce stress contours ("Akzentabstufungen"), and
finally rules for the assignment of rhythmic secondary stress (Kiparsky 1971: 69). Within these groups, the rules determining "unstressability" of certain prefixes and another rule marking every affix as initially un-stressed, are characterized as "precyclic" (p. 98). Thereafter the cyclic rules apply, which govern all other aspects of stress assignment.

The stress in stems is described as falling on the "last heavy syllable of the stem and/or the only stem syllable". This assumption leads to the claim that in words like 'Ameise' or 'Pavian' the main stress shifts to the first syllable, leaving a secondary stress in the "original place of stress" (Kiparsky 1971: 69). However, an explanation as to why stress shift occurs in these forms is not offered. To interpret the varying stress in the prefixes miss- and un-, Kiparsky uses aspects of constituent structure and distinguishes between morpheme boundaries, internal word boundaries, and external word boundaries (Kiparsky 1971: 77). Internal word boundaries are defined as marking "lexical constituents immediately dominating stems" (p. 77), as for instance in compounds. The difference in stress placement in 'unhöflich' vs. 'unsäglich' is then motivated by different internal boundaries: (§ un # höf + lich §) vs. (§ un + säg + lich §) (p. 78), corresponding to an interpretation where the first adjective is a compound while the second is not, although Kiparsky does not refer to compound structure in this context. In fact, compound stress is not specifically dealt with at all. The only reference to compounds is found in the section on sentence stress, where it is stated that "the compounds Säufernase, saugbohnen, altklug can be included in the same rule as the constituents with initial stress, VP and S" (Kiparsky 1971: 86). Further
on it is stated that by virtue of the rhythmic stress rule compounds of the structure \([AB][BC]\) are assigned the same stress sequence as compounds of the structure \([AB][C]\), i.e. 1 3 2, rather than 1 2 3. The rule for the assignment of a "rhythmic secondary stress" operates after sentence and compound stress have been assigned (p. 98).

Kiparsky's analysis of German stress is doubtless based on correct observations and describes certain idiosyncrasies of stress placement correctly. Yet the paper fails to provide any systematic explanation of these phenomena. On the one hand internal word boundaries, i.e. morphological information, is exploited to account for stress placement; on the other hand, a precyclic unstressability rule, i.e. a phonological rule, is made responsible for the occurrence or non-occurrence of the participial prefix \(ge\)-. While there is no doubt that an interrelationship between morphology and stress placement exists --in fact, it plays an important part in the hypothesis presented below in this paper--, the criticism here is that it has been used in an ad hoc manner. Moreover, analyzing word stress and phrasal stress on the basis of the same criteria seems a doubtful approach. Kiparsky's own examples of phrasal stress show that it tends to be assigned on the right-hand side; his superficial comparison of compound stress with the stress placement in the right-hand (i.e. isolated) constituents of complete sentences does not provide any insight. And finally, stress distribution in stems doubtless deserves more discussion than the one sentence Kiparsky dedicates to it.
2.2 Austin

In his 1976 paper, Austin presents an appealing reevaluation of Kiparsky's cyclic rule approach. Austin observes that, although Kiparsky's rule assigning stress to stems is listed as a cyclic rule in the summary, it actually never applies more than once in each case (Austin 1976: 112). Austin proposes instead a morpheme stress rule:

\[(2.1) \quad \text{Morpheme Stress Rule (Austin 1976: 109):} \]

\[V \rightarrow [\text{stressed}] \quad \text{C}_0 \quad (V \quad (C))_0 \quad [-\text{long}]\]

Although lacking further specifications as to syllable quantity, this rule will produce similar results to Kiparsky's stem stressing rule in that it assigns primary stress to the rightmost syllable, or to the penultimate if the final syllable contains a short vowel. Austin specifies that this rule applies to all morphemes, stems and affixes alike, which has the advantage that secondary stress can be assigned more easily, even in those prefixes which in Kiparsky's system are marked with the feature [+unstressable]. For prefixes which contain the "unstressable" vowel schwa, yet are assigned contour stress as in *entmagnetisieren*, Austin proposes that these morphemes have a "lexical minus-rule feature" excepting them from undergoing morpheme stress assignment (Austin 1976: 110). Secondary stress is assigned to these prefixes later in the derivation by the "Stress Prominence Assignment Rule" (p. 112). This latter rule is one of several which Austin refers to as "Word Stressing Rules", which are clearly associated with a word formation component and apply cyclically, while the morpheme stress rules apply "once and once only" and are ordered before the word formation component. Interestingly, and in contrast to Kiparsky's
analysis, Austin's model also clearly separates the domain where word stress rules apply from the domain of phrasal stress (Austin 1976: 113 f.).

This mini-model of German phonology has obvious resemblance with later models of lexical phonology and with the model to be developed in this paper. The proposal that the morpheme stress rule applies only once and that certain morphemes can be excepted from undergoing it, in short, to order morpheme stress assignment before cyclic stress assignment, almost amounts to proposing stress as an inherent feature. Unfortunately, Austin's paper is rather short and does not address a variety of issues related to German stress, such as polysyllabic morphemes, or non-native suffixes, but it appears to be a promising approach.

2.3 Wurzel

Wurzel's work on German phonology is extensive (1970 a, 1970 b, 1980) and is still referred to --though often critically-- in discussions on the subject. Wurzel follows generative/transformational theory blindly, to the extent that phenomena resulting from attested historical development are obscured.

Wurzel makes a distinction between native and non-native stress, the latter being the exclusive topic of a 1970 paper (Wurzel 1970 b). Non-native stress is characterized here as falling on the last heavy syllable from the right, and much of the discussion concentrates on accommodating the exceptions to this rule. Wurzel attempts to explain all stress phenomena by phonological rules, which become complicated when similar
forms show different stress: Mathemática, Muśik, Republika vs. Klássik, Logik, Pädagogik, or Mentor, Monitor, Professor, etc., vs. Humor, Major, Tenor (Wurzel 1970: 97). Wurzel claims that stress in German is not a distinctive feature contained in the lexicon (p. 98), but where his rules cannot be stretched to account for every distinction (e.g. Syntax, Kodex, Matrix vs. Annex, Komplex, Reflex), the respective forms are equipped in the lexicon with the feature [-Rule ...], which excepts them from being stressed (p. 97). In other cases, where even in Wurzel's complex rules purely phonological criteria are not sufficient, morpheme boundaries and semantics are invoked to account for certain exceptions. Aktiv and Positiv for example are supposed to have the feature [+ grammatical term] in the lexicon to distinguish them from aktiv and positiv (p. 100). In Wurzel's 1980 paper, these semantic features are interpreted as "principles" which together with "segmental-phonological, morphological, syntactic, [semantic], communicative and rhythmic (suprasegmental-phonological) phenomena" are factors determining German stress (Wurzel 1980: 312).

Altogether, Wurzel's analysis of German stress fails to convince. Guided by a reluctance to overload the lexicon, Wurzel attempts to account for all phonological processes and phenomena with productive rules, which leads to an extremely complex rule system and yet leaves some cases unexplained.

2.4 Benware

For the sake of completeness, Benware's 1980 paper on German stress
should be mentioned as well. Benware proposes three stress rules for German: (1) stress falls on the first syllable (this applies basically to native vocabulary), (2) stress falls on the final syllable, and (3) stress is assigned by a "Latinate" rule operating according to syllable structure "or other criteria" (Benware 1980: 299). As will be seen, the division into three distinct stress patterns in German is proposed in this paper as well; however, Benware's analysis of this phenomenon does not provide a motivation or explanation. Just as Wurzel, Benware tries to account for stress assignment by syllable quantity and other criteria, which in Benware's hypothesis even include orthography (pp. 308, 310). All in all, Benware's paper is primarily an enumeration of occurrences of stress, while his so-called rules remain outside any formal phonological theory.

2.5 Giegerich

Giegerich (1985) analyses German stress entirely within a metrical framework, based on Liberman & Prince (1977) and Hayes (1981). Giegerich's study is thus the most current one, and to my knowledge, critiques have not yet been published.

Giegerich starts out by claiming that, just as in English, "the Latinate stress rule applies in German", for both native and non-native vocabulary (Giegerich 1985: 23). He first develops a rule for stress assignment in non-native vocabulary, which states that primary stress falls on the rightmost heavy syllable, which may be followed by one or two light syllables (Giegerich 1985: 27). Note that this is not identical with the Latin stress rule, where the rightmost syllable is never stressed, even if
it is heavy (cf. Hayes 1981: 13). In metrical structure, the Latin pattern results in left dominant, or left branching, stress feet, since the rightmost foot of the word has by definition an "s" node on the left, followed by at least one "w" node. Giegerich assumes this type of structure for German as well, and it perfectly captures the stress assignment in A'genda, Kom'positum, or Ana'leptikon. However, German also has many words with final stress: De'kan, Deka'nat, Enzyklopä'die, which means that these words would have an "s" node in final, or rightmost, position. This does not conform with the Latinate stress pattern, and in order to obtain left dominant feet in these words as well, Giegerich devises a "Strength Provision", which states that "every lexical item contains at least one structure of the form S W, that is, a bisyllabic foot" (Giegerich 1985: 31). All words with final stress now simply receive a zero syllable which is dominated by the rightmost "w" guaranteed by the "Strength Provision":

\[(2.2) \quad (a) \quad M \quad (b) \quad M \quad W \quad S \quad W \quad S \quad W \]

De kan * De kan (Giegerich 1985: 31)

Giegerich now applies Liberman & Prince's word rule to German: "In a pair of sister nodes [N₁ N₂], N₂ is strong iff it branches", and observes that it "correctly places prominence labels [in the particular examples]" (Giegerich 1985: 36). The above two structures show the arbitrariness of Giegerich's system: in (a), the right-hand "s" just below the "M" branches because Giegerich has used a specially created mechanism to place a zero syllable to the right of the "s" immediately dominating the final syllable.
of the word; the structure under (b) violates the word rule, but it is ruled out because Giegerich does not allow an "s" in final position.

The question seems justified on what grounds the Strength Provision is proposed. Giegerich refers to Abercrombie, who notes the trend for English monosyllables to be joined by the following unstressed word, as in bread 'n butter. Giegerich follows from there "that it is a basic property of lexical items to attract enclitics" (Giegerich 1985: 12), and extends this property to German. However, while there are obviously also phrasal prominence patterns in German, there is no evidence that German exhibits the tendency to cliticize across syntactic and/or category boundaries in the way English does. On the contrary, if this were the case, one would expect a reversal of final obstruent devoicing, i.e. in the sequence Lob und Preis the final consonant in Lob, which is phonetically [p], would become [b] again as in the inflected forms of the noun: ['lo:bas]. Similarly, final voiceless [-s] would become [z] if another word with an initial vowel follows: Haus und Hof -> *[,hau-zun-'dho:f], and the glottal stop preceding initial vowels in German would disappear. However, while these processes regularly occur in medial position and lead to resyllabification, they never occur across word boundaries. Siebs, although not prescribing the prevocalic glottal stop as obligatory any longer, clearly specifies that "alle Vokale im Anlaut eines Wortes oder einer Silbe (alt, ohne, ein; Verein, überall) werden neu eingesetzt" (Siebs 1969: 51; cf. also Moulton 1962: 142).

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It can therefore not be claimed that all German words have a "w" node on their right, which, if it is not filled by an unstressed syllable, is "zero" and remains open to accommodate a potentially following element which is part of the next word. Rather, it appears that Giegerich bends the evidence to fit German into a metrical model which has been designed for English and/or Latin.

There are other incidents of a somewhat vague application of metrical principles. For instance, Giegerich does not commit himself to any clear definition of a metrical foot for German. The definition for the metrical structure of German words is given as follows:

(2.3)"(a) The DTE and all syllables on its right form a left-branching tree. Syllables on the left of the DTE are organised into left-branching trees
"(b) The syllable-dominating trees of provision (a) are organised into a right-branching tree whose root M is associated with the syntactic node immediately dominating the entire word" (Giegerich 1985: 35).

In the above, no mention is made of the possible size of the subcomponents of the word tree, which are also referred to as "trees" rather than feet. At one point Giegerich states that "...the effect of the Main Stress Rule... is the formation of a foot of the maximal size

```
S
S WW
```

(Giegerich 1985: 34). This corresponds to the "stress superfoot" identified by Selkirk (1980: 570), whose work on English is mentioned in passing. However, the structures Giegerich proposes for

2DTE = "designated terminal element" which is assigned the main stress of the word (Giegerich 1985: 8).
German frequently contain more "w" nodes than two dominated by one "s" below the "M" level. In *Enzyklopädie*, for example, the four syllables preceding the main stress are grouped into one single "w" stress foot (Giegerich 1985: 36).

The lack of a distinction between the foot and the word tree in Giegerich's metrical rule (2.3) above results in a somewhat clumsy reference to "left-branching trees" on either side of the DTE, the direction changing to right-branching just below the "M" level. Hayes (1981) deals with this phenomenon efficiently by proposing a left dominant direction at the foot level and a right dominant direction at the word tree level for languages where this is observed, English and Latin for example. While this may seem just a cosmetic deficiency in Giegerich's framework, the lack of specifics in foot construction also reduces the predictive power of Giegerich's rule.

While no specifics regarding foot construction are given, Giegerich makes it clear that what determines the DTE is always the rightmost heavy syllable. This corresponds to the facts in words like *Ka'denz* or *Enzyklopädie*, the first having a final consonant cluster and the second a final long vowel, but it does not explain the final stress in *Bal'lett* or *Karus'sell*, where the final syllables end in a lax vowel followed by a single consonant, making them light by the criteria for syllable weight in German. Giegerich's solution to the problem is to posit underlying geminate consonants, resulting in final consonant clusters (Giegerich 1985: 24). This approach may be defensible for some cases, but it is
inapplicable to words with a final velar nasal, as for instance Bal'kon ([-oŋ] or [-ɔ], plural [−oŋs], [ɔs] or [-ɔːn]e), or Arrangement [−ã], which are conveniently missing from Giegerich's list.

Another phenomenon which has to be dealt with is the fact that heavy final syllables become light when, after derivation, they are not in final position any longer: Dekan [de'ka:n] → Deka'nat [deka'na:t]. This happens whenever a stressed non-native suffix is attached to a stem, such as -ität, -ar, -ier(en), -al, -ist, etc., which Giegerich calls "Class I" suffixes, following Siegel's (1974) hypothesis for English affixation and stress assignment. Giegerich has again a very simple solution for the German problem by suggesting that "metrical structure, under this proposal and the same was suggested by Siegel (1974) for English" is erected once, and that is after Class I derivations have taken place" (Giegerich 1985:38). However, it must be noted that Siegel does not say that metrical structure is assigned only once. The relevant passage from Siegel reads as follows:

(2.4) "It was observed that there is a class of suffixes the members of which themselves may receive stress and which also cause a rightward shift of main stress in the words they attach to. ... Thus, noun-forming -y, -ation, -able, and -ity are all suffixes which satisfy the environment of the cyclic stress assignment rules and influence the placement of primary stress. Suffixes which have these properties are introduced with the + boundary ... [and] will henceforth be called Class I suffixes" (Siegel 1974: 111 f.).

And in a footnote referring to this passage, Siegel notes that "the + boundary does not block the application of phonological rules" (Siegel 1974: 189). So even Siegel does not deny the existence of phonological processes in the derivational cycle, and if Giegerich proposes that stems
do not have any metrical structure until the final Class I suffix has been added, it seems that he stands alone with this proposal. The other authors Giegerich frequently refers to, Kiparsky (1979), Selkirk (1980), and Hayes (1982), all discuss the problems which derivation often poses for metrical structure assignment, but nowhere is metrical structure dismissed at the early stages of derivation.

Giegerich then discusses "Class II", or native suffixes. Class II suffixes in Siegel's model "block stress placement, [and] are introduced with the # boundary" (Siegel 1974: 112). The behaviour of German native suffixes is similar in that they, unlike the non-native suffixes discussed above, never cause the main stress of the word to shift to the right. Giegerich claims that the distinction native - non-native is not necessary and that the same "Main Stress Rule" and principles of metrical tree construction (2.3 above) apply to both types of vocabulary and suffixes, the only distinction being that the rules assigning stress apply after Class I derivation. Giegerich presents the following structures with "Class II" suffixes:

\[(2.5) \text{ (Giegerich 1985: 114)}: \]

\[\begin{align*}
(a) & \quad \text{sym pa thie lo se} \\
(b) & \quad \text{tur ner schaft lich er e}
\end{align*}\]
of Giegerich's rule for tree construction is not met any longer, i.e. the
tree whose root is M (this label is missing in the structures presented at
this point), is no longer right branching, at least not in example (b)
above, which has a native root, turn. The second problem is that there are
now branching nodes on the right labelled "w", which violate Liberman &
Prince's word rule. As far as the first problem is concerned, Giegerich
ignores it and does not refer to it at all, but all Class II suffixation
and compounding show this reversed tree structure. The second problem, the
apparent violation of the word rule, is solved by suggesting that the word
rule "isn't apply in such instances where bits are added to existing
trees. Rather, it applies only in the simultaneous erection of a metrical
tree in a given domain" (Giegerich 1985: 114 f.). It can apply again at
the next prosodic level, i.e. in compounding, and much of the further
discussion centres around compounds.

Again following Liberman & Prince, Giegerich proposes that compounds
are governed by the same prominence rule as words, except that in compounds
this rule operates at the next higher level and is modified as follows: "In
a pair of sister nodes [A B]_N, B is strong iff it branches" (Giegerich
1985: 139). This produces the correct stress patterns for 'Schlepp,kahn,'
'Stimm,ritze', and also for 'Blumenkohl,suppe, which has the structure
[[AB][C]]. Also, Landes'sportbund or Städte'schnellverkehr, both
[[A][BC]], fit this pattern. However, the compound stress rule would not
produce the correct prominence in 'Haupt,bahnhof or Zen'tralflug,hafen,
which both have the structure [[A][BC]].
To solve this discrepancy, Giegerich first claims that "there is pressure for compounds to get lexicalised, to take on idiosyncratic meanings, along with which the internal structure disintegrates and the identity of the constituents gets obscured" (Giegerich 1985: 134). To ensure that an "obscured" compound is dominated by a single node "M", Giegerich proposes that the right-hand constituent is demoted to a Class II suffix, resulting in the following structural change (Giegerich 1985: 145):

\[
\begin{array}{c}
\text{a} \\
\begin{array}{c}
S \\
M
\end{array} \\
\begin{array}{c}
S \\
W
\end{array}
\end{array} \quad \begin{array}{c}
\text{b} \\
\begin{array}{c}
M \\
S
\end{array} \\
\begin{array}{c}
S \\
W
\end{array}
\end{array} \quad \begin{array}{c}
\text{c} \\
M \\
\begin{array}{c}
S \\
W
\end{array}
\end{array}
\]

In this analysis the noun \text{hof} is reduced in a similar way as the suffixes \text{-tum}, \text{-schaft}, \text{-los}, which at one point in history were free morphemes, have been reduced over time. \text{Bahnhof}, which in this way is interpreted as a single word, is thus dominated by one "M" which at the level of the new compound \text{Hauptbahnhof} does not branch, and the compound rule can apply. Giegerich lists a number of compounds which he interprets as [AB] rather than [[A][BC]]: \text{Hallenschwimmbad}, \text{Fausthandschuh}, \text{Qualitätmasstab}, etc. (Giegerich 1985: 141). In these cases it is obvious that the meaning of the right-hand two-part component of the compound has become lexicalized. A \text{Handschuh} for instance is no "shoe", and the use of the word in this context has become idiosyncratic. However, these parts of lexicalized compounds, i.e. \text{Schuh}, \text{Hof}, \text{Stab} etc., remain free morphemes occurring independently in different contexts. This characteristic clearly sets them apart from the above suffixes \text{-tum}, \text{-schaft}, \text{-los} etc., which are all bound morphemes. Besides, there are other compounds of the structure
with initial stress, where lexicalization of the right-hand constituents is at least questionable: 'Staatseisenbahn, 'Stadtbauamt, Amateurrennfahrer, Eternittrennwand, 'Plastikweihnachtsbaum, and many more can be produced. The difference between the stress patterns in the two types of three-part compounds seems to be that Landes'sportbund, Bundes'finanzministerium and similar forms are in fact nominal phrases composed of a noun plus a compound. In contrast to compounds, however, the right-hand or last constituent in nominal phrases is assigned the main stress (cf. Kiparsky 1971: 82). It seems again that Giegerich selects and interprets the evidence to fit the model that has been established for English.

The above discussion of Giegerich's work has revealed that a major problem has not been solved. Giegerich claims repeatedly that native and non-native vocabulary are governed by the same metrical rules so that a distinction between the two categories is not necessary. However, Giegerich's casual treatment of metrical structures, in particular the lack of a definition of what may constitute a stress foot and the missing distinction between the foot level and the word tree level, obscures the most striking phenomenon, namely the change in the direction of branching between native and non-native words, as is evident in the examples under (2.5) above. This difference is not even noticed by Giegerich, whose main concern is to match German prominence patterns to the one established in the literature for English. The value of this approach is questionable.

3See also Benware's compilation of stress patterns used by different speakers for this type of compound, which shows that there is considerable variation (Benware 1980b: 187).
2.6 Summary

Given the limited space reserved here for this purpose, the foregoing evaluation of the existing theories on German word stress has necessarily been sketchy. Yet it has shown the approaches used as well as the problems which remain unsolved in each one of the studies discussed. The one principal assumption shared by all five authors is that word stress in German is entirely rule governed. Austin and Giegerich are the farthest apart in their assumptions as to how these rules operate: Austin proposes precyclic morpheme stressing rules, and Giegerich does not see any stress assignment before Class I derivation has taken place. If nothing else, the polarity manifesting itself in these two approaches suggests that the topic of German word stress warrants more research, and it is the contradictions in the above studies which triggered the research for this paper.
3.0 **GERMAN WORD STRESS AND METRICAL STRUCTURE**

The purpose of this chapter is to provide a formal description of German word stress which will support the claim that German has three different inherent stress patterns.

Although metrical theory does not provide answers as to the motivation for this phenomenon, it seems to be a suitable framework to reveal the differences among the three stress patterns. Metrical theory is based on principles of relative prominence among syllables, and it will become evident that different criteria are required to capture German prominence patterns, resulting in different metrical structures.

3.1 **The Framework**

In his "metrical theory of stress rules", Hayes (1981) presents a "geometrical" model of tree construction which provides the framework to characterize stress patterns in any given language. Because of its great flexibility, this model seems a good choice for German as well, and much of the following is based on Hayes' theory. However, since Hayes' definition and application of foot construction seem somewhat general, criteria from other, earlier studies, in particular Kiparsky's 1979 and Selkirk's 1980 papers, will be referred to in the following as well. Although both Kiparsky's and Selkirk's studies deal with English, certain aspects relating to foot construction can readily be used in conjunction with Hayes' model for the characterization of German stress.
Stated briefly, Hayes' metrical model establishes parameters for the construction of metrical word trees, from which stress can be read. These parameters are language specific and include such aspects as relative prominence among syllables, size of trees, direction of branching, etc. Since these will be applied to German, it seems appropriate to list the parameters verbatim:

(3.1) "Tree Construction

a. Project rimes. Optionally form a subprojection of [+syl] segments within the rimes.

b. Select either right or left nodes as dominant.

c. Form the largest possible binary branching tree, such that recessive nodes do not branch. Optionally, it may be specified that

i. All terminal nodes are counted as non-branching.

ii. Dominant nodes must be terminal.

iii. Dominant nodes must branch" (Hayes 1981:48).

The "rime projection" in Hayes' framework is based on the concept that it is the rhyme of a syllable on which syllable weight is based. Syllable weight is, in most languages, the factor which determines relative prominence among syllables and as such is of crucial importance in a metrical framework. In some languages, it is vowel quantity alone which makes a syllable heavy, or a rhyme branch, whereas in other languages, for example in English and Latin, a heavy syllable is identified as ending in a long vowel (Vː), a diphthong (VV), or a vowel followed by a consonant (VC), and "anything heavier", or, in other words, as having a branching rhyme (Hayes 1981: 11 f.). Thus for languages in which heavy syllables are of the same structure as in English or Latin, the criterion of a branching
rhyme (or the rhyme projection) can be used to determine "s" and "w" nodes at the first level. In Hayes' terms, word trees which are based on this criterion are "quantity sensitive" (Hayes 1981: 50).

The next level in metrical structure is the foot. As mentioned earlier, Hayes does not give a precise definition of the foot, and it will therefore be useful to first examine the statements of two other authors. Kiparsky, referring to English, observes the following:

"The next level of metrical integration above the syllable I assume to be the foot. By foot I mean a metrical entity consisting of a syllable followed by any number of unstressed syllables, which are dominated by a single metrical node... I will assume that metrical structure provides an exhaustive segmentation of phonological strings into syllables and feet... Thus, each phonological phrase is taken to consist of one or more feet, each foot of one or more syllables, and each syllable of one or more segments" (Kiparsky 1979: 436 f.).

This definition places the foot clearly at a level above the syllable and below the phonological phrase; it is also implied that metrical feet must be left branching, which seems to be appropriate for English. Otherwise, however, the definition is fairly loose in that it does not specify any constraints on the size of the foot, or other criteria, such as syllable structure, or the nature of the metrical node dominating the foot.

Selkirk (1980) in contrast presents very specific templates for stress feet. In Selkirk's framework, there are two basic types of feet in English, a monosyllabic and a bisyllabic one, the latter consisting of a prominent syllable marked "s", and a weaker, unstressed syllable marked "w". In addition, there is a type of foot called "stress superfoot, [which] may consist of a foot (s) followed by another syllable (w)" (Selkirk 1980: 570). The details of what may constitute a foot in English
are not relevant here; what is important for application to Hayes' tree geometry is that here, too, the foot level is clearly set off against the level of the syllable on the one hand, and the level of the word on the other.

From the above two descriptions it follows that a precise definition is lacking which would establish the foot as a distinct phonological unit, and it is apparent that the criteria of what may constitute a foot are language specific. Hayes refers in general terms to Selkirk's definition of the foot (Hayes 1981: 5 f.), but apart from a "notation for foot structure" does not provide a specific definition himself. In fact, the parameters for tree construction (3.1 above), which constitute the core of Hayes' rule apparatus, do not contain any reference to feet; instead, the crucial parameter seems to be right or left dominant nodes. The labels for all nodes at all levels are "s" (= strong, dominant) and "w" (= weak, recessive), and in the diagrams Hayes uses, "...the feet are separated by a horizontal line from the remaining structure, which will be called the WORD TREE" (Hayes 1981: 6).

Yet despite this apparent lack of detail in the description of the foot, there is no doubt that the stress foot is a clearly distinguishable structure within the metrical framework. In Hayes' exemplification, there are cases where the direction of dominance changes from the foot level to the word tree level (Hayes 1981: 13, 51, 57, 62, 65) -- a phenomenon which supports the existence of the metrical foot. As far as German is concerned, it will be seen that the criteria for foot construction change
with the different stress patterns and will therefore be developed and discussed when the respective stress patterns are discussed. For the moment it is sufficient to define the notation which will be used in this paper. Following Selkirk’s concept, the symbol "Fs" will be used for a dominant foot, "Fw" for a weak one, and "F'" for a "superfoot", i.e. a ternary foot structure with one "s" and two "w" nodes.

Returning to Hayes' parameters for tree construction and having clarified rhyme projection and foot level, two further aspects need to be mentioned. If "all terminal nodes are counted as non-branching", as suggested in (c.1) above, the tree is referred to as quantity insensitive. The opposite would be a quantity sensitive tree, where "terminal nodes that branch under the appropriate projection are in fact counted as branching". The latter seems to be by far the more frequently encountered type.

Finally, what Hayes refers to as the "size" of tree needs clarification: a tree in which all "dominant nodes must be terminal" is referred to as binary, otherwise it will be "unbounded" (Hayes 1981: 50).

3.2 Vowel Quantity and Syllable Weight in German

In order to describe German stress it is necessary to define the concepts of vowel quantity and syllable weight.

In "native vocabulary", vowels are short and lax, or long and tense. Short vowels occur in closed syllables, forming a "close contact" with the

4 The term "native vocabulary" is to be understood here to include any lexical items with a native phonological structure, e.g. also loans like Datsche, Bus, kraulen, streiken, Stil (cf. Wurzel 1970b: 87).

The only short vowel occurring in open syllables is schwa, and it is never stressed. Long and tense vowels, including diphthongs, form a "loose contact" with the following consonant ("loser Anschluss", "schwacher Silbenschritt"), i.e. the "consonant begins after the vowel has passed its intensity peak" (Trost 1939: 320). The "loose contact" leads to resyllabification in certain inflected forms of monosyllables ending in one consonant: Staat becomes Staat-en.

Many German roots are monosyllabic, and if they are not, only the first, stressed syllable contains a full vowel. There are a few exceptions to this pattern: 'Her-zer, 'Hei-rat, 'Ur-laub, for instance, have long vowels in the second syllable, which is then, on account of the long vowel, heavy and is assigned secondary stress. The same applies to suffixes with long vowels or diphthongs: 'lan-gsam, 'Reich-tum, 'Echt-heit.

There are also short and tense vowels in German, but these occur almost exclusively in non-native vocabulary. Typically, they occur in unstressed syllables or in syllables with secondary stress at most. As will be shown later, it is not relevant whether tense vowels in non-native vocabulary are underlyingly long or short. In contrast to native vocabulary, the difference in quantity is here not phonemic, and stress assignment is not dependent on vowel length, but rather vowel length

5Non-native vocabulary will be considered here to cover lexical items that are phonologically non-native, which coincides with non-native stress.
adjusts to stress assignment, as is evident in instances of stress shift: 

\textit{Mu'sik} \([\text{mu'zi:k}]\) - \textit{Musiker} \(['\text{mu:zikar}]\). Lengthening and shortening due to stress was also suggested by Wurzel ("akzentbedingte Dehnung und Kürzung", Wurzel 1970b: 102 f.), who observes that in non-native vocabulary short stressed vowels regularly become long in open syllables and long unstressed vowels short (\textit{manisch} \(['\text{ma:ni:s}]\) vs. \textit{Manie} \(['\text{ma'ni:}]\)).

On the other hand, Wurzel finds it necessary to distinguish between long and short "base" vowels and claims that the \([u:]\) in \textit{Kon'sum} is underlyingly different from the \([u]\) in \textit{Konsum}, in order to be able to explain the different stress placement in the pair (Wurzel 1970b: 95). If this is assumed, however, then the vowels in \textit{manisch} - \textit{Manie} and \textit{Musik} - \textit{Musiker} would also have to be assumed to be underlyingly different.

As outlined above, in metrical theory stress is viewed as a function of relative prominence among syllables, which in languages with quantity sensitive metrical structures is determined by syllable weight. It has generally been claimed that English and German stress patterns operate along the same principles (Wurzel; Giegerich). However, whereas in English rhyme structures of the type -\textit{VV}, -\textit{V:}, or -\textit{VC} constitute a heavy syllable, there seems to be yet another distinction in German: whereas medial heavy syllables have the same structure as the one just described, a word-final heavy syllable has at least a long vowel or diphthong, or a vowel followed by TWO consonants, (e.g. \textit{Arro'ganz}). That means that for final syllables to be heavy the rules governing the rhyme projection must be more complex.

---

Giegerich, in order to match the pattern of final heavy syllables with medial ones and probably to justify the claim of similarity between English and German, declares word-final consonants extrametrical, or "(part of) the onset of the following syllable", and argues further that "syllables have compulsory onsets (and) this is how they can get filled" (Giegerich 1985: 49). It has been pointed out earlier in chapter 2 that this claim is unfounded and that German does not show any tendency to cliticize across syntactic boundaries. In the absence of a syllable-initial consonant, the tendency of syllables to have onsets is met by resyllabification word-internally, and by insertion of a glottal stop word-initially.

A more realistic approach would be to consider medial syllables before derivation or inflection, i.e. before resyllabification: Hund has the syllable structure CVCC, which is heavy. The plural Hun-de is a disyllable, in which the final consonant of the root has become the onset of the second syllable, as it does in non-native words: Ka'denz - Ka'den-zen. German is a language which prefers syllables with onsets, a fact which manifests itself in the glottal stop preceding initial vowels. When a syllable beginning with a vowel is added to a stem, as in the inflectional suffixes -e, -en above, resyllabification takes place to fill the onset of the second syllable:

\[
\begin{align*}
(3.2) & \quad \text{Hund} & \Rightarrow & \text{Hun-de} \\
& \quad \text{Staat} & \Rightarrow & \text{Staa-ten} \\
& \quad \text{Mann} & \Rightarrow & \text{Män-ner} \\
& \quad \text{Art} & \Rightarrow & \text{ar-tig} \\
& \quad \text{Ka'denz} & \Rightarrow & \text{Ka'den-zen} \\
& \quad \text{intelli'gent} & \Rightarrow & \text{intelli'gen-ter}
\end{align*}
\]

In Mann [man] above, the final consonant of the monosyllabic root becomes
ambisyllabic in the plural form to provide an onset for the second syllable, but the structure of the first syllable does not change. This is taken as evidence that, although in the surface representation the final consonant may attach itself to the following syllable, the underlying weight of the first syllable does not change in resyllabification. Therefore, if the aim is to show that the structure of heavy syllables is the same for medial and final syllables, then medial syllables should be interpreted as being underlyingly the same as final ones, i.e. -VCC, rather than removing the last consonant of final syllables by declaring it extrametrical. However, it seems much simpler to acknowledge the situation as it is and to count medial syllables of the structure -VC and final syllables of the structure -VCC as heavy. For the purpose of metrical structure assignment, this means that a rule is needed which will mark the respective nodes as dominant or "s".

\[\text{In this context, an interesting observation is made by Anderson \\& Jones (1974): in English certain medial consonant clusters can be final clusters in monosyllables, whereas they are "not permissible as a sequence pre-vocalically; only the second segment could be taken to belong to the following syllable" (Anderson \\& Jones 1974: 4).}

\[\text{An alternative solution to the dilemma of interpreting heavy syllables in German would be to consider the final consonant of a word extrametrical, as Giegerich suggests, though without joining it to the following syllable. Since it is assumed here that stress assignment is not dependent on the weight of the rightmost syllable, it is irrelevant for the construction of metrical trees whether a final syllable has the rhyme structure -VC or -VCC. If final consonants are extrametrical, no special rule would be needed to clarify the status of medial syllables. However, both analyses leave us with superheavy syllables in non-final position which are not necessarily stressed: ENT-\text{'werten}, DURCH-\text{'dringen}, \text{wer}ant-W\text{ORT}-lich, \text{wirt-SCHAF}T-lich, \text{\'hoff-NUNGS}-los.}\]
3.3 Native German Stress

The distinction between native and non-native vocabulary with a view
to different stress assignment has been made previously by Wurzel (1970a &
b, 1980), Benware (1980a), and Giegerich (1985). However, while Wurzel and
Giegerich claim that all stress assignment is governed by the same rules,

it will be shown here that native vocabulary has a metrical structure which

is different from that of non-native vocabulary.

Native stress is usually characterized as falling on the root or stem
vowel. Most German roots are monosyllabic (Mann, Staat, Haus, hell, ganz,
etc.), or have at most an unstressed second syllable (Segel, sicher,
dunkel, Keller, Leine, geben). All the monosyllables and the stressed
syllables in the disyllables have a branching rhyme and are therefore
assigned strong (s) nodes in a metrical framework. In contrast, the second
syllables with schwa as their vowel are unstressable. As an optional
variation, the schwa is often reduced further, leaving a syllabic liquid or
nasal in the second syllable: [ße:gl, ge:-bn]. In other cases schwa
deletion is compulsory and resyllabification takes place (Seg-lер).

Because of the alternation between schwa and no vowel in certain
environments the view has been presented in the literature that schwa is an
epenthetic vowel in German (cf. Wurzel 1970a). The phenomenon will be
discussed later on in this paper; for the moment it may suffice to state
that schwa is unstressable, and consequently a syllable containing schwa
will always be dominated by a weak node in metrical structure, even though
the rhyme may actually branch. In the following, the symbol $ stands for
syllable, F for foot, and M, derived from mot (= 'word', cf. Liberman &
(3.3) (a) Leine (b) sicher (c) dunkel

The pattern that can be identified here are left dominant, quantity sensitive feet.

Native polysyllables are almost always the result of affixation or compounding, or a combination of these processes. Suffixes will be analyzed first.

3.3.1 Unstressed Suffixes

In addition to inflectional suffixes, which contain at most schwa, German has the following derivational suffixes consisting of light syllables:

(3.4) -chen Häuschen, Schwesterchen
       -er Lehrer, Arbeiter
       -ig ärtig, gültig, gruselig
       -in Königin, Riesin, Chinesin
       -isch heidnisch, kindisch, künstlerisch
       -ler Tischler, Sportler
       -lich zeitlich, vergeblich, feierlich
       -ling Lehrling, Sträfling
       -nis Zeugnis, Finsternis, Ergebnis
       -sel Füllsel, Geriesel
       -ung Leistung, Sicherung, Begeisterung

Throughout this thesis, the symbol "M" and the term "word" denote a phonological word, as opposed to a syntactic word, although the two tend to coincide in German.
Although these syllables have in fact branching rhymes, they are light syllables because they are in final position, as discussed earlier. A simple rule is sufficient to ensure that the correct metrical structure is obtained:

\[
(3.5) \quad \begin{array}{c}
\$w \\
\overrightarrow{V C}
\end{array} \]

This rule states that a W-node is assigned in final position if the rhyme consists of the sequence VC. It has the desired effect that it will permit final rhymes of the structure V:, VV, or VCC to be marked "$s", and it will not apply when one of the above suffixes is followed by another suffix, as for instance in \textit{Sicherungen}, or \textit{künstlerische}. As will be seen below, this is exactly what is required.

However, German word stress shows another characteristic which is only partly governed by syllable weight, and that is a clearly recognizable alternating rhythm which starts with the main stress on the left and moves right in a strong-weak-strong pattern. This entails that even though a syllable in final position may be light according to rule (3.5) above, it will show a certain degree of prominence if it follows a completely unstressed syllable. In a characterization of word stress preceding Siebs' dictionary of pronunciation, three word stress levels are distinguished: main stress, strong secondary stress, and weak secondary stress. Although Siebs does not analyze the conditions in which strong and weak secondary stress occur, it can be deduced from the given examples that the former refers to trisyllables with derivational suffixes with full vowels, e.g. \textit{Königin}, \textit{feierlich}, \textit{Sicherung}, where the final syllables are
described as "strong enough to carry the rhyme in verses" (Siebs 1969: 115). The weak secondary stress is characterized as a "rhythmic accentuation" of inflectional suffixes (i.e. containing schwa) following completely unstressed medial syllables, as in 'warte, te, er'inner, te, Er'obe, rer, 'grösse, ren (Siebs 1969: 115 f.). In a metrical framework, this rhythmic alternation could be accounted for by the following rule:

\[
(3.6) \quad \begin{array}{c}
\text{s} & \text{w} & \text{w} \\
\text{F}_s & \text{F}_s' \text{w} & \text{M}
\end{array}
\]

Some examples of metrical structures illustrating the above rule are given below. The rhyme projection is assumed, but it will only be shown in further examples if it is needed for clarification.

\[
(3.7) \quad \begin{array}{llll}
\text{(a) kin} & \text{disch} & \text{(b) fei} & \text{er lich} \\
\text{F} & \text{w} & \text{F}_s & \text{F}_w & \text{M}
\end{array}
\]

\[
\text{(c) fei} & \text{er lich e} \\
\text{F}_s & \text{F}_s' \text{w} & \text{M}
\]

\[
\text{(d) Sich} & \text{er ung} & \text{(e) Schwes ter chen} & \text{(f) Lehr lin ge} \\
\text{F}_s & \text{F}_w & \text{F}_s & \text{F}_w & \text{M}
\]

The rhythm rule might lead to the assumption that metrical structures for German native words are quantity insensitive. However, example (3.7 f) above shows that a heavy medial syllable disrupts the s-w-s pattern, i.e.
we do not obtain the form *'Lehrlinge'. The rhythm rule only operates to organize sequences of two or more weak syllables into a rhythmic pattern. Sequences of two or more heavy syllables are discussed in more detail in the following section.

3.3.2 **Stressed Suffixes**

A number of native suffixes have the structure CV:C, CVVC, or CVCC, which identifies them as heavy syllables on any account, and carrying secondary stress. The following is a list of those suffixes:

(3.8) 
- **-bar** ehrbar, verwendbar, schmiedbar  
- **-haft** schmerzhaft, tugendhaft  
- **-heit** Freiheit, Menschheit, Verschiedenheit  
- **-icht** Dickicht, Röhricht  
- **-keit** Neugigkeit, Eitelkeit, Wachsamkeit  
- **-lein** Fräulein, Zünglein  
- **-los** brotlos, atemlos, bedingungslos  
- **-sal** Labsal, Mühsal  
- **-sam** seltsam, schweigsam, gehorsam  
- **-schaft** Mannschaft, Gewerkschaft, Errungenschaft  
- **-tum** Siechtum, Eigentum

Giegerich lists **-bar** and **-sam** as unstressed suffixes (Giegerich 1985: 105), but Siebs (1969) clearly identifies the vowels in these suffixes as long, so that there is not any doubt that they belong in the stressed category.

Examples of the metrical structures of some derivations with these suffixes follow:

(3.9) (a) ehr bar

(b) ehr ba res

(c) a tem lo se

\[
\begin{align*}
& (a) \quad \text{ehr bar} \\
& \quad \text{($S$ $S$)} \\
& \quad \text{Fs Fs M} \\
& (b) \quad \text{ehr ba res} \\
& \quad \text{($S$ $S$ $S$ $W$)} \\
& \quad \text{Fs Fs Fs M} \\
& (c) \quad \text{a tem lo se} \\
& \quad \text{($S$ $W$ $S$ $W$)} \\
& \quad \text{Fs Fs Fs M}
\end{align*}
\]
It so happens that none of the above examples contains sequences of more than two heavy syllables. In a word like *Wachsamkeit*, however, all three syllables are heavy and would produce three monosyllabic stress feet:

(3.10) *Wach sam keit

\[
\begin{array}{c}
\text{\$s} \quad \text{\$s} \quad \text{\$s} \\
\text{Fs} \quad \text{Fw} \quad \text{Fw} \\
\text{M} \quad \text{M'}
\end{array}
\]

This structure is undesirable, because the rhythmic pattern of German again produces 'Wachsamkeit', which requires an adjustment to make the second syllable recede in prominence in this environment. This could be done by "defooting"\(^{10}\), or depriving the second heavy syllable of its status as a foot. According to Kiparsky's earlier definition, however, a metrical foot cannot contain two heavy syllables (Kiparsky 1979: 436). Therefore, the medial heavy syllable must surface as a weak syllable, which corresponds to the rhythmic pattern of German:

(3.11) Defooting of heavy medial syllables:

\[
\begin{array}{c}
\text{\$s} \quad \text{\$s} \quad \text{\$s} \\
\text{Fs} \quad \text{Fw} \quad \text{Fw} \\
\text{M} \quad \text{M'}
\end{array} \quad \Rightarrow \quad \begin{array}{c}
\text{\$s} \quad \text{\$w} \quad \text{\$s} \\
\text{Fs} \quad \text{Fw} \\
\text{M} \quad \text{M'}
\end{array}
\]

\(^{10}\)For defooting of weak syllables, see Selkirk (1980: 585).
The correct structure for *Wachsamkeit* would then be:

(3.12) \[ \begin{array}{c}
Wach~sam~keit \\
\hline
\hline
$s$ & $w$ & $s$ \\
F & s w \\
M
\end{array} \]

From the examples presented so far, it can be seen that the native German stress pattern is left dominant, and that a rhythmic pattern operates. These characteristics are captured in the following tentative rule:

(3.13) On the rhyme projection, starting with the root syllable and going from left to right, construct left dominant, quantity sensitive, maximally binary feet and left dominant word trees.

That the requirement "starting with the root syllable" is necessary, will become evident in the following section, which deals with derivations with prefixes.

3.3.3 *Prefixes*

German has the following types of native prefixes:

Prefixes that are always unstressed:

(3.14) \[ \begin{array}{c}
be- \\
ent- \\
er- \\
ge- \\
ver- \\
zer-
\end{array} \]

\begin{array}{c}
be'deuten, be'nachrichtigen, Be'trug \\
ent'lang, ent'werten, ent'seelt, Ent'wurf \\
er'blinden, er'geben, Er'eignis \\
ge'bieten, ge'nau, Ge'birge \\
ver'hungern, ver'öffentlichren, Ver'dienst \\
zer'rütten, zer'lesen (adj.), Zer'würfnis
\end{array} \]

Prefixes that are always stressed (except when preceded by another
stressed prefix, as in 'un-an-genehm):

(3.15) ab- 'abnehmen, 'Absicht
an- 'anfangen, 'anständig, 'Ansturm
auf- 'aufheben, 'aufbegehren, 'Aufgang

Prefixes that can be either stressed or unstressed, depending on the meaning and/or context:

(3.16) un- 'unmenschlich - un'menschlich
durch- 'durchdringen - durch'dringen
um- 'umstossen - um'fahren
über- 'übersetzen - über'setzen
unter- 'unterstellen - unter'stellen

One prefix which is stressed in certain cases and not in others:

(3.17) miss- 'missbilligen, miss'handeln

It is interesting to note that the contrasting stress of the verbal prefixes is paralleled by different morphological behaviour. Verbs with unstressed prefixes do not form the past participle with ge- (except, of course, for those which have ge- as a prefix anyway): hungern - gehungert
vs. verhungern - verhungert, ziehen - gezogen vs. erziehen - erzogen, etc.

One might say that in these cases the unstressed prefix takes the slot of the participial prefix ge-.

By definition, the unstressed prefixes do not affect the stress pattern of the stem they precede; in other words, the left dominant stress pattern, starting with the root syllable, is preserved. For English, Selkirk (1980: 585) has proposed a method for "defooting" weak initial syllables, which could also be applied to German by joining the leftmost
weak syllable to the node dominating the adjacent foot:

(3.18) (a) Be 'trug

(b) ge 'bie ten

(c) be 'ar bei ten

M

M

Fw

Fs

Fs

M

This procedure is similar to the "stray syllable adjunction" which Hayes devises to accommodate extrametrical final syllables in Latin (Hayes 1981: 72 f.), or "the pre-stress destressing" proposed for English (Hayes 1981: 171 f.). However, both devices, defooting of initial light syllables and final stray syllable adjunction, are designed to deal with one syllable at the most. In German, on the other hand, unstressed prefixes may be heavy, as for instance, 'durch'drügen, or may have two, sometimes even three syllables: 'Über'einkommen, Ver,allge'meinerung, ver,gegen-'wörtigen.11 This seems too much to account for by extrametricality; these prefixes have secondary stress and constitute stress feet. Yet the main part of the word, the root, still shows a left dominant pattern whose metrical structure can expand considerably to the right, as in the examples below:

11The latter form, derived from 'Gegen'wart, represents a case of stress shift which is not too frequent in German, but obviously exists. Consider, in contrast, ver'gegen,ständlichen < 'Gegen,stand, where the main stress is not relocated. A recent paper by Kooij & van der Niet (1985) deals with this type of stress shift in Dutch, where it occurs much more regularly. Their conclusion is that it is largely "determined by features of prosodic structure and rhythmical organization" (Kooij & van der Niet 1985: 113). Since for German the phenomenon seems to be marginal, it will not be dealt with in depth in this paper.
The above structures are not entirely satisfactory, since there are complex stress feet appearing to the left of the main stress. What becomes evident at this point is that stress assignment is not only governed by phonological input, but that morphological information plays a part as well. The word Verallgemeinerung above, for example, is derived from the adjective stem ge'mein, a root with an unstressed prefix, which is first expanded to the adjective allge'mein (also 'allgemein, in which case it could be considered a compound, see below), then the verb stem verallge'meiner- is formed, and finally the noun Verallge'meinerung. It will be shown in the next chapter that metrical structure is preserved through the various cycles of derivation, leaving the main stress on the root. It must therefore be accepted that the metrical rule (3.13) formulated above does not capture every aspect of stress, and in fact
cannot be formulated to do so without elaborate reference to morphological information. In any event, the structures under (3.19) above show clearly enough that a left dominant stress pattern is still prevailing, which is the main point I have been trying to make here. The situation is different in words with stressed prefixes, which will be discussed next.

Prefixes which attract the main stress of the word exhibit a different behaviour from unstressed prefixes in that in certain inflected verb forms they are separated from the root, i.e. an-zu-fangen, an-ge-fangen, fang an. Other differences between verbs with stressed prefixes and the corresponding forms with unstressed prefixes are of a syntactic nature. Sometimes the unstressed prefix verb is transitive (einen Text (acc.) über'setzen = 'to translate a text'), whereas the verb with stressed, separable prefix is intransitive: 'übersetzen ⇒ er setzt über den Fluss (= lit.: 'he sets across the river' = 'he is crossing the river'). This example demonstrates firstly, that the stressed prefix is clearly a free morpheme, and secondly, as in many other verbs of this type except those with un- or miss-, the prefix, when separated, assumes its original function as a preposition again.

This behaviour, together with the stress pattern, suggests that the stressed prefix verbs are actually compounds, and this is indeed how they have been interpreted in the literature (Fleischer 1969, Wurzel 1980, Giegerich 1985). Wurzel and Giegerich, however, in keeping with their view that English and German stress patterns are governed by much the same rules, follow the proposals of Chomsky & Halle (1968) and Liberman & Prince
(1977: 251) for compound stress and suggest a similar rule for German, i.e. stress in compounds differs from word stress in that it falls on the initial or leftmost constituent (Wurzel 1980: 309; Giegerich 1985: 168).

Syntactically, a compound represents a word as opposed to a phrase, and in English the principal criterion to indicate this distinction is stress. Although German has other (morphological) means to make this distinction, the stress of compounds must by definition be word stress. It seems to be a particular merit of the metrical stress rule proposed above for native German vocabulary that it is applicable without change to compounds, namely the construction of left dominant feet and word trees, starting at the leftmost root of the word (or compound).

Applying the general rule established under (3.13) for erecting metrical structures for native German vocabulary, that is, assigning left dominant, quantity sensitive feet, beginning at the left, the following trees can be constructed for words with stressed prefixes:

\[
\begin{array}{ccc}
\text{(3.20) (a) Un mensch} & \text{(b) un mensch lich} & \text{(c) Un ter schied} \\
\begin{array}{c}
$s$ \quad $s$ \\
Fs \quad Fw \\
M \\
\end{array} & \begin{array}{c}
$s$ \quad $s$ \quad $w$ \\
Fs \quad Fw \\
M \\
\end{array} & \begin{array}{c}
$s$ \quad $w$ \quad $s$ \\
Fs \quad Fw \\
M \\
\end{array}
\end{array}
\]

\[
\begin{array}{ccc}
\text{(d) auf mer ken} & \text{(e) auf merk sam} & \text{(f) ü ber lau fen} \\
\begin{array}{c}
$s$ \quad $s$ \quad $w$ \\
Fs \quad Fw \\
M \\
\end{array} & \begin{array}{c}
$s$ \quad $w$ \quad $s$ \\
Fs \quad Fw \\
M \\
\end{array} & \begin{array}{c}
$s$ \quad $w$ \quad $s$ \quad $w$ \\
Fs \quad Fw \\
M \\
\end{array}
\end{array}
\]
Notice that in (e) above the rhythm rule causes the medial syllable, which would otherwise be heavy, to recede in prominence and surface as a "w" node. However, a different analysis for *aufmerksam* will be proposed below under compounds.

3.3.4 Compounds

If, as has been observed earlier, words with stressed prefixes behave phonologically like compounds, it follows that compounds should have a similar metrical structure. That this is indeed so will be shown in the following examples. It will also be shown that it is irrelevant for the final output of the metrical operations whether an "M" level is established between the foot level of the individual constituents and the final M labeling the compound. This particular point may be of interest in the debate whether certain lexicalised compounds, such as *Schornstein*, *Himbeere*, *Bahnhof*, *Handschuh*, are indeed compounds, which is frequently disputed on morphological and/or semantic grounds (cf. Fleischer 1969).

Metrically, these and other compounds can be represented as having exactly the same structure as *Herzog*, *Zierat*, *Leichnam* (which may well be lexicalised compounds now not transparent anymore), or as words with stressed prefixes:

\[ (3.21) \begin{align*}
\text{Her} & \begin{array}{c}
\$s \\
Fs \\
\end{array} & \begin{array}{c}
\$s \\
Fw \\
\end{array} & \begin{array}{c}
\text{zog} \\
M \\
\end{array} \\
\text{Schorn} & \begin{array}{c}
\$s \\
Fs \\
\end{array} & \begin{array}{c}
\$s \\
Fw \\
\end{array} & \begin{array}{c}
\text{stein} \\
M \\
\end{array}
\end{align*} \]
The only difference in the above structures from earlier examples is that the rhythm rule is operating at the next higher level in compounds. Consider (d) above, where three heavy syllables follow each other, but their relative prominence is organized by the alternation of strong and weak stress feet, which are again grouped into "s" and "w" nodes at the word level. This approach seems justified, since we are dealing here with roots, which always consist of heavy syllables, as opposed to derivational suffixes, many of which are light. Taking the rhythmic organization at the foot level into account, the word aufmerksam will now be reanalyzed as a compound:

\[
\text{(3.22) \quad [[[auf]} [merk]} \text{sam]}
\]

In the first cycle of derivation, the compound verb stem \([aufmerk]_V\) is formed and assigned metrical structure, with the second, the right-hand constituent, receding in prominence. In the second cycle, the suffix is attached, without disrupting the metrical structure erected on the previous cycle. Clearly, the information on which the erection of such a structure
is based is morphological, and the interaction of derivation and metrical rules will be examined in detail in the next chapter. The purpose of parsing aufmerksam in two different ways here has been to show that the metrical structure assignment for compounds parallels the one for derivations with suffixes exactly. As pointed out earlier, the fact that the general rule for stress assignment in native words includes compounds as well, is seen as additional evidence for the existence of a general left dominant stress pattern in German.

3.4 Final Stress in German

It has been acknowledged in the literature that, in addition to native stress, there is a non-native stress pattern (Wurzel 1970b, 1980; Benware 1980a; Giegerich 1985). The three authors recognize one non-native pattern, and Wurzel and Giegerich want to see even the one pattern to be governed by the same rules as native stress. Wurzel rejects the idea that non-native words are stressed according to the languages they were borrowed from, and that they are marked with features such as [+Latin], [+French], because, Wurzel argues, then words like Kakadu and Zebra would "require the features [+Malay] and [+Bunda]" (Wurzel 1970b: 88). While it is not suggested here that German non-native vocabulary has features that would assign it any language-specific stress patterns, it seems on the other hand that stress in non-native vocabulary falls into two clearly distinct main categories: final and penultimate stress.

In a large portion of the non-native vocabulary the final syllable of the uninflected word carries the main stress, as in Universität.
Tele'graph, Enzyklopä'die, Arro'ganz. Mostly the final stressed syllable is heavy, as in the examples just cited: the first two end in the sequence CV:C, the third ends in CV:, and the fourth, in CVCC. However, it is not clear at all whether the final syllables do not become heavy when they are stressed. In Telegrap'hie for example, derived from Telegraph, the [a] in the penultimate syllable is tense, but short, presumably because it is no longer stressed. The same holds for the examples mentioned earlier: the final syllables of Mu'sik and Kon'sum are heavy because they have a long vowel, but the vowel becomes short and the syllable light when the main stress is no longer on that syllable (Musiker, Konsu'ment, kon-su'mieren). Also, there are words with a light final syllable, which is stressed nonetheless: Bal'lett, Sal'on ([ö]), Arran'ge'ment ([a]).

The nasal vowels in the last two examples clearly point to the French origin of the borrowings, and there is sufficient evidence to assume that in fact the entire final stress pattern in German is an import from France. In discourse, French stress is variable, but words in isolation have final stress, and according to Delattre, even when "intensity stress" or "emotional stress" applies, final stress is never quite abandoned (Delattre 1966: 65). In her study on French loans in German, Kirchmeyer observes that standard German adopted the final French stress and even intensified it (Kirchmeyer 1973: 70). Kirchmeyer further states that French polysyllables are assigned "an additional secondary accent" in German because German does not have sequences of more than two unstressed syllables; thus in borrowings with final stress the first syllable is assigned secondary stress (Kirchmeyer 1973: 72).
The phenomenon that the final syllable carries the main stress regardless of syllable weight clearly sets this stress pattern apart from the pattern developed in the previous section for native vocabulary. The differences will be borne out in a metrical characterization. Obviously, in words with final stress the final syllable must be marked as the "Designated Terminal Element" or DTE (Giegerich 1985: 8), for receiving the main stress. At the same time, the criterion for determining relative prominence is no longer a branching rhyme, in other words, the metrical structure is not quantity sensitive. To account for the secondary stress which German tends to assign to word beginnings, or for the relative prominence of the initial syllable, the first node on the left must be an "s"-node, with the following syllables alternating rhythmically. The result is a metrical structure with left dominant feet as proposed for native German stress, but with the DTE on the far right. Since regardless of the number of syllables to the left of the DTE the final syllable is always assigned the main stress, the word trees must be right dominant. If this sounds somewhat contrived, it should be remembered here that this is merely a description of what is actually happening in the language.\textsuperscript{12} The following types of structures are suggested:

\begin{align*}
(3.23) (a) & \quad \text{Ar chiv}  \\
& \quad \quad \quad \quad \quad $s$ \quad $s$  \\
& \quad \quad \quad \quad \quad Fw \quad Fs  \\
& \quad \quad \quad \quad \quad M
\end{align*}

\begin{align*}
(3.23) (b) & \quad \text{In gen ieur}  \\
& \quad \quad \quad \quad \quad $s$ \quad $w$ \quad $s$  \\
& \quad \quad \quad \quad \quad Fw \quad Fs  \\
& \quad \quad \quad \quad \quad M
\end{align*}

\textsuperscript{12}In this context, consider Hayes' metrical rules for Garawa, a language with quantity insensitive feet starting at both edges of the word (Hayes 1981: 54).
In the above examples, particularly (c) and (d), a considerable number of syllables have been grouped into weak stress feet, while the only "s" foot dominates a single syllable, the most prominent one, in each word. This may be unusual from the point of view of metrical theory, but, as pointed out earlier, it reflects the phonological reality: German has been subjected to borrowed stress patterns, and the competition with the native pattern has resulted in a combination of the native strong-weak-strong rhythm and the dominating final stress.

That final stress in German is somehow linked to the suffix in final position becomes apparent in derivations like the following: Nation' on + -al => nation'al + -ist => Nation'a list. In each case, it is the suffix which attracts the main stress. The list of stressed non-native suffixes is extensive. Giegerich lists 31, Benware 39, my count comprises at least 50 (Benware 1980a: 297; Giegerich 1985: 28). It could be argued that some of these are not true suffixes but are either part of the stem, as for instance the -et [e:t] in As'ket, Pro'phet, Mag'net, or that others are roots, as is evident in 'GRAPHik vs. Tele'GRAPH, PHONolo'gie vs. Tele'PHON. However, this question does not have to be answered in this context. What
is important here is that these final syllables behave like suffixes and carry the main stress. The most frequently used non-native suffixes are probably the following:

(3.24)  
- al  global, dimensional, Lokal  
- ei  Spielerei, Stümperei, Polizei  
- ell  industriell, Zeremoniell  
- ent  vehement, Firmament, Talent  
- ie  Apathie, Batterie, Enzyklopädie  
- ier(en)  musizieren, evakuieren, halbieren  
- il  labil, infantil, Reptil  
- i'on  Produktion, Union, Absolution  
- i'tät  Formalität, Universität  
- iv  defensiv, kooperativ, Motiv  
- os, -ös  dubios, tendenziös  
- ur  Natur, Architektur, Kandidatur

Most of the above suffixes attach to non-native stems; exceptions like halbieren, buchstabieren, Lieferant are rare. The only non-native suffix which attaches regularly to native stems is -ei, forms like Polizei being the exception. This suffix occurs in complementary distribution with -ie, the latter combining exclusively with non-native stems. It is interesting to note that -ei, which was borrowed into German long before -ie, has become quite "German sounding" by undergoing diphthongization, yet it has retained its characteristic of carrying the main stress even in combination with native stems. The stressed suffixes and their role in stress assignment will be discussed in more detail at a later stage; the foregoing may suffice for a mere description.

On the basis of the above examples, a rule for metrical structure assignment for words with final stress can now be formulated:
(3.25) a. Label the rightmost stressable syllable the DTE, i.e. an "s"-node.

b. Starting from the left edge of the word, construct binary, or maximally ternary, left dominant, quantity insensitive feet.

c. Construct right-dominant word trees.

An important aspect of stress assignment remains to be discussed, which involves the combination of non-native stems with derivational native suffixes. Although the group of suffixes lending themselves to this process is not large, many of the derivates occur quite often. The adjective suffixes -bar, -los, the feminine agent marker -in, and the verbal suffix -en (attached to -ier-) are among the most frequent ones. Similarly, syllabic inflectional suffixes can be attached (e.g. Univers- si'tät-en, Ar'chiv-e). When these suffixes are combined with non-native stems, the stress remains on the final syllable of the stem, although -bar and -los are heavy syllables.

One possible interpretation of this behaviour is the approach taken by Siegel (and earlier in SPE). For English, Siegel analyzes this type of suffix, which she calls "Class II", as "playing no role in the assignment of stress" or "stress-neutral", and Siegel continues: "to ensure that these suffixes block stress placement, they are introduced with the # boundary" (Siegel 1974: 112). Although there is a definite similarity in the behaviour of English and German suffixes of this type, which is exploited by Giegerich (Giegrich 1985: 104 f.), for German a different interpretation of stress assignment in derivations seems preferable. In keeping with the approach taken in this paper that stress patterns are inherent, it is
suggested here that these native suffixes transform the derived word, consisting of non-native stem plus native suffix, into a native word as far as stress is concerned. In other words, although the lower level structure in combinations of this type, i.e. the foot level and the main stress within the non-native stem, remain unchanged, the resulting word trees after suffixation show an overall left dominant pattern. This is illustrated in the following structures, where the non-native level has been set off against the native level by a horizontal line under the "M" labeling the non-native stem:

(3.26) (a) Se kre tärin  (b) re a liser bar
    $s$ $w$ $s$ $w$
      /   \
     Fw    Fs
       /   \ 
      M     M'

    $s$ $w$ $w$ $s$ $s$
      /   \
     Fw    Fs
       /   \ 
      M     M'

(c) e ner gie los  (d) E ner gie los kelt
    $s$ $w$ $s$ $s$
      /   \
     Fw    Fs
       /   \ 
      M     M'

    $s$ $w$ $s$ $s$ $s$ $w$ $s$
      /   \
     Fw    Fs
       /   \ 
      M     M'
The difference from Siegel's approach is firstly, that it would be misleading to refer to the suffixes in question as stress neutral, since in fact they determine the stress pattern of the whole word. Secondly, and this may merely seem a technicality at the moment but is in fact crucial to the hypothesis developed in this paper, the distinction between affixation at the morpheme boundary as opposed to the word boundary is much less straightforward in German, and most suffixes would be more appropriately described as being attached to the stem, as for instance in *possier-lich*, *begreif-lich*, *realisier-bar*, *begeh-bar*.

Support for the above proposal within lexical phonology will be developed in the next chapter. From a merely descriptive point of view, it is worth noting that change in the direction of prominence patterns has been proposed in a different context for English as well, where compounds are characterized by left dominant metrical structures as opposed to the word level which is generally right dominant.

3.5 Penultimate Stress

The third German stress pattern, another non-native one, is clearly distinguishable from the native pattern and the pattern with final stress. This pattern might be called 'Latinate' since it operates exactly like Latin stress, i.e. the main stress falls on the penultimate syllable if it is heavy or in disyllables (*An'gina*, *Orga'nisman*, *'Solo*), or on the antepenult if the penultimate is light (*Ak'kordeon*, *Har'monika*, *Lapiz-'lazarul*). The particular criteria which distinguish this stress pattern from the two previous ones are firstly, that relative prominence is again
determined by syllable weight, but "counting" starts at the right, and secondly, that, although heavy syllables attract stress, the final syllable is never stressed. This latter distinction accounts for the different stress placement in 'Larynx and Arroganz, which both end in -VCC(C) sequences, but the former conforms to the Latinate stress pattern and has penultimate stress, while the latter has inherent final stress.

In formulating specific parameters for tree construction for Latin, Hayes first states a fairly simple set of rules (Hayes 1981: 13), but later introduces extrametricality, which complicates the tree structure (Hayes 1981: 72 ff.). It is not quite clear why extrametricality is needed, since Hayes' first version seems adequate to capture Latin stress, and it serves equally well as a model for the characterization of Latinate stress in German. The following rule is proposed:

(3.27) a. Starting at the right edge of the word, construct left dominant, quantity sensitive feet.

b. The rightmost node must be a "w".

c. Construct right dominant word trees.

Provision (b) above ensures that the final syllable is not stressed even if the rhyme happens to be heavy as in Larynx.

The structures below exemplify rule (3.27):
All of the above final syllables are light by the criteria for German (cf. section 3.2), so that provision (3.27 b) need not even be applied here.

Comparing examples (a) and (e) above, it appears that in the inflected form (e), the last syllable of the non-native stem is now followed by another syllable, which results in resyllabification, leaving a long vowel and heavy syllable in penultimate position. According to the Latinate stress pattern, a penultimate heavy syllable is assigned the main stress, and consequently the stress shifts in inflected words of this type. Other examples are Akkumulat’or ⇒ Akkula’toren, Cha’rakter ⇒ Charak’tere, or

\[ l\text{k-si-kon} \]

\[ l\text{k-si-kon} \]
in derivation:  \textit{Dik'tator} $\rightarrow$ \textit{dikta'torisch}. A possible analysis of this phenomenon is to assume that in these particular cases the Latin stress pattern is responsible for the stress shift. In that case an underlyingly long vowel is assumed in the suffixes -or and -er (the latter being distinct from the native agent marker -er). These vowels are shortened when the suffixes are in final position where they cannot be stressed, but in penultimate position the underlyingly heavy syllables attract the main stress in a right dominant word tree. On the other hand, since these cases are very limited, it could also be assumed that the inflected forms are listed as special stems in the lexicon. This would match the assumptions made for other German stems, as will be developed in the next chapter.

With the hypothesis developed here that the Latinate and final stress patterns differ in their metrical structure, certain phenomena, which so far have not been explained satisfactorily, can now be easily accounted for. Words with similar phonological structure but different stress assignment are simply members of different pattern groups: 'Traktor, \textit{Venti'lator}, \textit{In'spekto}r for instance fall under the Latinate stress pattern, while \textit{Ma'jor}, \textit{La'bor}, \textit{Me'te'or} have inherent final stress. The same applies to 'Baldri'an vs. Obsidi'an, 'Satan vs. Or'gan, 'Konsum vs. Kon'sum. In cases where the same lexical items are assigned varying stress, such as 'Motor - Mo'tor, 'Altar - Al'tar, 'Marzipan - Marzi'pan, the stress patterns are registered differently in the lexicon of the individual speakers.
3.6 **Summary**

In this chapter, it has been argued that three different stress patterns are operating in German, and rules for metrical structure assignment to capture these patterns have been presented. The fact that the proposed rules fully account for all incidents of stress, which has so far not been achieved within theories proposing one stress pattern, is seen as evidence for the validity of the claim.

The development of the various metrical structures has revealed the fact that stress is often inherent in the suffix. This insight points to the relationship between stress assignment and morphology. How this relationship is organized in the lexicon, will be the topic of the next chapter.
4.0 GERMAN STRESS AND THE ORGANIZATION OF THE LEXICON

The metrical description of German stress phenomena developed in the previous chapter has revealed that, (1) stress assignment in German is linked to morphological information, and (2), at least in some cases stress must be an inherent feature. These phenomena will now be examined in the light of Lexical Phonology.

A number of authors have contributed to the studies in Lexical Phonology over the last few years, yet there does not seem to be a standard work on which the theory is based, and modifications to it are still being made (cf. Kiparsky 1985). The 1985 paper by Kaisse & Shaw presents an analytical overview of the various approaches as well as the issues which still need clarification, and to some extent fills that need. The present analysis is mainly based on Kaisse & Shaw's paper and Kiparsky's 1982 and 1985 publications, as well as Lieber's 1981 dissertation, which is actually one of the forerunners of Lexical Phonology rather than belonging in the theory proper.

4.1 The Framework

Lexical Phonology can be briefly characterized as follows: it is a theory of level ordered morphology, in which the principle of word and morpheme boundaries has been replaced by bracketing (cf. Kaisse & Shaw 1985: 11). At each level, sometimes also referred to as stratum, the output of the respective morphological processes (derivation and/or inflection) is subject to the operation of phonological rules. Within a
level, the interaction between morphology and phonology is governed by the Strict Cycle Condition, which states that "cyclic rules apply only to derived representations" (Kiparsky 1982: 154). As Kaisse & Shaw point out, a significant consequence of the Strict Cycle Condition is that cyclic rules are characterized as "a subclass of rules which are structure preserving" (Kaisse & Shaw 1985: 17), which means in practical terms that metrical structure erected at a particular level is normally carried over to the next cycle of derivation. Metrical structure preservation, or the "carrying over of prosodic word structure", was also noted by Selkirk (1980: 601), and earlier by Kiparsky (1979: 430).

Another central principle of Lexical Phonology is Bracketing Erasure: the concept that "internal brackets are erased at the end of a level" (Kiparsky 1982: 140). In other words, information as to the internal morphological makeup of a lexical item is not available to the next level, nor to the previous level. This idea is aptly characterized by Kaisse & Shaw as reflecting in miniature within the lexicon what also holds for the relationship between lexicon and the postlexical domain: the output of the lexicon is words, and internal brackets within a word are not visible for postlexical phonology14 (Kaisse & Shaw 1985: 8).

The main question is: what type of morphological rules operate at what lexical level? Or: what are the criteria that determine what material is processed at what level? Obviously, since each language

14Since the topic of this study is word stress, postlexical phonology will not be considered here, and the discussion will concentrate on the lexicon itself.
differs from any other in its morphological structure, these criteria must be language specific. Given the model of hierarchical ordering, it may be expected in every language that the more intimately linked morphological units are processed at an earlier level than units that are not so closely linked. This idea is not so remote from the traditional distinction between "+boundary" and "#boundary", and interestingly, Kiparsky still uses these terms to define morphological processes in his model for English (Kiparsky 1982). It may be that the morphological structure of English is such that boundary distinctions do not interfere with the concepts of morphological levels and bracketing, although that has been argued (cf. Strauss 1979). German morphology, on the other hand, shows clearly that bracketing has a distinct advantage over more traditional approaches.

In German, it is not always obvious whether a suffix attaches at the morpheme boundary or at the word boundary since most roots and stems are bound morphemes: Fräu- + -lein, teil- + -bar, gült- + -ig, realisier- + -bar. It has been suggested by Giegerich that these and all other native suffixes are "Class II" suffixes along the lines of Siegel's proposal (Giegerich 1985: 105; see also Chapter 2). Siegel divides English suffixes into two classes according to their behaviour with regard to stress assignment: when "Class I" suffixes attach to a stem, the stress pattern of the derivation is affected, suggesting a closer bond and leading to the claim that this type of suffixation takes place at the "+boundary". "Class II" suffixes, on the other hand, do not change the stress pattern of the stem they attach to, are, in other words, "stress neutral" and are therefore "introduced with the #boundary" (Siegel 1974: 112). The problem
with this analysis is that it uses phonological criteria, i.e. stress assignment, to establish morphological classes; then the resulting morphological classes are used to explain phonological processes. But apart from the fact that this is untenable as a phonological hypothesis, the analysis is based on English. While it may be the case that native German suffixes display the same stress related behaviour as English Class II suffixes, to classify native German suffixes as "Class II" would imply that the boundaries in the examples above are word boundaries, a claim which is at least questionable. When morphological bracketing is used on the other hand, the distinction between morpheme and word boundaries need not be made, since affixes are considered to attach to stems: [[kalkuliér]Vbar]A, [[Fräu]Nlein]N, [[teil]Vbar]A, [[gült]Vig]A. The only question is at which level in the lexical hierarchy the respective suffix is attached, and this will be dealt with shortly.

The form gült- above, a stem related to the verbal root gelt-, points to another difference between English and German: German has many more occurrences of umlaut than English, in fact, the view is often held that umlaut is a productive process in German. Kiparsky interprets umlaut and ablaut in English as derivational and/or inflectional processes which take place at level 1, i.e. they are associated with the "+boundary" (Kiparsky 1982: 132). If the same were assumed for German, practically all types of derivation would have to go through the level at which umlaut and ablaut occur. For instance, the plural of Mann would then be produced at the level associated with the "+boundary", since it contains umlaut: Männer, whereas the plural of Frau might be considered to be formed at the level

60
associated with the "#boundary": Frauen. In English the occurrences of
term vowel changing forms may be limited; also, when umlaut occurs, it is
usually the only morphological and phonological change: blood - to bleed,
tooth (sing.) - teeth (pl.), etc. In German, however, the incidents of
umlaut are countless and moreover mostly associated with some form of
affixation, of which the forms Männer, Fräulein, and gültig are but few
examples.

A workable hypothesis to deal with these phenomena has been developed
by Lieber (1981). For German, the most significant aspect of Lieber's
model is that roots and stems are listed in the permanent lexicon, so that
phenomena like umlaut or ablaut need not be considered the output of
inflectional or derivational processes. For example, a lexical class may
be made up of the two stems Vater and Väter, which correctly predicts the
existence of both forms in derivations and compounds: waterlos, väterlich,
Vaterland, Vätersitte (Lieber 1981: 11, 14).

Lieber's model of the lexicon consists of the Permanent Lexicon, the
Lexical Structure Component, and a component where String Dependent Rules
operate. The Permanent Lexicon contains "lexical terminal elements" or
"unanalyzable morphological elements" with lexical entries. The lexical
entries "specify all information about a terminal element which is
arbitrary, unpredictable, and idiosyncratic to that element", such as
category class, phonological representation, semantic representation,
subcategorization, diacritics, and insertion frames (Lieber 1981: 35 f.).
The lexical terminal elements can be stems or affixes. What distinguishes
a stem from an affix is the lexical entry referring to subcategorization: a stem does not have a subcategorization frame, while an affix must attach to some other morpheme.

Stems and affixes are members of lexical classes, to which they belong by virtue of morpholexical rules. These rules are "purely classificatory in nature"; they serve to identify pairs of items, and to express the relationship between two lexical items, but they do not change category or any other inherent information (Lieber 1981: 42). A root is defined by Lieber as the "more elementary member" of a pair of lexical items, or the "least element in a partial ordering of lexical terminals" (Lieber 1981: 43). The concept of the root being "more elementary" than a stem corresponds to the generally held view that a stem is a root plus one or more derivational morphemes, which implies that the product of all derivation is a stem. In the following, the use of "stem" in Lieber's sense will therefore always be distinguished from the more general use.

As mentioned above, Lieber defines the lexical terminal elements as "unanalyzable morphological elements". However, some of the German stems which Lieber identifies as members of lexical classes are clearly plural forms consisting of a root plus suffix: (Staat, Staaten), (-ung, -ungen) or (Mann, Männer) (Lieber 1981: 43). Lieber accounts for this by stating as one of the characteristics of the morpholexical rules that they "mimic" certain morphological processes (Lieber 1981: 42). There is obviously a discrepancy here in Lieber's model. If derived forms --even if the derivations are supposedly "mimicked"-- are listed as lexical terminal
elements, then this characteristic conflicts with the requirement that the lexical terminal elements be unanalyzable, and a revision of the criteria determining what is listed in the permanent lexicon seems indicated. Besides, it is not quite clear why simple plural formations involving merely suffixation of -en or -er should be part of the permanent lexicon. It seems more economical to assume for instance the forms Mann and Männ- as permanently listed, with the stem Männ- then being available for regular inflection (Männer) and derivation (männlich). Staat and -ung, on the other hand, must be seen as not being morpholexically related to another stem. The issue will become relevant again when umlaut is discussed at a later point.

The next component in Lieber's model of the lexicon is the Lexical Structure Component where derivation, inflection and compounding take place. Lieber uses morphological brackets, for which the inherent lexical entries provide the category labels. Labeled brackets correspond to tree structures, and the latter provide an ideal framework to show how the word formation process works. The fact that in derivation the outermost suffix usually determines the category of the derivate, is translated into the following labeling conventions for morphological tree structures:

Convention I states that "a stem morpheme ... labels the first, non-branching node dominating it", while, according to Convention II, "an affix morpheme labels the first branching node dominating it" (Lieber 1981: 47). Since there may be other features inherent in an affix or stem which after affixation apply to the derived word, such as German gender, Lieber suggests that these features be "percolated up" in the same way as the
category labels, i.e. in the case of stems to the next non-branching node, and in the case of affixes to the next branching node (Lieber 1981: 49). In the example below, the feminine gender inherent in the suffix -heit will thus be percolated up to the N-node, resulting in a noun with feminine gender. The operation of the above conventions is illustrated in the examples Wahrheit and mälerisch as follows:

\[ (4.1) \]

\[ (a) \]

\[ (b) \]

Lieber makes another provision to cover affixes that are not labeled for category, as for instance the English prefix counter-, which can prefix a verb, noun or adjective. In such cases, Lieber contends, the branching node dominating the particular affix will obtain category features from the next lowest labeled node (Lieber 1981: 50). This would apply to German prefixes as well, which are generally not labeled for category and occur with various stems: with verb stems (misslingen, bedeuten, entwerten, erblinden, gebieten, verhungern), noun stems (Missernte, Unruhe, Betrug, Entwurf, Ereignis, Gebirge, Verdienst, Zerwürfnis).
or adjective stems (misshellig, unartig, behutsam, entgeistert, erlesen, genau, verdutz, zerlesen).

What remains in Lieber's model of the lexicon is a component where morphological processes take place which Lieber refers to as governed by "string dependent rules", or locally determined processes which "can be blind to lexical structure" (Lieber 1981: 186). This component and its rules will be discussed later on when German umlaut is examined, which Lieber interprets as a productive string dependent rule. In order to sketch the model of the lexicon on which the later discussions are based, it is sufficient to determine where this component can be accommodated in lexical phonology. Lieber's model of the lexicon could be regarded as having but one level, with the main principles of lexical phonology operating at this single level, i.e. the restriction of cyclic rule application to derivations and ensuing structure preservation during derivation, and internal bracket erasure before an item leaves the lexicon. The "string dependent rules" correspond then to the phonological rules which operate at each level and interact with the morphology in Kiparsky's or Kaisse & Shaw's model.

To sum up the foregoing discussion, the organization of the lexicon assumed in this paper for German utilizes Lieber's concept of lexical terminal elements, which can be stems or affixes, with permanent lexical entries, corresponding to the "underlying representations" in Kaisse & Shaw. Lieber's Lexical Structure Rewrite Rule and the Feature Percolation Conventions --which are nothing else but the morphological processes-- are
also used. For German, it is assumed that these processes operate twice, once at each of the two levels deemed necessary for German. At level 1, all non-native derivation takes place, or, in Lieber's terms, non-native lexical structure is erected, with non-native metrical structure being assigned in the phonology component. At level 2, all native derivation and inflection take place, with the corresponding native metrical structure accompanying the morphological processes. This model might look as follows, drawing from Kaisse & Shaw (1985: 9) with the modifications outlined above:

(4.2)

In the following sections, the morphological and phonological processes taking place at the two lexical levels will be motivated and elaborated.
4.2 Level 1 - Non-native Lexical Structure

In the previous chapter, non-native vocabulary was defined as vocabulary with a phonological structure which is distinct from native phonological structure. In the first place, this distinction referred to vowel quantity, the non-native vowel system including tense short vowels which are absent in the native German system, and, again differing from the native system, showing no phonemic distinction between long and short vowels. Secondly, it has been shown that non-native vocabulary has stress patterns that are distinct from native stress, and that two different non-native metrical rules operate. In the model of lexical phonology proposed here, the non-native metrical rules are restricted to level 1, which corresponds to and at the same time stresses the separation of the levels into native and non-native morphological material.

However, there is also morphological motivation for a separation of the non-native from the native level: the non-native morphological elements are much more restricted in type and occurrence, i.e. only derivational affixes exist, and a non-native suffix cannot follow a native one. On the other hand, after non-native derivation, many non-native stems can undergo native suffixation, as for instance kalkulier-bar, nationalistisch. This supports the concept that non-native derivation is effected first, namely at level 1, with native derivation following at level 2. Similarly, all inflectional processes are effected by native suffixation after all non-native derivation has taken place. Interestingly, there are no non-native verbs, only verb stems ending in -ier; the suffixes which complete the word formation process are native and therefore attach at the
next level, be it the infinitive ending -en\textsuperscript{15}, or any other suffix marking the respective person, number, tense, etc.

The above means that, projected within a model of morphological bracketing, native affixes attach always on the outside, while the non-native elements are nested inside the native morphology, suggesting a closer linking within the non-native component than between this component and the native component. This corresponds to other aspects of non-native morphology in German: many roots and stems do not have any semantic content for the average speaker and only "make sense" in derivations which have become lexicalized. The words Nation, Natur and Nativität for example are derived from one root, the Latin stem nat-. This root can be isolated by peeling off the suffixes which are all found in other combinations: Un-ION, Tastat-UR, Akt-IV-ITÄT, suggesting that these suffixes are productive. However, their productiveness is limited and idiosyncratic in the German language, and, as pointed out above, native suffixes cannot be inserted before non-native suffixes. This illustrates the intimate bonding between the individual elements and supports the concept of a non-native lexical level.

It has been shown earlier that non-native vocabulary falls into two stress patterns, and that in derivation certain stems may switch stress category, as for instance 'Zentrum, zen'tral, zen'trieren, zentrali'sieren.

\textsuperscript{15}Other German suffixes usually thought of as inflectional are actually derivational: the adjectives gravierend and blasiert, for example, appear to be present and past participles respectively. However, modern German does not have the corresponding infinitives, and the suffixes -end and -t must be considered derivational.
where stressed suffixes cause the main stress to shift from the stem. Almost all words with final stress can be analyzed as made up of a stem plus stressed suffix. Therefore, leaving the stressed suffixes aside for the moment, the underlying, or, one might say, the "unmarked" non-native stress pattern must be the "Latinate" one, which assigns penultimate stress, left dominant feet and right dominant word trees, as stated in rule (3.27) in the previous chapter. This corresponds to the history of borrowing: most of the learned Latin words were introduced into German long before the relatively recent bulk of French imports, which, however, with their final stress system, had a much wider effect on the German phonology. After all, on the surface Latinate stress has many similarities with the native German pattern, where the syllable carrying the main stress is often followed by one or sometimes two unstressed syllables. The Latinate or unmarked stress pattern operates where stressed suffixes are not attached, i.e. in certain underived non-native items, or words with unstressed suffixes. It is also the default for borrowings from other languages, as the following examples show: 'Kakadu (< Malay), 'Petong (< Chinese, vs. Be'ton < French), 'Pharao (< Egyptian), 'Algebra, 'Kaffee (< Arabic, vs. Ca'fé < French).

The number of monomorphemic lexical items is relatively small and restricted to disyllables or maximally trisyllables: 'Slalom, 'Amok, 'Kanu, Ki'mono (also 'Kimono). These items would pass the morphological component at level I without undergoing any modification and would enter the phonology, where metrical structure is assigned according to rule (3.27). The majority of non-native items, however, are composed of a stem
plus one or more suffixes, even though the stem may never surface by itself or the intermediate forms may never surface. Yet as stated earlier, the stem is usually recognizable and the suffixes are productive, resulting for example in the following analysis of the stem \([\text{lexik}]_S\)\(^{16}\):

\[
\begin{align*}
\text{(4.3)} & \quad (a) \; [[\text{lexik}]]_S \text{ on}]_N \\
& \quad (b) \; [[\text{lexik}]]_S \text{ al}]_A \\
& \quad (c) \; [[[\text{lexik}]]_S \text{ al}]_A \text{ isch}]_A \\
& \quad (d) \; [[[\text{lexiko}]]_S \text{ log}]_S \text{ ie}]_N \\
& \quad (e) \; [[[\text{lexiko}]]_S \text{ log}]_S \text{ isch}]_A \\
& \quad (f) \; [[[\text{lexiko}]]_S \text{ graph}]_N \\
& \quad (g) \; [[[\text{lexiko}]]_S \text{ graph}]_N \text{ ie}]_N \\
& \quad (h) \; [[[\text{lexiko}]]_S \text{ graph}]_N \text{ isch}]_A \\
\end{align*}
\]

It is assumed that the -o- in examples (d) to (h) above is the last segment of a stem \([\text{lexiko}]\) which is related to the stem \([\text{lexik}]\) by a morpholexical rule defining both in Lieber's sense as a set or pair of lexical items listed in the permanent lexicon. On the other hand, since this segment appears also in \textit{Phon-o-logie}, \textit{Astr-o-logie}, \textit{Chem-o-therapie}, etc., it could be argued that it would be more economical to analyze it as another morpheme, resulting in a stem \([\text{lexik}]_S\) which never surfaces. However, there does not seem to be any morphological motivation for a separate suffix or morpheme. It does not seem to be an epenthetic vowel either, since its shape is completely unpredictable. Therefore, the analysis suggesting a lexical class (\textit{lexik} - \textit{lexiko}) is preferred.

\(^{16}\)Stems which are transparent as to category are labeled "S".
Lexical phonology assumes that after each morphological operation the output undergoes phonological rule application, then it is available again for further morphological operations at the same level, if required (cf. Kaisse & Shaw 1985: 18). The above derivations of the stems [lexik] - [lexiko] illustrate this in a perfect way. In (a), the output of the first cycle is Lexikon, which happens to be a complete word. Since [lexik] is not labeled for category it has been marked as S for "stem". To this stem, the unstressed suffix -on is attached, which is labeled for the category "noun", but does not have any inherent stress features. Consequently, the phonology component assigns the unmarked non-native metrical structure, or ante-penultimate stress:

(4.4) (a) Morphological Structure (b) Metrical Structure

In (4.3 b), lexikal, one cycle is sufficient as well to produce a complete word, except that this time the suffix has the category "adjective" and, moreover, has the inherent feature [+s]. In the first cycle the structure as in (4.5 a) below results. According to Lieber's proposal that features inherent in affixes are percolated up to the next branching node, the feature [+s] inherent in the rightmost suffix just
attached is now dominating, which results in the selection of rule (3.25) to assign metrical structure to the derivation, i.e. a right dominant word tree with binary, left dominant, quantity insensitive feet and the DTE on the far right will be produced, as in (4.5 b) below:

(4.5) (a) A

(b) lex i kal

The items [{[lexiko]S log}S ie]N, [{[lexiko]S graph}N}17, [{[lexiko]S graph}N ie]N (4.3 d, f, g above) undergo several cycles of derivation. Each time metrical structure is assigned after the morphological operation, first the unmarked structure, then, when the first suffix with an inherent "$s" is attached, the structure assigning final stress:

(4.6) Level 1 - Morphology - Phonology

Lexical terminal element: [lexiko]S

1st cycle: [{[lexiko]S log}S

| $s

2nd cycle: [{[lexiko]log}S ie]N

| $s $s

17While [lexikolog] is transparent as to category, [lexikograph] seems to be recognizable as a noun stem. The framework used here permits us to assume [-graph] to be represented twice in the permanent lexicon, once as an affix without category, and again as a nominal affix; both would be in the same lexical class, related by morpholexical rules. For reasons of simplicity, the nominal affix [-graph]N has been used in the above context.
As a result of the stress shift to the syllable attached in the second cycle, the vowel in the syllable now in penultimate position becomes short, and the now weak syllable is defooted and must be attached to another syllable to be part of a foot. The question is whether it joins the following or the preceding syllable. From the point of view of structure preservation it might be expected that it would join the following syllable, since in that case the new word tree would reflect the previously assigned metrical structure:

\[
\text{lex i ko log} \Rightarrow \text{lex i ko lo gie}
\]

However, this would result in a reversal of the dominance pattern at the foot level from left to right, which is undesirable. It must be accepted as a fact of German phonology that in words with final stress the rightmost suffix is assigned the main stress and, if several suffixes follow each other, the stress moves along, regardless of previously assigned metrical structure. As pointed out earlier, this behaviour corresponds to the shift of grammatical category to the rightmost suffix, and just as grammatical gender is an arbitrary feature inherent in German noun suffixes, final stress is arbitrary and therefore implicitly inherent. Just as category overrules previously assigned category, final stress intrinsically
overrules previously assigned metrical structure.

Returning to the above example, the alternative is to join the now unstressed penultimate syllable of *lexikolo'gie* to the preceding foot, resulting in a structure which correctly reflects the left dominant feet and the rhythmic prominence pattern in German. Defooting of penultimate syllables is expressed in rule (4.8) below:

\[
(4.8) \quad X \Rightarrow X
\]

The processes under (4.6) above can now be illustrated by tree structures:

\[
(4.9) \quad (a) \quad S \quad \text{lexiko}\_log
\]

---

18 It should also be noted in this context that disruption of earlier assigned metrical structure has been allowed for the English Stress Rule by Hayes (1982: 244), and recent research has prompted Kiparsky to revise the whole complex of constraints that have led to the formulation of the Strict Cycle Condition (cf. Kiparsky 1985).

19 See also Selkirk for the metrical structures of Sudan and Sudanese, with the weak second syllable in the derivation being joined to the left weak stress foot (Selkirk 1980: 584).

20 Note that this type of defooting, which is due to stress shift, is distinct from the defooting of heavy medial syllables proposed under rule (3.11) for native vocabulary of the type *Wachsamkeit*.
The processes of non-native derivation described so far and the insight that the outermost suffix may be stressed regardless of syllable weight, offer a logical solution to a problem that has not been solved satisfactorily by the authors dealing with German stress to date: non-native underlying vowel length and stress placement. As mentioned earlier in this paper, Wurzel sees differing underlying vowel quantity, and Giegerich's whole theory hinges on the claim that stress falls on the rightmost syllable containing a long vowel or a short vowel followed by two consonants. However, it now appears that it is always the vowel in the last, i.e. rightmost, stressed suffix which is long, while vowels in suffixes attached in previous cycles, which are then to the left of the final suffix, remain tense, but not long. This phenomenon suggests that vowels in non-native derivational suffixes become long when they are stressed, as in Lexikograph, Lexikographie. In the first case, the -a- is long, in the second, it is not, but the -ie- is long. This can be expressed in a phonological rule which, since it is a consequence of stress placement, follows the assignment of metrical structure:
Vowel lengthening in stressed syllables:

\[
\begin{array}{c}
V \rightarrow V:/
\end{array}
\]

Another phenomenon related to vowel length, which was briefly mentioned earlier in this paper, is that in the process of concatenation, syllables with tense vowels undergo resyllabification: [-gra:f] \( \rightarrow \) [-gra-fi:]. Two factors are responsible for this. Firstly, within the German phonological structure, the tense vowels have in common with the long vowels that they form a "loose contact" with the following consonant, leading in resyllabification to a syllable cut between the vowel and the consonant. Secondly, as stated earlier as well, German prefers syllables with onsets, and when a vowel-initial suffix is attached to a syllable ending in a consonant, it attracts the final consonant and uses it as an onset. In the case of syllables of the structure -VCC, the cut is effected between the consonants (e.g. Musikan-ten), and in syllables with short lax vowels the final consonant becomes ambisyllabic to satisfy the need for an onset: Bal-letr. Since metrical structure is based on syllables, this rule, which applies also to native phonological structure, must be ordered before metrical structure assignment:

Syllabification Rule:

(1) \( \begin{array}{c}
X \ C \ V \rightarrow X \ C \ V
\end{array} \)
Summarizing the above, the order of the phonological rules applying at level 1 after each morphological operation is: (1) Syllabification, (2) Weight Reduction in Penultimate Syllables, (3) Metrical Structure Assignment, (4) Vowel Lengthening. Of these rules, only (3) applies always. (1), (2) and (4) apply when the output of the morphological operation meets the structural description of the respective rule.\(^2\)

Only words consisting entirely of non-native material have been analyzed up to this point. However, some of the forms in (4.3) above are combinations of non-native stems with a native adjectival suffix: [lexikalisch, lexikologisch and lexikographisch]. Native suffixation takes place at the next level, so after a stem like \(\text{[lexik]al}\) has been formed, the item moves to level 2. According to the Bracketing Erasure Convention, all internal morphological brackets are erased in this process. The stem emerging from level 1 has a metrical structure assigned to it at that level, but once it arrives at level 2, it will be treated like a native item, with the embedded metrical structure with the main stress on its final syllable functioning as the prominent item in the metrical structure erected at level 2, resulting in a left dominant word tree. That the other phonological rules of German, such as final obstruent devoicing or voicing of initial /s/, have not been addressed in this paper since they are not vital to the issues discussed.

\(^2\) Other phonological rules of German, such as final obstruent devoicing or voicing of initial /s/, have not been addressed in this paper since they are not vital to the issues discussed.
metrical structure from the previous level should be visible at the next level is not surprising. It was noted earlier that the relationship between levels mirrors the relationship between the lexicon and the postlexical domain, and obviously metrical structure must be visible beyond the lexicon in order to determine varying degrees of prominence among syllables during speech. The following structures illustrate derivation and metrical structure assignment at level 2:

Similarly, the stems [lexikolog]S and [lexikograph]N move to level 2 where the adjective suffix -isch is attached to produce lexiko'logisch and lexiko'graphisch. While [lexikograph] and [lexikal] are stems that can appear on their own as a noun and/or adjective, the suffix [-log], with no inherent category, needs to be followed by another suffix, either the non-native [-ie]N or the native [-isch]A, the latter moving the item to the next level of derivation.

It so happens that the forms lexi'kal and lexi'kalisch both exist in the German vocabulary, they are alternants with exactly the same meaning. There are numerous incidents, however, where the intermediate form, the
output of level-1, does not surface before the native suffix is attached:

\((4.13)\) \([[[\text{peru}an]\text{isch}]_A, [[[\text{Peru}an]\text{er}]_N, \star [[[\text{peru}an}\]

\([[[\text{musik}]\text{al}\text{isch}]_A, \star [[[\text{musik}]\text{al}\]

\([[[\text{obligat}or]\text{isch}]_A, \star [[[\text{obligat}or}\]

\([[[\text{system}at]\text{isch}]_A, [[[\text{System}at}ik]\text{er}]_N, \star [[[\text{system}at]\]

\([[[\text{liban}es]\text{isch}]_A, [[[\text{Liban}es}e]_N, \star [[[\text{liban}es}\]

\([[[\text{solid}ar]\text{isch}]_A, \star [[[\text{solid}ar}\]

The formatives -an, -al, -at, -ar, -es, -or in the above list are not labeled for category, but owing to their productivity they must be viewed as separate elements in word formation, with a subcategorization frame prescribing the type of suffix to follow, and with the inherent feature \([+\text{stress}]\).

Having ascertained that this type of morphological element, which is embedded between a stem and another suffix, exists, it is now possible to re-analyze other non-native suffixes. Traditionally, the suffixes -abel, -ibel, -iade, -age, -ier- etc. have been listed together with the other non-native stressed suffixes (Giegerich 1985: 28). It is interesting to note that Giegerich represents the verbal suffix -ieren without the native ending -en, obviously in recognition of the fact that it is a separate suffix. It is proposed here that what is obvious in the case of -ieren, also applies to the other disyllabic non-native suffixes, i.e. they are separable into a non-native formative followed by a native suffix, which

\[22\text{In this context, see also Strauss, who analyzes information, relaxation and devastation as having the same internal hierarchical structure (Strauss 1980; 1982: 2).}\]
can be labeled for verb, noun or adjective category.

The following evidence is presented to support this concept. First, consider the adjective endings -abel and -ibel. The formatives -ab- and -ib- occur also in combination with other suffixes: [[[Rent]AB]il]ität, [[[Sens]IB]il]ität. It is clearly not a matter of phonology that the corresponding adjectives are not *rentabil or *sensibil, since adjectives with this ending do exist: de'bil, se'nil, gra'zil, etc., with stress on the final syllable. On the other hand, a native adjectival suffix -el exists as well: 'dunkel, 'eitel, 'heikel. The case of the nominal endings seems to be even more obvious. In many instances the final -e is reserved for words with feminine gender: Reportage, Olymphiade, Zikade, corresponding to the extremely frequent native feminine nominal marker -e. Many pairs of non-native suffixes exist where the form without -e has either masculine or neuter gender, whereas the same suffix with -e denotes the feminine gender, suggesting that it is the native derivational suffix. A number of nouns also show -e as the masculine agent marker as a distinction to nouns denoting objects. Note that in the examples below, stress is always on the same syllable:

(4.14)    -'al     Pokal (m.), Futteral (n.)
    -'ale   Zentrale, Spirale (f.)

    -'an     Fasan (m.), Organ (n.)
    -'ane   Kurtisane, Ottomane (f.)

    -'ell    Rebell (m.), Karussell (n.)
    -'elle   Frikadelle, Bagatelle (f.)

    -'et     Prophet (m.), Paket (n.)
    -'ete    Rakete, Tapete (f.)

    -'ett   Bankett, Kabinett (n.)
    -'ette   Bankette, Klarinette (f.)
- 'eur Amateur (m.), Malheur (n.)
- 'euse Friseuse, Ballettuse (f.)
- 'in Rubin (m.), Benzin (n.)
- 'ine Margarine, Maschine (f.)
- 'iv Detektiv (m.), Negativ (n.)
- 'ive Offensive, Initiative (f.)
- 'ott Boykott (m.), Schafott (n.)
- 'otte Marotte, Klamotte (f.)
- 'eg Kolleg, Sakrileg (n.)
- 'ege Kollege, Stratege (m., +ag.)
- 'og Monolog, Katalog (m.)
- 'oge Psychologe, Archäologe (m., +ag.)

As an example, the derivation of the noun Initiative will be developed step by step below:

(4.15) Stem from the permanent lexicon: [initi]

Level 1,
1st cycle:

\[
\begin{align*}
S & \quad \rightarrow \quad \text{initi}|S \quad \text{at}|\text{Aff} \rightarrow \quad \text{FS} \\
& \downarrow \downarrow \downarrow \downarrow \\
& \quad \text{initiat}|S \quad \text{iv}|N \quad +N \rightarrow \quad \text{FS} \\
& \downarrow \downarrow \downarrow \downarrow \\
& \quad \text{M}' \\
& \downarrow \downarrow \downarrow \downarrow \\
& \quad \text{M} \\
\end{align*}
\]
With the foregoing analysis, the separation of levels into non-native and native material is complete. There is no native derivation or inflection taking place at level 1, there is not even schwa present in the entirely non-native phonological structure. This concept adds to the motivation for, and justification of, the distinction between native and non-native stress patterns. Non-native stress is restricted to the domain of level 1; native stress on the other hand is excluded from level 1 and operates everywhere else, encompassing non-native items as they emerge from level 1. Seen in this way, German phonology presents an organized, economical and morphologically well motivated picture.

4.3 Level 2 - Native Lexical Structure

After non-native derivation, the following morphological processes remain:

- native derivation (prefixes and suffixes),
- inflection (prefixes and suffixes),
- compounding.
Since these morphological processes all interact with the same phonological rules, it seems logical to assume that they all take place at the same level. Just as at level 1 the phonological structure is restricted to non-native elements, the phonological structure at level 2 is entirely native. This refers on the one hand to the vowel system, which is based on a long:tense vs. short:lax contrast. On the other hand, metrical structure at this level is left dominant: the greatest relative prominence, and consequently the main stress of the word, is on the root syllable, which generally precedes derivational and inflectional suffixes, resulting in left dominant feet and left dominant word trees. As shown in chapter 3, this pattern extends to compounds as well, which brings native word formation in its entirety under one set of phonological rules. Non-native stems emerging from level 1 and undergoing additional native derivation or inflection at level 2 are treated as embedded in the native metrical structure, in which the non-native stem is interpreted as the most prominent element so that an overall left dominant tree structure results.

The principles of derivation based on Lieber's Lexical Structure Rewrite Rule have been illustrated in the course of the discussion of level 1, so that it will not be necessary to go through every detail of native derivation. However, certain aspects which differ from non-native derivation need to be examined against the theoretical background as developed so far, namely unstressed prefixes and compounding. Two other phonological phenomena will be discussed as well: schwa deletion, since it affects metrical structure assignment, and umlaut, which is of central
interest in a proposal for a model of lexical phonology for German.

4.3.1 Unstressed Prefixes

In chapter 3, words with unstressed prefixes resulted in metrical structures which did not seem to fit in the left dominant native stress pattern. Within the model of Lexical Phonology developed here, the interaction between prefixation and metrical structure assignment can now be shown more clearly. Consider the example be'arbeiten:

\[(4.16)\] Level 2 - Morphology

Stem from perm.
lexicon: \([arbeit]_v\)

Phonology

\begin{align*}
\text{ar} &\quad \text{beit} \\
\$s &\quad \$s \\
\text{Fs} &\quad \text{Fw} \\
\text{M} &\quad \\
\end{align*}

1st cycle:

\[\begin{array}{c}
\text{V} \\
\text{[be]}_{\text{Aff}} \quad \text{[arbeit]}_v \\
+V
\end{array}\]

\[\begin{array}{c}
\text{be ar bei ten} \\
\$w \quad \$s \quad \$s \\
\text{Fs} \quad \text{Fw} \\
\text{Ms} \\
\text{M'}
\end{array}\]

2nd cycle:

\[\begin{array}{c}
\text{V} \\
\text{[be (arbeit)]}_v \quad \text{en}_{\text{Aff}} \\
+V
\end{array}\]

\[\begin{array}{c}
\text{be ar bei ten} \\
\$w \quad \$s \quad \$s \quad \$w \\
\text{Fs} \quad \text{Fw} \\
\text{Ms} \\
\text{M'}
\end{array}\]
An example of a word with three unstressed syllables preceding the main stress, for which a metrical tree structure was presented in chapter 3 (3.19 c), is Verallgemeinerung. Derivation and metrical structure assignment will be developed for this word below. Notice that a lexicalized stem \([\text{ge'mein}]_A\) (= unstressed prefix + root) is assumed, since \([\text{mein}]_A\) by itself does not occur:

\[4.17\]  

**Level 2 - Morphology**

Stem from perm. lexicon: \([\text{gemein}]_A\)

**Phonology**

\(\text{ge mein}\)

\(\text{sw} \quad \text{ss}\)

\(\text{Fw} \quad \text{Fs}\)

\(\text{M}\)

1st cycle:

\([\text{all}] \quad [\text{gemein}]_A\)

\(+A\)

2nd cycle:

\([\text{all [gemein]}]_A \quad [\text{er}]_{Aff}\)

\(+A\)

\(+V\)
The above two examples illustrate why the unstressed prefixes can precede the main stress in an otherwise left dominant stress pattern: at level 2, metrical structure is preserved through the various cycles of derivation. Level 2 differs in this respect from level 1, where in non-native derivation metrical structure can be disrupted.

Another phonological rule operating in the above examples, which has not been specifically mentioned in the context of level 2 morphology and phonology, is resyllabification. When a vowel-initial suffix is attached to a stem, the stem-final consonant moves to the next syllable to form
its onset. The rule (4.10) developed earlier for non-native vocabulary, also operates at this level, or rather, to account for the proper order of events, it operates for native vocabulary in the first place and is also applicable to non-native material.

4.3.2 Compounding

It has been stated repeatedly that compounding is subject to the same morphological processes and phonological rules as native derivation, and metrical structures illustrating the phonological aspects of this claim were developed in chapter 3.

Lieber's system of feature percolation specifies that category features inherent in stems are percolated to the node dominating the stem, while category features inherent in affixes are percolated up to the next branching node dominating the stem and the affix. A compound is a structure in which two stems are joined, and in German and English it is the right stem which determines the category of the compound. To account for this phenomenon, Lieber formulates another Feature Percolation Convention, which specifies that in compounds features from the right-hand stem are percolated up to the branching node dominating the stems (Lieber 1981: 54).

The process of compounding will be illustrated below by developing the structures for two examples. The first one, Stehlampe, is one of the most basic types of compounds, a simple verb stem and a simple noun stem. The second one, Eternittrennwand, has the structure \([A][BC]\), of which
the right-hand subcomponent cannot possibly be interpreted as being
lexicized with the ensuing demotion of the third constituent to an
affix. The second example is also a combination of a non-native noun
stem with a native one.

(4.18) Example: Stehlampe

Morphology

Level 2
Stems from perm. lexicon:
\[ \text{[steh]}_{V}, \text{[lampe]}_{N} \]

1st cycle:

\[ \text{Steh} \rightarrow \text{N} \]
\[ \text{lampe} \rightarrow \text{N} \]

Phonology

\[ \text{Steh lam pe} \]
\[ \text{Fs Fs} \]
\[ \text{Ms Mw} \]

(4.19) Example: Eternittrennwand

Stems from perm. lexicon: \[ \text{[trenn]}_{V}, \text{[wand]}_{N} \]

Derived stem from Level 2: \[ \text{[eternit]}_{N} \]

1st cycle:

\[ \text{trenn} \rightarrow \text{N} \]
\[ \text{wand} \rightarrow \text{N} \]

\[ \text{Fs Fs} \]
\[ \text{Ms Mw} \]

\[ \text{Ms Mw} \]

---

23cf. Giegerich's claim that the -hof in Bahnhof and the -hafen in
Flughafen are "Class II" suffixes (Giegerich 1985: 144 f.; cf. also
section 2.5 above).
in the last example above, the non-native stem is subject to the same processes as native stems, with its internal structure, carried over from level 1, remaining unchanged. Both examples show that in the present framework compounds correspond structurally to other native words, regardless of number and internal structure of subcomponents: grammatical category is determined by the right-hand constituent in compounds, parallel to the right-hand suffix in derivations, while the main-stress is assigned to the root on the left-hand side, both in compounds and in derivations.

4.3.3  Schwa Deletion

One of the characteristics of the native German phonology is that schwa may appear in certain unstressed root syllables or inflectional suffixes, and not in others. In concatenations of several unstressed syllables and suffixes the presence of schwa is obviously governed by certain regularities. Consider the following forms:

(4.20)  (a) Segel - Segler
        Sammel(platz) - Sammler
In (a) above, the root on the left has schwa in its second syllable, but when a vowel initial suffix follows, the root schwa is not present.
In (b), the root schwa is preserved in derivations, but the verbal suffix, which usually appears as -en, e.g. bau-en, tanz-en, is realized here as -n. (c) above shows some genitive forms and an inflected adjective, which vary as to whether or not they contain schwa, and in (d), the second and third person suffix shows schwa after an apico-alveolar stop in reitest, but not in rätst.

Agreement on whether German schwa is epenthetic or whether it deletes in certain environments, or whether both these processes occur, has not been reached in the literature to date. Wurzel posits underlying forms without schwa only (Wurzel 1970a: 170-193). If every schwa is assumed to have been inserted, as for instance in [seg1] -> [segel], the consequence is that in certain cases it must be deleted again.
\([\text{segel} + \text{er} \rightarrow \text{segler}]\), which makes Wurzel's rule for schwa epenthesis and deletion extremely complex. Apart from the fact that such a procedure does not seem economical in the grammar of a language, it also reflects a complete disregard of historical facts, i.e. the gradual vowel reduction in unstressed syllables, leading to deletion in some cases or a minimal vowel, schwa, in others. With this knowledge, it does not seem quite justified to posit complete absence of schwa in underlying forms in a synchronic grammar of German.

Issatschenko makes a distinction between "schwa mobile", referring to a "fleeting" vowel which may disappear in certain instances, and "schwa constans", which "retains its syllabicity in all phonological environments" (Issatschenko 1974: 142 f.). However, the distinction seems rather ad hoc and does not imply that a systematic process is responsible for the alternation. Issatschenko also proposes epenthesis of schwa in cases where it is deleted again (p. 147).

A different approach is taken by Bach & King who assume underlying full vowels for certain suffixes with schwa in their surface form, and acknowledge at the same time that in other instances schwa is inserted (Bach & King 1970: 10). Bach & King's main topic, however, is umlaut, and the phenomenon of schwa is not fully explored.

A comprehensive and convincing analysis of schwa-zero alternations in German is presented by Strauss (1982: 92-126). Strauss assumes roots and affixes with underlying schwa and distinguishes the following types...
of schwa deletion: dative/genitive schwa deletion, morpheme-final schwa deletion, suffix schwa deletion, and root schwa deletion. In Strauss' analysis, both phonological and morphological information is needed. For instance, the forms Blei-s and blau-es are distinguished by the fact that the former is the genitive case of Blei, where schwa deletion is obligatory for monosyllabic nouns ending in a sonorant, while in the latter, the neuter form of the adjective blau, the initial schwa of the suffix is not deleted. In other instances internal morphological brackets constitute constraints. Morpheme-final schwa for example is not deleted across a "[" bracket: [[Auge] + lein] -> [[Aug-] lein], but in [[gaze] + [bausch]] or [[be [rat] e]n] the elision of the e is blocked.

One point on which one might disagree with Strauss is that root schwa deletion should be optional. In Seg-ler or dunk-ler for instance it is doubtless obligatory, and there are pairs where the presence of schwa may alter the meaning: Sied-lung - Besiedelung. It seems therefore that the circumstances under which root schwa deletes require further investigation.

Another issue which is not discussed specifically in Strauss' analysis is the question whether there is any schwa epenthesis in the verb paradigm. The second and third persons singular and the past

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24cf. Issatschenko (1974: 162), who distinguishes between nomina rei, with schwa deletion (Kuplung, Siedlung, Entwicklung), and nomina actionis, in which the schwa is preserved (Verkuppelung, Besiedelung, Umwicklung). However, this is a tendency at most, and pairs of the type Reglung - Regelung do exist without a difference in meaning. The alternation would then be tempo governed, and consequently a topic for postlexical phonology.
participle of most verbs are formed by attaching -st and/or -t to the stem: gehst/geht, weinst/(ge)weint, hungerst/(ge)hungert, machst/(ge)-macht, etc. Only when the stem ends in a dental stop or, after root schwa deletion, in an obstruent-nasal cluster, is schwa inserted: rechnest/(ge)rechnet, atmet/(ge)atmet, reitet/reitet, wartest/(ge)-wartet. An exception to these are verbs with umlauted stems in the second and third persons, where the schwa is not present: rätst/rät, giltst/gilt. Epenthesis could be assumed here (and is assumed by Bach & King and Wurzel) because the monosyllabic forms above do not motivate schwa deletion, so that in these two suffixes the schwa could be underlyingly absent. In the weak verbs ending in a dental stop schwa would be inserted to avoid sequences of two or three dental obstruents. On the other hand, giltst, rätst etc. prove that such sequences are not a problem. Moreover, if all other inflectional and derivational schwa-initial suffixes are considered to contain schwa in their underlying form, the generality of this pattern would be disrupted if -(e)st and -(e)t were not included. There is no factor present that would exclude the possibility that schwa deletes in these cases as well. The fact that Strauss does not particularly mention the schwa-zero alternation in the verb paradigm seems to be an indication that he considers these particular inflectional suffixes not to be different from the others for which he assumes an initial schwa.

Based on the foregoing discussion, the following phonological rules governing stress related processes are assumed to operate at level 2:

1. Schwa deletion,
2. Syllabification,
3. Metrical structure assignment.

Application of these rules is illustrated in the examples hungern, schreibt, arbeitet, Segler below:

\[(4.21) \quad \begin{align*}
(a) \text{ Stem from the permanent lexicon: } & \text{[hunger]}_N \\
\text{Level 2 - 1st cycle: } & \text{Morphology} \quad \text{Phonology} \\
& \text{[hunger]}_N \text{en}_V \rightarrow \text{Schwa deletion} \quad \text{[hunger]}_n \\
& \text{Syllabification} \quad \text{hungern} \\
& \text{Metrical structure} \quad \text{Fs}
\end{align*}\]

\[(b) \text{ Stem from the permanent lexicon: } \text{[schreib]}_V \\
\text{Level 2 - 1st cycle: } \text{Morphology} \quad \text{Phonology} \\
& \text{[schreib]}_V \text{et}_V \rightarrow \text{Schwa deletion} \quad \text{[schreib]}_t \\
& \text{Sg. Pres.} \quad \text{Metrical structure} \quad \text{schreibt} \\
& \text{schreibt} \\
& \text{Fs}
\]

\[(c) \text{ Stem from the permanent lexicon: } \text{[arbeit]}_N \\
\text{Level 2 - 1st cycle: } \text{Morphology} \quad \text{Phonology} \\
& \text{[arbeit]}_N \text{et}_V \rightarrow \text{Syllabification} \quad \text{arbeitet} \\
& \text{Sg. Pres.} \quad \text{Metrical structure} \quad \text{arbeitet} \\
& \text{arbeitet} \\
& \text{Fs} \quad \text{FW}
\]
4.3.4 Umlaut

Earlier in this paper, the claim was made that umlauted stems are listed in the permanent lexicon. While this issue may not be directly related to stress assignment, it is, however, of relevance in a model of Lexical Phonology, and therefore the implications of such a claim will be explored.

It is a well known fact that umlauting of German stem vowels takes place regularly before certain suffixes (e.g. -lein, plural marker -er), never before others (e.g. -schafft, -heit, -sam), and sometimes before yet another group (e.g. -ig, -isch, -chen, -nis, agent marker -(l)er). It is also known and generally accepted that this phenomenon goes back to a phonological rule which caused the fronting (umlauting) of back vowels before non-back vowels in the following syllable. That this rule is not generally productive any longer is evident from the following examples, where in the same phonological environment the root vowel, or in some cases the last stem vowel, undergoes umlaut in some cases, but not in others:
The most commonly held view in the literature to date is that modern German umlaut is a productive process, but the analyses differ as to what the triggering factor is. The following observations are generally made when umlaut is discussed:

1. There are two types of umlaut, first, the inherent or underlying umlaut, as in grün or öl, and second, the derived umlaut which is obviously related to an unumlauted stem or root, as for instance Begräbnis – graben, körnig – Korn, etc.

2. Suffixes do not undergo umlaut even if they are in a position immediately preceding another suffix which would normally cause umlaut: wissen-SCHAFT-lich, wahr-HAFT-ig, Sinn-LOS-ig-keit.

3. Umlaut can occur across another syllable between the umlaut causing suffix and the root: bäuerlich, öffentlich, Kugelchen, etc.,
although it is sometimes claimed that it is only the suffix immediately following the root which triggers the umlauting of the root vowel (Bach & King 1970: 8).

Bach & King's analysis is strictly phonological, which means that in order to account for the occurrence of umlaut before certain suffixes with schwa in their surface form, Bach & King posit underlying forms of these suffixes with high vowels. It is not surprising that these underlying forms correspond to the attested historical forms of Old High German, which was the period when umlaut began to appear in the German language.

Wurzel (1970a) concedes that modern umlaut is not a purely phonological process any more, but that morphological factors play a part as well. However, the generative-transformational rule developed by Wurzel is so complex and has so many subcomponents that its usefulness is questionable (Wurzel 1970a: 163-169). Both analyses, Bach & King's and Wurzel's, leave a large number of occurrences, or failure to occur, of umlaut unexplained. These are then marked as exceptions.

A departure from the above analyses is presented by Strauss who establishes that the domain of the "minus Umlaut feature" is larger than the domain of umlaut and consequently includes the latter. Strauss makes the observation that "... the exceptionality of a root with respect to Umlaut is determined, in part, by the particular prefix or compounding element attached to its left" (Strauss 1982: 134). Strauss leaves it at
that, but the logical consequence of this observation is that the occurrence, or the non-occurrence, of umlaut is lexicalized. However, before the specifics of such a proposal are developed here, Lieber's view on umlaut will be examined.

Lieber presents and discusses two possible analyses of German umlaut, a "morpholexical" approach and a "productive string dependent rule". Both are based on the concept that the subcategorization frame of suffixes includes the feature [+U], [-U], or [±U], which in the case of the morpholexical approach causes the suffix to select an umlauted stem (or unumlauted, as the case may be) from the permanent lexicon, while in the string dependent hypothesis the suffix causes the stem vowel to be fronted, or stay the same (Lieber 1981: 180-199). Perhaps it is somewhat surprising that Lieber rejects the morpholexical analysis, for which she developed the suitable framework, in favour of the productive rule approach. The latter is ultimately a phonological analysis, since it "requires string adjacency of a vowel rather than structure adjacency" and is "blind to lexical structure" (Lieber 1981: 186). Lieber prefers this analysis for reasons of economy. The principal argument Lieber raises against the morpholexical analysis is that the lexicon would be overloaded if all the umlauted forms were listed as permanent terminal elements (p. 185).

A much more serious concern against the proposal that suffixes select umlauted stems from the permanent lexicon are prefixed stems. In a case like bekömml ich the suffix - lich attaches to a derived stem.
[[be [kömm] lich]], which means that the stem has left the permanent lexicon and has moved to level 2 for prefixation in the first cycle, to be followed by suffixation in the second cycle. Lieber notices this as well and correctly states that the suffix -lich cannot "cross two brackets to 'see' the umlaut feature on kömm" (Lieber 1981: 186).

However, Lieber claims that in her model of the lexicon the feature percolation mechanism "will allow the feature [±U] to percolate to the first branching node dominating kömm: since prefixes like ab and be are not specified for the umlaut feature, this feature can percolate from the righthand constituent. Notice that this allows us to state the subcategorization of -lich with no violation of the Adjacency condition" (Lieber 1981: 185), and the following structure is presented:

(4.23) (Lieber 1981: 185)

In the above tree structure, whose nodes correspond to morphological brackets, it is still not clear what device is available to trigger the selection of a [+U] stem rather than kömm, unless it is assumed that the prefix has some influence on the selection. This is exactly what Strauss hinted at. Notice, however, that the stem be-kömm also exists. It would therefore not be economical to equip the prefix be- with the inherent feature [±U] which would optionally select an umlauted stem among the
lexical terminal elements, since this would increase the information required in the lexicon to ensure the correct selection. Rather, it seems more profitable to assume that the permanent lexicon contains prefixed umlauted stems which are selected when a suffix subcategorized for umlaut is attached, as in [bekömm lich], [fabkömm lich]. At the same time this analysis accounts for the absence of umlaut in cases where it could be triggered by the suffix. Consider the following forms:

\[(4.24) \quad \text{[veräch]_V lich}_A \quad - \quad \text{[be [acht]_V lich}_A \quad \text{[bekömm}_V lich}_A \quad - \quad \text{[vor [kömm]_V ni}_N \quad \text{[ver [trag]_N lich}_A \quad - \quad \text{[gespräch]_N ig}_A \quad - \quad \text{[[mehr]_A [sprach]_N [ig]_A}

In the examples on the left, umlauted stems, three of them prefixed, are available for the [+U] suffix. On the right, however, prefixes are attached to the stems in regular derivation before suffixation, with the result that umlaut is blocked because of two intervening brackets. This analysis also explains why suffixes are never umlauted: stems like [wissen] schaft] (-> wissenschaftlich) or [wahr] haft] (-> wahrhaftig) are not lexicalized. The same applies to the great number of non-native stems from level 1 which undergo native derivation with [+U] suffixes, such as [diktator] isch], [peruan] isch], etc. These stems do not as a rule have lexicalized alternates showing umlaut. Only a handful of non-native stems with umlaut do exist (figürlich, europäisch), and these must be seen as lexicalized exceptions.
What are the arguments against an analysis assuming the existence of prefixed umlauted stems in the permanent lexicon? The main concern which continues to be raised in connection with the interpretation of umlaut is that it may not be economical if the lexicon is assumed to contain too many permanent entries. In the first place, however, it is impossible to determine a priori what the numerical limit of lexical terminal elements would be. And secondly, the analysis proposed above is perhaps even the most economical one since it drastically reduces the number of exceptions which have to be assumed in any productive phonological interpretation of umlaut. And finally, although the lexicalization analysis does not need historical facts as an explanation, it is nonetheless reassuring that it reflects the historical development perfectly. When umlaut as a productive phonological rule ceased to operate, the forms existing then became lexicalized. In subsequent word formation the lexicalized forms have been used when the context calls for it, i.e. suffixation with an umlaut selecting suffix. But where other derivational processes precede this type of suffixation, resulting in more than one bracket, or node, between stem and suffix, umlaut does not occur.

4.3.5 Morphological Conversion

The assumptions made in the previous section about the existence of lexicalized umlauted stems necessarily lead to similar assumptions for a morphological process which is usually interpreted as and referred to as "zero derivation" (cf. Kiparsky 1982: 135). A "zero suffix" is proposed for cases where a noun is derived from a verb stem, or a verb from a noun stem, with the derived form having exactly the same phonological form as
the original stem. English examples are spy, guide, cook or snowball, which can be either verb or noun (Kiparsky 1982: 135, 141). Here again, German morphology with its vowel changes is too complex to extend the rules for English zero affixation to German. In German, the derived noun stem is often derived from a form in the verb paradigm which is not the infinitive and has a different vowel:

(4.25)  

fluchen (infinitive)   -   der Fluch  
reiten, ritt (preterite) -   der Ritt  
stechen, sticht (3rd pers. sg. pres.) -   der Stich  
finden, gefunden (past participle) -   der Fund  
binden, band (preterite) -   das Band  
' , gebunden (past participle) -   der Bund  

Since it is not always the same verb form from which a noun is derived, and since the derived nouns may even belong to different plural classes (cf. das Band - die Bande, die Bänder; der Fluch - die Flüche), Lieber concludes that in German different zero affixes would be necessary, corresponding to the various umlaut classes, on which the derived nouns are based (Lieber 1981: 121). Lieber therefore proposes that morphological conversions are effected as redundancy rules in the permanent lexicon. In this proposal, a "relation R=N <-> V... relates pairs of lexical items like (Bandy, bandy) which differ only in category". These pairs are called "conversion pairs", with "conversion mates" as their members (Lieber 1981: 127).
The advantages of this analysis are obvious for the interpretation of verb derived nouns where a corresponding verb stem does not exist any longer:

\[(4.26)\] sprechen - der Spruch
fliegen - der Flug
setzen - der Satz
schieben - der Schub
werfen - der Wurf
betrügen - der Betrug
heben - der Hub

If zero derivation was assumed for the above nouns, it would be necessary to posit underlying stems which do not surface but which would have to be accessible for derivation. On the other hand, since in the hypothesis presented here umlauted stems are assumed to be listed in the permanent lexicon, the noun stems on the right above can be interpreted as the result of morphological conversion, although a corresponding verb stem which could serve as a basis does not exist any longer. The topic would deserve considerably more discussion, but since it is not a central issue in this paper, the above may suffice to hint at the parallels between "zero-derived" stems and umlaut.

4.4 Summary

In this chapter, a model for a lexical phonology of German has been sketched, whose framework offers plausible explanations for morphological and phonological processes. The principal insights arrived at are that,

1. German morphology operates at a non-native and a native level, with
the corresponding phonological processes interacting with the morphological processes, and (2) the permanent lexicon lists a variety of stems.

In particular the second claim may seem bold, but earlier approaches have always had to develop numerous and complex rules to account for the variety of umlaut and ablaut phenomena. It has been argued in the foregoing that a hypothesis in which umlauted and even complex stems are lexicalized is ultimately more economical. In presenting this hypothesis, it has been tacitly assumed that the organization of the lexicon in German has changed with time, and that the now lexicalized stems were at one point the result of derivation, presumably at level 1. It would doubtless shed more light on the phenomena encountered in modern German to develop a historical model in which umlaut and ablaut were still productive processes.

As the German language presents itself today, however, it seems to be the optimum approach to reserve non-native derivation, which is becoming opaque, for level 1, with all the non-native phonological processes taking place at that level as well. The entire native morphology and phonology, on the other hand, is dealt with at level 2, which makes it possible to incorporate the output of level 1 inside the native processes.
5.0 CONCLUSION

The purpose of this thesis has been to analyze German word stress, and lexical phonology was chosen as the framework for this study. In the following, the results of this investigation will be briefly recapitulated.

On the basis of the model of the lexicon developed in the previous chapter, it has been shown that German phonology interacts with the morphology at two different levels, a level of non-native derivation, and a level at which native derivation, inflection and compounding take place. Justification for positing these two levels was seen in morphological as well as phonological criteria: morphologically, derivations effected at the non-native level are closely linked, often opaque as to individual morphemes, and nested inside any potentially attached native affixes, which are always attached on the outside of any non-native stem or affix. Native morphological processes on the other hand, proposed to take place at level 2, seem to be more transparent, and typically include inflection and compounding of non-native items.

This distinction into a non-native and a native level is accompanied by distinct phonological patterns. It has been shown that the non-native vowel system lacks the long:short contrast which is phonemic in the native system, and that in non-native derivations tense vowels are lengthened when they are assigned the main stress, stress shift being another strictly non-native phenomenon. Based on these characteristics, it has been proposed that different stress patterns operate for native and non-native material.
in German, and different rules for the erection of metrical structures were
developed. The basic non-native stress pattern has been identified as
operating essentially like Latin stress, i.e. stress is assigned on the
penultimate syllable, or the antepenultimate when the penult is light,
which translates into left dominant, quantity sensitive feet and right
dominant word trees. This pattern can be overruled when suffixes with
inherent stress are attached, which converts the entire derivation into an
item governed by final stress. It has been shown that, similar to category
features, final stress is always tied to the rightmost suffix and thus
causes stress shift. Implicit in this phenomenon is also that metrical
structures of this type are quantity insensitive. Native phonology, on the
other hand, is governed by rules assigning strictly left dominant, quantity
sensitive metrical structures, in derivations as well as in compounds, and
when native derivation incorporates non-native elements, the native
metrical structure takes over, embedding the non-native item both
morphologically and phonologically.

These processes, it has been argued, make the division into a non-
native and a native lexical level obvious, with the specific phonological
rules operating at the respective level, and only at that level (excluding
such phonological rules which operate at both levels, as for instance
syllabification). It has been argued that this division into levels, which
restricts non-native phonological rules to non-native morphological
processes, reflects a tidy and economical system, which should remove any
potential doubts that may initially have existed as to the postulation of
three stress patterns.
Among the fallout from this investigation is the insight that German stress and English stress are dissimilar, a fact which deserves mention in view of the claims made in the literature.

The model of the lexicon developed in chapter 4 may suffice to explain the basic processes and phenomena related to stress assignment in German. On the other hand, it has not been the intention to provide a comprehensive study of German morphology as well. Many aspects such as prefixing, morphological conversion, the contents of the permanent lexicon, among others, have merely been sketched, and are awaiting further research.


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eye
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bagatelle
station
valerian
balcony
ballet
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tie
banquet
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battery
to build
rustic
remarkable
to work (trans.)
to mean
unconditional
threatening
passable
enthusiasm
funeral
understandable
careful
to obtain
wholesome
to inform
gasoline
to advise
colonization
concrete
fraud
to cheat
matter (only in idiomatic phrases)
to bind
blasé
blue
lead
cauliflower soup
bloody
boycott
out of work
to spell
federation
federal treasury
bus
café
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female Chinese
Russian summer house
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<td>evakuieren</td>
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reflex
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wealth
to ride
profitability
news coverage
reptile
republic
giantess
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reed-bank
ruby
factual
neuter (gramm.)
sacrilege
parlor
to gather
meeting point
gatherer
Satan, the devil
set; sentence
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to vacuum-polish
scaffold
horrible
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to speak
saying
state
public railway
staff, stick
municipal engineering department
inter-city rapid transit
to sting
floor lamp
stitch
bull-necked
style
glottis
convict
strategist
to strike
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without sympathy
syntax
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systematic (adj.)
talent
to dance
wallpaper
keyboard
divisible
telegraph
telegraphy
telephone
tendentious
tenor
expensive
cabinet maker
tractor
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