TRAUGOTT, Elizabeth C. & Bernd HEINE (Hg.). *Approaches to Grammaticalization*. 2 Bde., Amsterdam/Philadelphia, Benjamins, 1991.

WEINRICH, Harald. *Textgrammatik der deutschen Sprache*. Mannheim, Dudenverlag, 1993.

WILLEMS, Klaas. *Kasus, grammatische Bedeutung und kognitive Linguistik. Ein Beitrag zur allgemeinen Sprachwissenschaft*. Tübingen, Narr, 1997.

WITTICH, Ursula & al. "Präpositionen in der deutschen Gegenwartssprache". In: *Sprachpflege* 24, 16-21, 1975.

ZIFONUN, Gisela & al. *Grammatik der deutschen Sprache*. Berlin/New York, de Gruyter, 1997.

RECENT DEVELOPMENTS IN PHONOLOGY

*Heinz Vater**

Resumo: Como quase nenhuma outra disciplina lingüística, a fonologia passou por uma evolução turbulenta nas duas últimas décadas. Ao contrário da abordagem clássica da Gramática Gerativa, que se concentrou na descrição de cadeias de segmentos fonológicos e de suas transformações em virtude de regras fonológicas, a Fonologia Não-linear colocou as relações prosódicas em enunciados em primeiro plano. A sílaba foi redescoberta como unidade prosódica; muitos trabalhos foram dedicados à análise de estruturas silábicas e de relações de sonoridade. Acima da sílaba, o pé e a palavra fonológica foram utilizados como unidades prosódicas relevantes para a descrição das estruturas de acento e entonação. Abaixo da sílaba, reabilitou-se a mora, já conhecida a partir da Filologia Clássica.

No presente artigo, descrevem-se, a partir de exemplos do alemão e de outras línguas, as duas abordagens principais da Fonologia Não-linear, a Fonologia Autosegmental e a Fonologia Métrica. Procura-se mostrar que, com esses modelos, alguns fenômenos prosódico-fonológicos que antes só podiam ser descritos com grandes dificuldades ou eram até mesmo indescritíveis podem ser analisados de maneira adequada e elegante.

Palavras-Chave: Fonologia Autosegmental; Fonologia Métrica; Fonologia Não-linear; Prosódia; Sílaba; Sonoridade.

Zusammenfassung: Wie kaum eine andere linguistische Disziplin hat die Phonologie in den letzten zwei Dekaden eine stürmische Entwicklung durchgemacht. Im Gegensatz zum klassischen Ansatz der Generativen Grammatik, der sich auf die Beschreibung phonologischer Segmentketten und ihrer Veränderungen durch phonologische Regeln

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konzentrierte, hat die Nichtlineare Phonologie prosodische Relationen in Äußerungsketten in den Mittelpunkt gestellt. Die Silbe wurde als prosodische Einheit wiederentdeckt; viele Arbeiten widmeten sich der Analyse von Silbenstrukturen und Sonoritätsrelationen. Oberhalb der Silbe wurden der Fuß und das phonologische Wort als relevante prosodische Einheiten zur Beschreibung von Akzent- und Intonationsstrukturen verwendet. Unterhalb der Silbe kam die aus der Klassischen Philologie bekannte More zu neuen Ehren.

Im vorliegenden Aufsatz werden die beiden Hauptansätze der Nichtlinearen Phonologie, Autosegmentale und Metrische Phonologie, anhand von Beispielen aus dem Deutschen und anderen Sprachen beschrieben. Es wird versucht zu zeigen, dass einige vorher nicht oder nur sehr umständlich beschreibbare prosodisch-phonologische Phänomene nach diesen Ansätzen adäquat und elegant analysierbar sind.

Stichwörter: Autosegmentale Phonologie; Metrische Phonologie; Nichtlineare Phonologie; Prosodie; Silbe; Sonorität.

Keywords: Autosegmental Phonology; Metrical Phonology; Non-linear Phonology; Prosody; Syllable; Sonority.

0. Introduction

Phonology has undergone a remarkable development during the last two decades. It did away with the rigid framework established by SPE (CHOMSKY & HALLE 1968) and resumed old roads of development that had been cut off by SPE, especially in the area of Prosodic Phonology. In doing so, modern phonology furnished a new framework that allowed for types of analysis unheard of before. This is especially true of the multiple tier approach in Autosegmental Phonology, which makes phonological analyses resemble musical scores (cf. VAN DER HULST & SMITH 1982).

My survey will concentrate on *Non-linear Phonology*, with its two main directions, *Autosegmental Phonology* and *Metrical Phonology*. Both

theories have been applied primarily to prosodic phenomena like syllable, accent and tone structure but had also impact on segments, e.g. concerning the analysis of affricates. Another important development has been the introduction of *Lexical Phonology* (cf. WIESE 1994): while in classical Generative Grammar, in the so-called *Standard theory*, morphology was reduced to "readjustment rules" transforming the output of syntax into an appropriate input for the phonological component, Lexical Phonology is based on the assumption that there is a close interaction between phonological and morphological processes in the lexicon, where morphological rules form the input for phonological rules and vice versa. Since many phonologists have given up Lexical Phonology during the last decade because it turned out to be too rigid and very often not compatible with the data of language, I will not include it in my survey.

1. From Classical Generative Phonology to Non-linear Phonology

The paradigm of Generative Grammar was first presented in CHOMSKY's *Syntactic Structures* (1957) and elaborated in CHOMSKY's *Aspects of the Theory of Syntax* (1965). Its application to phonology did not occur before the end of the sixties. CHOMSKY & HALLE (1968), *The Sound Pattern of English* (SPE), was the standard work of Generative Phonology up to the middle of the eighties. Classical Generative Phonology stands in opposition to Structural Phonology by considering two levels of phonological representation rather than one: phonological deep structure (also called *phonological representation*) and phonological surface structure (also called *phonetic representation*).

One of the central changes of SPE as opposed to Structural Phonology, its predecessor, concerns the basic entities of phonological description. In structural linguistics, the main entities of phonological description were phonemes. There are several different approaches to the definition of the phoneme. The most workable one stems from

TRUBETZKOY (1939) defining the phoneme as the minimal distinctive phonic entity (cf. RAMERS & VATER 1995, § 2.1), where *distinctive* is defined by means of oppositions occurring between so-called *minimal pairs* as demonstrated by (01); there are distinctive features like "voiced" vs "non-voiced" or "front" vs "back" underlying these oppositions.

(01) a Bein "leg" vs Pein "pain" ("voiced" vs "non-voiced")
b Reh "deer" vs roh "raw" ("front" vs "back")

In Generative Phonology, the basic entities are no longer phonemes but underlying segments (cf. RAMERS & VATER 1995, § 2.4). CHOMSKY & HALLE (1968: 11) practically abolished the phoneme: "We will make no further mention of 'phonemic analysis' or 'phonemes' in this study ...". They did so, since it turned out that phonological rules not only changed allophones – as in (02a) – but also phonemes as in German final devoicing (cf. (02b)); /b/ and /p/ are phonemes because they contrast in prevocalic position (cf. *Bein / Pein*).

(02) a Bach [bax] "brook" vs Bäche [bɛçə] "brooks"
([x] and [ç] are allophones)
b Diebe [di:bə] "thieves" vs Dieb [di:p] "thief"
(/b/ and /p/ are phonemes)

In standard theory, phonological representations consist, at every level, of a linear arrangement of segments and boundaries:

> "Segments are conceived of as unordered sets of features (with a feature specification). The boundaries interspersed between the segments are, with respect to their 'nature' and location, dependent on morphological and syntactic structure. They partition the string of segments into substrings that constitute possible domains for phonological generalizations. The hierarchical aspect of the morpho-syntactic structuring is only of limited importance for the application of phonological rules, with the one exception of stress rules. It is important to note that the segments are not grouped in terms of any other hierarchical structure, such as e.g. syllables." (VAN DER HULST & SMITH 1982: 3)

Underlying segments with their distinctive features are not predictable, whereas the realizations on surface structure – being the output of phonological rules – are predictable.

Thus, final devoicing in German involves all obstruents; they become voiceless at the end of a morpheme and before a consonant after a single morpheme boundary (#). In this way, chains like (03) are obtained which are associated with syntactic trees:

(03) ###zi##gebn##im##di##hand### *Sie geben ihm die Hand*
"they give him their hands"

A word is defined as "a string of formatives ... contained in the context ##__##" (CHOMSKY & HALLE 1968: 13). In addition, a clause is included in #...#.[1] Chains of segments like (03) undergo the following changes which are described by means of phonological rules (according to an old tradition, phonemic transcription is put between slashes and phonetic transcription between square brackets):

– *lengthening* of tense vowels under stress: /gebən/ becomes [ge:bən]; /im/ → [i:m]; in German, the tense vowels (earlier called "closed vowels") /i, y, e, ø, ɑ, u, o/ can be long or short, whereas the lax ("open") vowels /ɪ, ʏ, ɛ, œ a, ʊ, ɔ/ are always short; cf. *Ozon* [ot'so:n] "ozone", *Motte* [mɔtə] "moth";

[1] There is a third kind of boundary in SPE phonology "+", "for reasons having to do with the applicability of certain phonetic rules" (CHOMSKY & HALLE 1968: 13).

- *final devoicing* (*Auslautverhärtung*): obstruents (i.e. consonants with an opposition of voiced and voiceless like *Bein* vs *Pein*) become devoiced at the end of a syllable (which is not indicated in German orthography): /hand/ → [hant];

- *schwa elimination* between obstruents and sonorants (nasals and liquids, being always voiced); thus /ge:bən/ becomes [ge:bn];

- (progressive) *assimilation* of nasal consonants occurring immediately after obstruents (which is here the case after schwa elimination): [ge:bn] → [ge:bm]; as a result of an assimilation, a sound is more similar to a neighboured sound; here dental /n/ is assimilated to bilabial /b/ and becomes bilabial /m/.

After application of the rules, the boundary symbols are erased and the *phonetic representation* (04) obtains:

(04) zi ge:bm i:m di hant

Phonological rules have the general format (05):

(05) A → B / X __ Y (Chomsky & Halle 1968: 14)

That means: an element of type A is changed to B if it is preceded by X and followed by Y. The change produced by a phonological rule consists of a substitution, an addition or a deletion of features. According to Wurzel (1970: 260), final devoicing is encoded as a rule with voiced and voiceless obstruents as input and voiceless obstruents as output; this change takes place:

(i) before a double morpheme boundary – /d/ at the end of the first word in the compound *Handschuh* "glove" becomes [t]: [hantʃu:] – or

(ii) before a single morpheme boundary if a consonant follows.

Thus, *Jagd* "hunt" becomes [jA:gt] according to (i) and then [jA:kt] according to (ii). For reasons of simplicity, Wurzel does not specify the input as [+voiced]: voiceless obstruents undergoing this rule are not changed. The rule is encoded in terms of phonological features. (06) is an informal (and simplified) notation of the rule given by Wurzel (1970):

(06) [+obstr] → [–voiced] before (a) ##
(b) #[+consonant]

SPE phonology concentrates on changes of segments in a sequence. It can explain all kinds of complementary distribution of phonological segments. What it cannot explain are all kinds of prosodic (suprasegmental) phenomena like syllable and stress structure, tone contours, and intonation. In the SPE approach, attempts were made to deal with some of these phenomena (especially stress), but the theoretical frame did not allow for it, since it only provided linear chains rather than hierarchical phonological structures. The *Compound Rule* and the *Nuclear Stress Rule* (cf. Chomsky & Halle 1968) are an attempt to analyze stress in English by associating it with segments; this leads to very artificial solutions since stress is associated with syllables rather than with single segments (vowels and consonants).

Besides, there are some problems of segmental analysis that could not really be handled within the SPE framework. Consider the treatment of affricates. As early as in Structural Phonology the question was discussed whether affricates were to be considered to be monophonematic or biphonematic. Phonotactic regularities in German and other languages seem to advocate a monophonematic analysis, whereas their feature matrices do not allow for this analysis: Since each segment consists of a bundle of unordered features, there is a clash between the [–continuant] specification of the stop part and the [+continuant] specification of the fricative part; (07a) contains the two contradictory features in a single bundle together with other non-contradictory features as [+obstr]; (07b) treats the feature specifications as if they were contained in two succeeding bundles; this cannot be true of a single segment.

(07) a
$$\begin{bmatrix} -\text{continuant} \\ +\text{continuant} \\ \dots \end{bmatrix}$$

b
$$\begin{bmatrix} -\text{continuant}, +\text{continuant} \\ \dots \end{bmatrix}$$

SPE theory is, in accordance with GOLDSMITH (1976; quoted from VAN DER HULST & SMITH 1982: 5), an 'absolute slicing hypothesis'. A sequence of sounds is sliced; the slices (segments) are in linear order. Suprasegmental phenomena cannot be attributed to segments, since they concern relations between several segments (or entities of a higher order). Thus, stress is nothing else but "relative prominence" of a syllable.

According to VAN DER HULST & SMITH (1982: 2), there are two phases in the history of Generative Phonology. In the first phase (SPE), main emphasis was put on the derivational aspect, the elaboration of phonological rules relating phonological structures with phonetic ones. In the second phase, the representational aspect, i.e. the structure of phonological representations itself became more important. This development was introduced by the debate on abstractness. The problem was to define how abstract underlying phonological structures were allowed to be. The representatives of the abstractness principle tried to derive as much as possible by rules; their underlying phonological structures were very abstract, far away from surface realizations. WURZEL (1970), a of the principle of abstractness, postulates that native roots in German are monosyllabic, because the occurrence of schwa between obstruents and sonorants is predictable:

(08)	a Vater	/fatr/	"father"
	b Vogel	/fogl/	"bird"
	c Frieden	/fridn/	"peace"

The advocates of *Natural Phonology* (cf. VENNEMANN 1974 and HOOPER 1976) opposed the idea of abstractness. There were ardent debates that contributed to the elaboration of Non-linear Phonology. Another result of these discussions was the insight that phonology and morphology should be seen and analyzed in close interaction. This led to the elaboration of *Lexical Phonology*; part of the phonological rules were transferred to the lexicon to form an integrated phonological-morphological component within the lexicon (cf. KIPARSKY 1982).

Interestingly enough, a similar development took place in syntax, resulting in the elaboration of "lexicalist syntax" (cf. CHOMSKY 1970). More and more syntactic phenomena that formerly were derived by transformations were now treated in the realm of the lexicon. Thus, e.g., HÖHLE (1978) showed in his book on active-passive-relations in German, that the constructions under investigation could be described as syntactic frames associated with certain lexical entries.

Another reason for the development of basically new phonological theories was the growing interest in prosodic (suprasegmental) phenomena, connected with the insight that they could not be treated within the framework of SPE.

2. Non-linear Phonology: approaches and goals

Discussions of all the problems mentioned in section 1. led to the rise of Non-linear Phonology, which manifested itself in two approaches that basically developed independently of each other: *Autosegmental Phonology* and *Metrical Phonology*.

2.1 Autosegmental Phonology

Autosegmental Phonology was elaborated by LEBEN (1973), WILLIAMS (1976) and GOLDSMITH (1976), mainly in the field of tone contours,

harmony, and syllable structure. In the following, an account of the most characteristic autosegmental procedures developed in these areas will be given.

2.1.1 Tone contours

The specific pitches of syllables in a sequence form a melody, similar to music. The pitch structure of a sequence in language is called *intonation*. While most European languages associate such melodies only with sentences or phrases, there are languages like Ibo, Yoruba and Hottentott in Africa or Chinese, Tibetan, Thai, Malaian, Vietnamese and Aino in East Asia, where a special tone is associated with every syllable; this is called "tone contour".

KIECKERS (1931: 106) gives a very good illustration of the four tones to be found in Northern Chinese by using the German word *so*:

> "Es entwickelt sich folgendes Gespräch zwischen drei Männern, von denen der erste ein Experiment vorführt. Er sagt zum zweiten: du mußt es so machen. Der Ton setzt hier bei 'so' ziemlich scharf und hoch ein und verharrt in dieser Tonlage (so^1). Der zweite sagt in einer daran anschließenden Frage (indem er jetzt den Versuch macht): meinst du so? Der Ton setzt ebenfalls hoch ein, steigt aber noch etwas (so^2). Der erste antwortet: ja! Und nun sagt der dritte, der darüber erstaunt ist und nun auch das Experiment ausführen will: so? Der Ton setzt tief ein und steigt erst gegen Ende hoch (so^3). Da er es falsch macht, zeigt der erste es nochmals, wobei er ärgerlich sagt: nein, so! Der Ton setzt in mittlerer Höhe ein und sinkt gegen Ende stark (so^4)."[2]

[2] Speaker A shows B how to carry out an experiment, saying: *you have to do it so*^{1} (i.e. "this way"), persevering on a high pitch. B asks: *so*^{2}*?* ("like this?"). Here, we have a high, rising tone. A says: *yes*. A third person C, who also wants to carry out the experiment, asks: *so*^{3}*?* ("like this?"); this tone starts on a low level and rises towards the end. Since he does it wrong, A shows it another time, uttering: *no, so*^{4} ("this way"), with the tone starting on a medium pitch and falling towards the end.

In typical tone languages, tone is distinctive, i.e. serves to distinguish otherwise homophonous (monosyllabic) words; thus, in Chinese, *fu*^{1} means "husband", *fu*^{2} "luck", *fu*^{3} "prefecture", *fu*^{4} "rich". Tone contours can also be found in some European languages, namely Lithuanian, Serbo-Croatian, Swedish and Norwegian; however, in the two Scandinavian languages, tones patterns are associated with bisyllabic words rather than with monosyllabic ones (cf. Swedish *ànden* "the duck" vs *àndén* "the ghost"); this means that tones can only differenciate a small number of bisyllabic words.

There are two kinds of tones: *level tones* and *contour tones*. With level tones the pitch remains the same throughout (high, medium or low); with contour tones, pitch changes (falling, rising, falling-rising, etc.). According to the description of KIECKERS (1931: 106), only the first of the four tones of Northern Chinese is a level tone; the other ones are contour tones.

In some African tone languages, like Igbo, a phenomenon can be observed that is called *downdrift*. The tone is lowered gradually during an utterance:

(09) ó nà áìwà ínyà ígwè (VAN DER HULST & SMITH 1982: 6)

In the utterance, we find subsequent high and low tones. Usually, high tones are marked with "´" over the tone carrying vowel, low tones with "`" over the vowel; if the tones are described as separate entities "H" means "high", and "L" means "low". The utterance (09) has the tone pattern "H L H L H L H L", but in such a way that each H L pattern is lower than the preceding. The words *áìwà* and *ígwè* have the same pattern H L, but the phonetic realization is different. Whereas the differences between the tones are the same, H and L of the first word have a higher pitch than those of the second word; cf. (10), where "!H" marks a lowered high tone:

(10) H → !H / L __

In languages with downdrift, the H tones are not only lowered after L tones but also after F (where "F" marks a falling tone).

(11) H → !H / L v F __ (a high tone is lowered after L or F)

Since such a disjunction shows up again and again, a generalization must be missing. Low tones and falling tones behave alike in all relevant contexts. The generalization is as following: A falling tone F is composed of H and L; L, thus, is the relevant context for downdrift. Rule (10) is appropriate to explain both cases: H is lowered after L, regardless whether L is a level tone or the second part of a falling tone HL.

There are languages with contour tones not only on long vowels but also on short ones. Long vowels have always been interpreted as combinations of two short ones; the tone pattern HL of a falling tone can be distributed on the two "halves" of a long vowel. But a short vowel cannot be divided. Here we meet the same problem as with the description of affricates. We obtain a combination of two contradictory features [+high, –high]. All three notations of (12) are inadequate: (12a) contains a contradiction of features; (12b) contains a sequence of features, forbidden within a single segment; (12c) contains two segments, which is not an adequate description of a short vowel:

(12) a [+high, –high, ...]

b [+high, –high, ...]

c [+high, ...] [–high, ...]

Short vowels with contour tones cannot be represented within a strictly segmental theory. The autosegmental solution is as simple as radically new: Rather than one level of representation, there are postulated two *tiers* associated with each other. Every tier is an independent chain. In the upper tier, the tone structure of the utterance is indicated; in the lower tier the segments are located:

(13) tone tier [+high] [–high]

segmental tier [+cons, ...] [–cons, ...] [+cons, ...] [–cons, ...]

Van der Hulst & Smith (1982: 8) point out that this multi-tiered representation is similar to the notation of a song with the melody on top and the text at the bottom. Stressed vowels are associated with tone elements in the tone tier (cf. Halle & Vergnaud 1982: 66). Goldsmith (1976) formulates wellformedness conditions:

(14) (i) All tones have to be associated with at least one syllabic element.

(ii) All syllabic elements have to be associated with at least one tone.

(iii) Association lines must not cross each other.

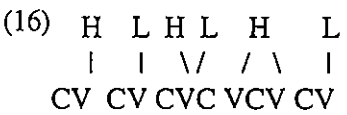
According to these stipulations, a tone can be associated with several segments, and vice versa. A short vowel that has a contour tone corresponds to a segment in the segmental tier being connected with two elements in the tonal tier:

(15) [+high] [–high]
\ /
[–cons]

For reasons that will become obvious in connection with the treatment of syllable structure, a third tier, called the *skeletal tier*, has been

postulated. The skeletal tier serves as an intermediate tier between the segmental tier and the tone tier. It contains abstract elements called C (from "consonant") and V (from "vowel") that form phonotactic constituents, i.e. have a function in syllable structure: V entities are syllabic, i.e. form syllable peaks and are usually (but not always!) connected with vowels in the segmental tier, whereas, by contrast, C entities are marginal, non-syllabic entities.

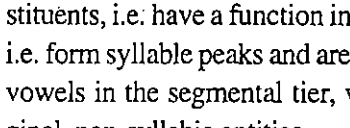
H and L can only be connected with V elements in the skeletal tier. (16) shows that there is not necessarily a 1:1 correspondence between the entities of the different tiers. The third H in (16) being connected with two V elements in the skeletal tier is an example of a phenomenon called *tone spreading*: there are languages in which several vowels of a sequence carry the same tone.

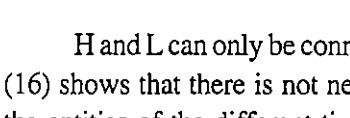
(16)


The theory is called *autosegmental*, because tones are considered to be autonomous segments (autosegments). Other prosodic phenomena also allow for a representation in terms of autosegments, as will be shown later. The adequacy of the multi-tier model can be shown in dealing with processes on one tier that do not necessarily have an influence on processes occurring on a different tier. Thus, in the Niger-Kongo language Etsako, we find reduplication like in (17b). The underlying form is (18a). The deletion of the first /a/ concerns only the segmental tier: The "remaining" tone L is then associated with the following vowel resulting in a rising contour tone on the short vowel (cf. (18b)).[3]

[3] This might remind us of the limerick about the young lady of Riga (cf. DAHL 1967): "There was a young lady of Riga / Who rode with a smile on a tiger. / They returned from the ride / With the lady inside / And the smile on the face of the tiger."

(17) a ówà "house"
b ówõwà "every house"

(18) a


b


2.1.2 Vowel and nasality harmony

Another suprasegmental phenomenon is *vowel harmony* in languages like Hungarian or Turkish. The Hungarian word *torok* "throat" contains only back vowels, the word *török* "Turkish" only front vowels. The combination of front and back vowels within a simple word is excluded.

Complex words (at least compound words) are treated as a sequence of simple words. This suprasegmental phenomenon is analyzed in Autosegmental Phonology in a similar way as spreading of tones (cf. (16) and (18b)). In the *harmony tier*, there is a feature [±back], which is associated with all vowels in a non-compound word. This means that the following tiers have to be postulated for a language with vowel harmony: segmental tier, skeletal tier, harmony tier. If a language has tones and vowel harmony, a fourth tier (the tone tier) has to be added.

The tiers should not be thought of as different layers but rather as different dimensions. Specific phonological processes can affect different tiers or association lines between tiers.

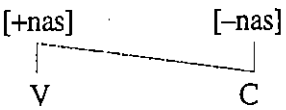
Another type of harmony concerns nasality (cf. VAN DER HULST & SMITH 1982: 22f). In Terena, an Indian language of South America, there is a morpheme (expressing subjects of verbs and first person possessive

pronouns) consisting only of nasality: a span of nasality extends from the beginning of a word, spreading to the right as far as the first stop or fricative which surfaces as a prenasalized obstruent. One may treat obstruents as opaque segments associated with an autosegment [–nas]. Prenasalized stops are then the result of a rule that spreads nasality (cf. (20)):

(19) a 'owoku "his house"

b 'õwõìu "my house"

(20)



What kind of features should be treated as autosegments? The answer is basically that each feature that behaves independently from all others can be localized on a special tier, "but that there are substantial constraints, related to matters of articulation, on the number of tiers present in languages" (VAN DER HULST & SMITH 1982: 23). GOLDSMITH (1979: 202) says:

> "What distinguishes autosegmental phonology from the *Sound Pattern of English* type of generative phonology is, first the development of a multi-linear phonological analysis in which different features may be placed on separate tiers, and in which the various tiers are organized by 'association lines' and a Well-Formedness Condition; and second, analysis of phonological phenomena less in terms of feature changing rules as such, and more in terms of rules that delete and reorganize the various autosegments, through the readjustment of the association lines."

2.1.3 Syllable structure

Syllable structure is a suprasegmental phenomenon treated as well in Autosegmental Phonology as in Metrical Phonology (cf. VAN DER HULST & SMITH 1982: 37ff, 42f). Like with tones and affricate structure,

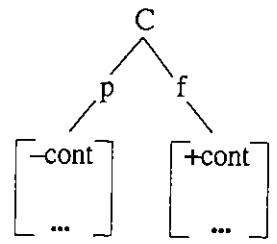
Autosegmental Phonology can represent associations between syllable structure and segmental structure which do not necessarily stand in a 1:1 correspondence.

As early as 1969, FUDGE remarks that linguistic chains are organized in two different ways simultaneously: on the one hand, there is the morpho-syntactic hierarchy, where segments are combined to morphemes, morphemes to words, words to phrases, etc.; on the other hand, there is a phonological hierarchy grouping segments to syllables, syllables to feet, feet to phonological words. This latter organization is called *phonotactics*. The Latin example in (21) illustrates this twofold organization: there is no 1:1 correspondence between morpho-syntactic and prosodic organization of a linguistic chain. (The dot within the phonological transcription marks the syllable boundary.)

(21) temp-us fug-it.
[tɛm.pUs fu:.gIt]

The basis of the autosegmental analysis of syllable structure is the assumption of a CV (or skeletal) tier indicating the phonotactic structure of a phonemic string. The affricate problem discussed above can now be solved: Two segments of the segmental tier (which have different values for the feature "continuant" [±cont]), as e.g. /pf/ in *Pfanne* "pan", are associated with one C entity of the skeletal tier because they behave phonotactically like one entity. The autosegmental analysis of affricates in (22) demonstrates that there is no 1:1 correspondence between the segmental tier and the skeletal tier:

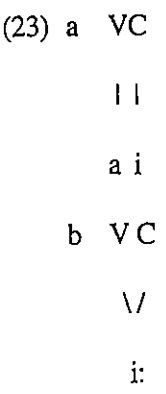
(22)



Another example is furnished by the treatment of long vowels. Already in Structural Linguistics (cf. MOULTON 1962), it was observed that long vowels behave phonotactically like diphthongs, i.e. as if they were combinations of two short vowels or rather a short vowels and a glide (i.e. a semivowel or rather a non-syllabic vowel).

(23) illustrates the autosegmental representations of a diphthong and a long vowel respectively. In the diphthong, the vowel is associated with V, and the glide with C; in the long vowel, the vowel is again associated with V, and the length is associated with a C-element in the CV tier. With long vowels, we find no 1:1 correspondence between the skeletal and the segmental tier: one segment of the segmental tier is associated with two entities of the skeletal tier.

(23) a

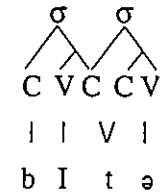


b

Some linguists – e.g. HOGG & MCCULLY (1987: 35ff) – represent a long vowel as a vocalic segment associated with two V elements in the skeletal tier. I think that this is an inappropriate representation, because V indicates a syllabic position.

Most linguists dealing with the phonology of German assume that intervocalic consonants like in *Mappe* "briefcase", *bitte* "please", *Jacke* "jacket", *Ebbe* "low tide", *Kladde* "notebook", and *Egge* "harrow" are *ambisyllabic*. In this case, the consonant is associated with two C entities in the CV tier:

(24)



In my opinion, this representation is problematic: usually, only long segments are associated with two entities of the CV tier. This is true of long vowels (see (23) above) as well as of long consonants. Long consonants – like [n:] in Italian *donna* "woman" or in German *rennen* "run" after elision of schwa ([rɛn:]) – are associated with two C entities, since they behave phonotactically like a consonant cluster. But German ambisyllabic consonants like /t/ in *bitte* are usually short. They have been postulated in order to explain the fact that in German a syllable is usually closed by a long vowel or a consonant. I tried to show (in VATER 1992) that German has syllables ending in short vowels and that the assumption of ambisyllabic consonants (terminating such "defective" syllables) is not adequate. It suggests that the consonants in question behave like long consonants, which they do not do.

The syllable peak is normally a vowel. But there are languages like Czech that allow for consonants (usually sonorants) as syllable peaks.

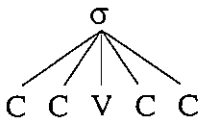
(25) Stř̌c př̌st skř̌s kř̌k.
"put (your) finger through (the) throat"

In German, the sonorants /l/, /m/, /n/ und /ɐ̯/ can form a syllable peak, as an alternative to the realization of schwa before sonorant (cf. (26)). In rare cases, an obstruent can form a syllable peak, as in the interjection *pst*.

(26)	a	Himmel	[hɪml]	"heaven"
	b	Atem	[ɑ:tm]	"breath"
	c	Ofen	[o:fn]	"stove"
	d	Regen	[re:gɐ̯]	"rain"

(27) constitutes a "flat" syllable structure, where the syllable is not subdivided into constituents. Such a model has been advocated by CLEMENTS & KEYZER (1983: 8) for English, French and other languages and by WIESE (1986: 3) for German, who proposes a syllable model with one V entity (constituting the peak) and four C positions (including those representing vowel length, cf. (23a) above):

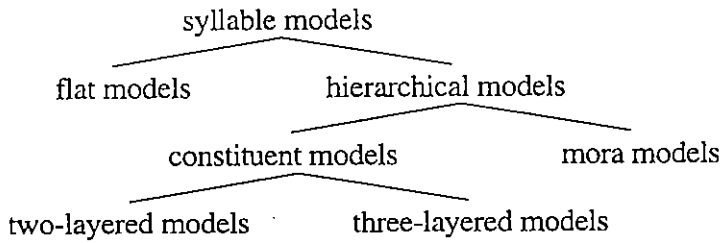
(27)



WIESE (1986, 1996) explains additional consonants – like the final consonants in *Mond* [mo:nt] "moon" (where one of the C positions is taken up by the length of the vowel), *Obst* [o:pst] "fruit" and *Herbst* [hɛrpst] "autumn" – as extrasyllabic. He observes that all of those extrasyllabic consonants or consonant clusters (/s/, /t/ or /st/) are coronal (from lat. *corona*), i.e. "using the tip or blade of the tongue" (LADEFOGED 1993: 5). WIESE (1986: 5) assumes that the syllable nucleus always consists of two elements. The assumption of a syllable nucleus (containing the peak and one more element) contradicts WIESE's postulation of a flat syllable model. Besides, the assumption of a nucleus consisting obligatorily of two elements does not allow for a distinction between light and heavy syllables, which seems to be relevant for the explanation of stress in German (cf. RAMERS 1992: 256).

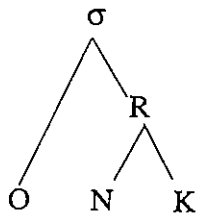
The flat syllable model is opposed to several types of hierarchical models:

(28)



I advocate the "classical" three-layered constituent model proposed by PIKE & PIKE (1947: 92) and adopted by FUDGE (1969: 273) and SELKIRK (1982: 341). This model, which I applied to the representation of German syllable structure in VATER (1992), is presented in (29) (R = rhyme, O = onset, N = nucleus, K = coda):

(29)

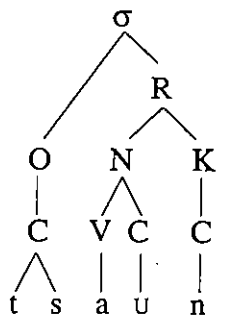


In the two-layered model used by NOSKE (1992), HALL (1992), NEEF (1996) and WIESE (1996), the constituent *rhyme* (R) is missing.

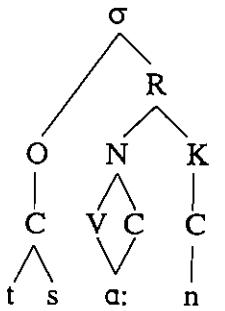
Whereas the constituent models operate with several different constituents (comparable to syntactic constituents), the mora models subdivide the syllable in so-called *moras* (weight entities). In mora models, the consonants preceding the syllable peak (forming the onset in constituent models) are considered to be "weightless" (cf. HAYES 1989, AUER 1991 and NOSKE 1992); they are not counted. Every short vowel and every coda consonant is counted as one mora; a long vowel counts as two moras.

In associating the constituent model of the syllable presented in (29) with the C/V entities of Autosegmental Phonology we obtain the following diagrams for *Zaun* "fence" and *Zahn* "tooth":

(30)



(31)



There is a general belief among phonologists that in describing syllable structure a phenomenon called *sonority* has to be taken into consideration. Although the phonetic substrate of sonority has not really been discovered yet, we know that the sonority of a syllable is minimal at the edges and grows towards the *syllable peak* (which is the most sonorous element of a syllable). The sonority scale for syllables is obviously universal. It is true of all languages possessing sonorants that these are more sonorous than obstruents and that vowels are more sonorous than sonorants. (32) contains examples from German, (33) from English, (34) from French – all witnessing the same kind of sonority hierarchy:

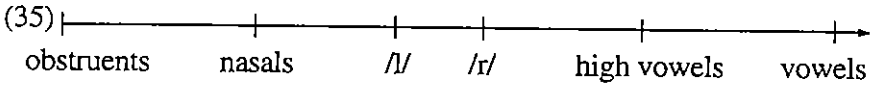
(32)	a	Zelt	/tselt/	"tent"
	b	Gruft	/gruft/	"grave"
	c	Pflicht	/pflɪçt/	"obligation"

(33)	a	hand	/hænd/	
	b	cleft	/kleft/	
	c	risk	/rɪsk/	

(34)	a	verbe	/verb/	"verb"
	b	triste	/trist/	"sad"
	c	disque	/disk/	"disk"

The universality of sonority can be influenced by language specific facts (like lack of glides). Wiese (1996: 260) proposes the sonority scale (35), with sonorants being differentiated in three groups (nasals, /l/ and /r/) (for a criticism of this scale and a proposal of a different scale, cf. Neef (1996) and Vater (1998)).

(35)



2.2 Metrical Phonology

The theory of Metrical Phonology was created in the investigation of stress phenomena and later extended to include other phenomena like vowel harmony and syllable structure, thus competing with Autosegmental Phonology. Let us first look at the metrical theory of stress. Two different procedures have been proposed in order to deal with stress: metrical trees and metrical grids. They partially compete and partially complement each other.

2.2.1 Metrical trees

Metrical trees represent the stress pattern of a word by means of binary branches whose nodes are labelled "S" (for "strong") and "W"

(for "weak") according to the American tradition (cf. LIBERMAN & PRINCE 1977, HALLE & VERGNAUD 1980, HOGG & MCCULLY 1987). I prefer the small letter labels "s" and "w" used in the German tradition (e.g. WIESE 1996). (36) represents the two possible patterns of bisyllabic words (main stress on a syllable is indicated by a preceding accent mark):

(36) a

```
    .
   /\
  s  w
['gy: tə]
 Güte    "goodness"
```

b

```
    .
   /\
  w  s
[by 'ro:]
 Büro    "office"
```

Non-binary, asymmetrical and irreflexive trees are forbidden:

(37) a

```
*  .
  /|\
 w s w
```

b

```
*  .
  /\
 s  s
```

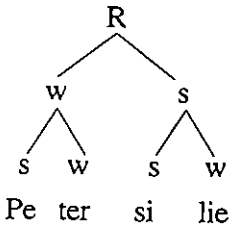
c

```
*  .
   |
   w
```

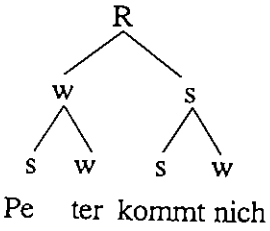
Stress is a relational property: you cannot associate stress with a single segment. Thus, the irreflexive tree (37c) does not make sense. Since "s" is a relational feature (meaning "stronger than"), (37b) does not make sense either. (37a) would mean that the first and the third syllable are equally weak in relation to the second; in general, this is not the case as will be shown in the following examples.

The stress structure of syntactic constituents (phrases and sentences) can be represented in the same way as the stress structure of words, as can be shown by the examples (38) and (39) from German, where (38) illustrates the prosodic structure of the word *Petersilie* "parsley" and (39) the prosodic structure of the sentence *Peter kommt nicht* "Peter comes not", i.e. "Peter is not coming" ("R" is, according to HOGG & MCCULLY (1987: 66), "a simple way of annotating the root or topmost node of the tree"; i.e. it is used as a cover term for words and syntactic constructions):

(38)

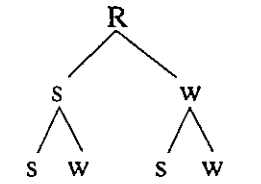


(39)

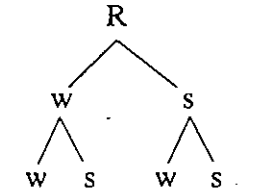


In both cases, we have a bipartition in w and s (s following w) on the upper level; both constituents are then split up into s and w (in this order). This does not mean that all sequences of four syllables have the same structure, as can be witnessed by words like *Winterkleidung* "winter clothing" (cf. (40)), where the upper level consists of an [sw]-sequence, or the sentence *Der Tee ist heiß* "the tea is hot" (cf. (41)), where both first order constituents are split up into [ws]-sequences:

(40)

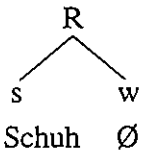


(41)

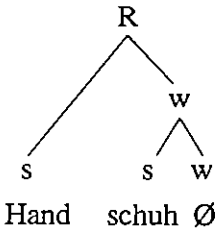


Since Metrical Phonology is based thoroughly on the representation of relations, it can handle prominence relations within words and syntactic constructions very well. But how can it deal with monosyllabic words? We saw that the occurrence of a lonely s or w is forbidden (cf. (37c)), because "s" means always "stronger than" and "w" means "weaker than"; i.e. they are relational notions. GIEGERICH (1985: 13) solves this dilemma by postulating zero constituents, thus reviving the zero elements known from Structural Linguistics. The German word *Schuh* "shoe" gets the metrical structure (42); the compound *Handschuh* "glove" is represented as in (43) (cf. GIEGERICH 1985: 277):

(42)



(43)



GIEGERICH (1985: 13) justifies his treatment of lexical monosyllables:

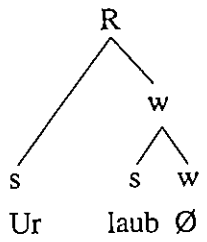
> "Giving them two bottom-level nodes, the left one being strong, allows us to treat prominence relationally even in these items."

It is assumed that in languages like English and German, the prosodic structure of complex words is, in general, isomorphic with the morphological one, i.e. that the morphological constituents behave prosodically in the same way as if they were free words; according to this assumption, the metrical structure of *Sonnenblume* "sunflower" is predictable from the metrical structure of *Sonne* [sw] and *Blume* [sw]; the compound has the constituents s and w, and each of them has, again, the constituents s and w. But this is not the whole truth as can be shown with the compound *Handschuh*; since *Hand* is monosyllabic, we would expect a metrical structure [sw] [sw] – i.e. two [sw]-sequences, the first dominated by s, the second by $\overset{s}{w}$ –, $\overset{w}{}$ where both w constituents match zero elements. But GIEGERICH (1985: 277) postulates the structure rendered above as (43). Since *Handschuh* is a "lexicalized compound", its constituents are fused and it behaves like a monomorphematic word like e.g. *Bantu*, i.e. the first zero-w is omitted. In *Tanzschuh* "dancing shoe", on the other hand, the first zero is kept. I am not quite satisfied with this treatment.

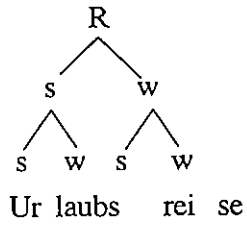
The procedure proposed for compounds works also with derived words: *Urlaub* "vacation" is a derived word containing the (unproduc-

tive) prefix *ur-* which carries the main stress; *-laub* (which also occurs in *erlauben* "to permit") has secondary stress and, therefore, is associated with s, w being a zero element. In *Urlaubsreise* "vacation trip", the first zero is omitted:

(44)



(45)



Trees contain a "designated" element which is exclusively dominated by s-nodes. It determines "culminative" properties of a phonological chain like stress in polysyllabic sequences or the peak in a syllable. In the following, I will concentrate myself on simple nouns.

Stress is distributed backwards, beginning with the end of a word. The distribution of stress in a word is highly dependent on its syllable structure. According to Liberman & Prince (1977: 271), a syllable is usually heavy, if it contains a long vowel or a diphthong or if the vowel is followed by one or more consonants. If the last syllable (also called "ultima") is heavy, it receives stress: *Mu'sik* "music". If the last but one syllable ("penultima") is heavy, it receives the main stress: *A'roma* "aroma" *'Ä'quator* "equator". If the penultima is light, containing a short vowel and maximally one consonant, the preceding syllable ("antepenultima") receives the main stress, regardless whether it is heavy or light: *A'merika* "America").

Giegerich (1985: 48) notices that in German syllable weight depends on the position of the syllable:

> "[...] word-medially, a CVC sequence constitutes a heavy syllable and a CV sequence a light one, while word-finally CVCC sequences are heavy and CVC ones light. CVC is thus heavy in word-medial and light in word-final position."

This is illustrated by German words like *Assis'tent* "assistant" with a heavy final syllable vs *'Lexikon* "lexicon", where the final (as well as the medial) syllable is light and cannot receive stress.

A sequence consisting of a stressed syllable followed by unstressed syllables is called a *foot*. Typical examples of simple words forming a foot in German are monosyllabics like *Fuß* "foot", bisyllabics like *Schule* "school" and trisyllabics like *rettete* "saved". Schwa syllables in German are always unstressed; thus they are predestined to form weak syllables. In German, there are feet consisting of a stressed syllable followed by as many as three schwa syllables like *goldenere* "being more golden" (inflected form). In agreement with the given definition of foot, there are as many feet in a word as there are stressed syllables. A bisyllabic word can contain two feet as can be seen in *Arbeit* "work", *Heimat* "home (country)", *Demut* "humility" and in derived words like *Urlaub* "vacation", *Schönheit* "beauty" or *Handlung* "action". In these words, the first foot carries the main stress (primary stress), whereas the second foot carries a second(ary) stress.

There are, of course, also words, where the second foot carries primary stress, as e.g. in *Bäckerei* [bekW'raj] "bakery" or *Rarität* [rAri'te:t] "rarity". Giegerich (1985: 201) attributes the elision of the zero syllable in *Urlaubsreise* "vacation trip" (cf. (45)) to "defooting", which occurs in his opinion in compounds of German.

According to NESPOR & VOGEL (1986: 109), the prosodic category immediately dominating the foot is the *phonological word*. This entity is, at the same time, the lowest constituent of the prosodic hierarchy that makes "substantial use of nonphonological notions". Thus, "the phonological word represents the interaction between the phonological and the morphological components of grammar" (ibid.). Every word constitutes a phonological word. Usually, also words forming constituents of (non-lexicalized) compound words are considered to be phonological words. Thus, *Haustür* "front door" and *Rotlicht* "redlight" consist of two phonological words. Lexicalized compounds like *Handschuh* "glove" and *Hochzeit* "wedding" usually are considered to form only one phonological word.

Whether there are also affixes forming phonological words is a matter of debate. Some linguists assume that suffixes starting with a consonant (like *-lich* and *-nis* in German) form phonological words, whereas affixes that begin with a vowel do not form phonological words by themselves but are integrated in the phonological words they are attached to.

2.2.2 Metrical grids

KAGER (1995: 382) gives the following definition of *grid*:

> "The grid is a hierarchical representation of stress and rhythm, and its purest form eliminates reference to the notion of constituency. It consists of a sequence of columns of grid marks whose height represents *prominence levels*, while horizontal distance between marks represents *rhythmic structure*. All syllables are represented by a mark at the lowest layer, stressed syllables by a mark on the next layer up, while distinctions between main and secondary stresses are represented at still higher layers."

The metrical grid was originally considered to be autonomous (cf. VAN DER HULST 1984), with construction principles matching those of metrical tree theory. HOGG & MCCULLY (1987: 130) think that a metrical grid shows the relative prominence of syllables in a more detailed way than a tree.

According to FÉRY (1986), the grid is built up by first giving each syllable one beat (level 1), then adding a beat for each syllable with a full vowel (level 2). Finally, a beat is added to the syllable with the most prominent full vowel. The more syllables the word has the more beats we need for marking the relative prominence of each syllable. The levels correspond to steps in the derivation of the accent pattern of a word and, at the same time, to horizontal layers of the final pattern (i.e. to the three rows in (46)). FÉRY (1986) describes the stress structure of German words. In German, the class of "full vowels" can be defined as all vowels except schwa (and the "r-vowel" [ɐ], which is derived from the combination of schwa and consonantal /r/). NEEF (1998) uses the cover term *Reduktionssilbe* (*reduction syllable*) for syllables with schwa, [ɐ] and with a syllabic consonant (like [ml] in [hɪml] *Himmel* "heaven"; cf. (26) above) The procedure proposed by FÉRY (1986) is illustrated in (46):

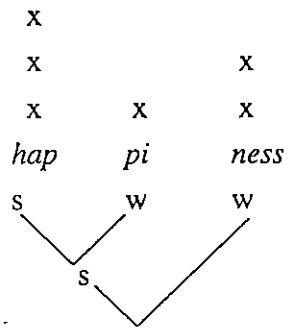
(46)

x		
x		x
x	x	x
wun	*der*	*lich*

On level 1, all syllables of the word *wunderlich* "strange" receive one beat. On the second level, the two syllables with full vowels receive one more beat. On the third level, the first syllable, being the most prominent one, receives an additional beat. It has to be added that *wunderlich* is a derived word with the "normal" suffix *-lich*, i.e. a suffix that does not get stress (in contradistinction to a suffix like *-erei* that gets stress, cf. *Bäckerei* "bakery", mentioned above). Thus, the stress pattern of the base word *Wunder* ("miracle") is kept when the suffix is added.

LIBERMAN & PRINCE (1977) think that trees and grids can be combined to result in representations like (47):

(47)



As far as I can see, the theory of Metrical Phonology has its merits in revealing the relative prominence of syllables within a word or a syntactic construction (phrase or sentence). It can do this in a more elegant and more natural way than SPE. But Metrical Phonology is not free from dogmatic preoccupations either: It forces us to handle all kinds of stress phenomena by using binary structures. But there are words and even syntactic constructions consisting of one syllable only (cf. *Haus* "house", *Ei* "egg", *nur* "only", *nein* "no" etc.). Since a lonely "s" (or a lonely "w", cf. (37c)) is forbidden, we are left in the lurch. GIEGERICH (1985) makes excessive use of zero syllables to deal with monosyllabics in his otherwise excellent account of stress and syllable structure in English and German.

Autosegmental Phonology is freer in this respect, since it is not bound to binary structures. But both, Autosegmental and Metrical Phonology, have one characteristic feature in common: In associating stress to syllable structures, they rely heavily on "syllable weight" (i.e. on the interpretation of a syllable as "light" or "heavy"). This leads to all kinds of problems (cf. VATER 1992).

There are obviously "light" syllables which can get stress though they should not. Thus, GIEGERICH (1985: 24ff) has a stress rule saying

that in German (as in English), the last syllable receives stress if it is heavy. This is true of *De'kan* "dean", *Mo'ral* "morality", *Diszi'plin* "discipline", *Pe'ru* "Peru", *Che'mie* "chemistry", but not of *Fa'gott* "bassoon", *Me'tall* "metal", *Dia'gramm* "diagram", *Ty'rann* "tyrant", *Kon'greß* "congress", *Ske'lett* "skeleton", where the last syllables are light. According to GIEGERICH (1985: 82), "... the final syllable in /fagɔt/ behaves like a heavy one although it shouldn't really ... because regularly such a syllable would be light – compare *Fa'gott* and *'Margot'* (a name). It has to be remembered that a CVC sequence is heavy in word-medial position but light in word-final position (cf. section 2.2.1 above). GIEGERICH solves the problem by treating the final consonant in *Fa'gott* etc. as an underlying geminate (i.e. [tt]) which is later shortened. This explanation does not convince me.

3. An alternative stress theory: EISENBERG (1991)

Peter EISENBERG (1991) developed an alternative theory of stress in German – which could also be applied to English and other languages. This theory is not only simpler than the one by LIBERMAN & PRINCE (1977) and GIEGERICH (1985) but in my view also more adequate. It avoids the problems discussed in connection with the autosegmental and metrical analyses and reduces the number of exceptions. EISENBERG (1991: 37ff) makes the following assumptions:

(i) Stress patterns are connected with feet.

(ii) The "word" as a prosodic entity is an inflected word rather than the stem (as e.g. realized in the nominative singular of nouns and the imperative of verbs).

(iii) The relation between "stressable syllables" and "stressed syllables" is most relevant for the determination of the prosodic structure of a word.

EISENBERG (1991: 44) thinks that it is wrong to consider a word like *Haus* "house" as monosyllabic. You have to work with the inflected form *Häuser* (plural); then you will see that *Häuser* and *Meter* "meter" follow the same trochaic pattern {–_}, which is the main pattern of simple (underived) words in German. All syllables with full vowel are stressable; all syllables with schwa are unstressable. Among the stressable syllables there is a subset of syllables that are really stressed, and among these there is a subset of usually one syllable receiving the main stress (for this reason, "stress structure" and "accent structure" have to be distinguished, the latter one determining the syllable with main stress among all stressed syllables). In non-native words, main stress can fall on the last syllable: [by'ro:] *Büro* "office", [kroko'di:l] *Krokodil* "crocodile", [anato'mi:] *Anatomie* "anatomy". In order to take account of words with the main stress on the penultima like ['auto] *Auto* "car" or antepenultima ['ananas] *Ananas* "pineapple", we probably have to consider syllable weight, though this factor cannot be responsable for stress differences between words like *'Auto* and *Bü'ro*. EISENBERG (1991: 62) can explain a part of these stress differences because the nouns belong to different inflexional paradigms (cf. *Fa'gott* and *'Margot*).

The word ['ro:zə] *Rose* "rose" consisting of a stressable and an unstressable (schwa) syllable and the word ['ɛço] *Echo* "echo" consisting of two stressable syllables obtain the same stress (and accent) patterns:

(48)	a	syllable sequence:	{[ro:][zə]}
		stress potential:	{ +, – }
		stress structure:	{ –, _ }
		accent structure:	{ Â, _ }
	b	syllable sequence:	{[ɛ][ço]}
		stress potential	{ +, + }
		stress structure:	{ –, _ }
		accent structure:	{ Â, _ }

"Â" indicates the main (primary) stress. With bisyllabic words, stress and accent structure are identical. *Rose* and *Echo* both follow the trochaic pattern. Eisenberg (1991: 47) says: "Der Trochäus {Â,_} ist *das* Substantivmuster." ("The trochee {Â,_} is *the* noun pattern.") FÉRY (1996) also thinks that the trochee is the most characteristic stress pattern of German nouns.

There are, of course, also dactylic feet like ['rɛtətə] *rettete* "saved". Their structure is totally predictable since they contain two schwa syllables after the stressed syllable; schwa syllables are unstressable. A foot with four syllables like *goldenere* can be reduced to a trisyllabic foot (in this case *goldnere*; cf. EISENBERG 1991: 62).

For derived words, there is also a strong tendency to use the trochaic and dactylic pattern. In forms containing more than three syllables, we usually find combinations of bisyllabic and trisyllabic feet. The word *Afri'kanerinnen* "African women" gets the following stress and accent structure:

(49)	syllable sequence:	{[a][fri][ka:][nə][rɪ][nən]}
	stress potential:	{ + + + – + – }
	stress structure:	{ – _ – _ – _ }
	accent pattern:	{ – _ Â _ – _ }

Compound words like *Apfelbaum* "apple tree" and *Autoverkäufer* "car seller" obtain the same stress pattern as their component words, main stress usually being placed on the first component (*'Apfelbaum*, *'Autoverkäufer*). EISENBERG's procedure has several positive consequences:

(i) It can do without measuring the "syllable weight" (which is a problematic factor).

(ii) The stress patterns of native and non-native words can be determined with the same procedure.

(iii) The trochaic pattern turns out to be the relevant pattern for simple words.

4. Summary

Recent theories of phonology, especially the two main approaches of Non-linear Phonology, Autosegmental and Metrical Phonology, have brought a considerable progress, especially in the field of Prosodic Phonology. They have furnished a frame work and a methodology that allows the analysis of phenomena like tone, stress and syllable structure, and intonation (which I have not included in this report); these really were not analyzable in the SPE framework.

The competing models of Autosegmental and Metrical Phonology are almost equally effective and have partially obtained good results in the same fields (especially in syllable structure). But both have their shortcomings. I am not sure whether Autosegmental Phonology is adequate for analyzing stress. WIESE (1996) analyzes stress in terms of Metrical Phonology although he uses the autosegmental approach for the analysis of syllable structure and other prosodic phenomena. Metrical Phonology, on the other hand, is somewhat dogmatic, forcing us to execute only binary analyses of syllable and stress structure, as I pointed out. Both theories are still developing.

There are a few newer approaches, inside and outside Autosegmental and Metrical Phonology, some of which I discussed briefly. The stress theory advocated by EISENBERG (1991) seems to be especially promising to me, since it is simpler than the metrical approach to stress by LIBERMAN & PRINCE (1977) and GIEGERICH (1985) and, at the same time, more natural, avoiding abstract solutions like zero syllables, underlying geminates, etc. Among other theories that have been elaborated recently, there is the so-called Word-Design Theory (NEEF 1996) which attempts to take the interaction of (prosodic) phonology and morphology into account. As far as I can determine, the analyses carried out within this framework are more convincing than those done in Lexical Phonology (cf. section 1).

Optimality Theory (OT) – praised as "THE Linguistic Theory of the 1990s" by ARCHANGELI (1997: 1) – is a very systematic theory that has been applied to various linguistic fields and topics, especially those in the area of phonology. Since the description of this theory requires a detailed explanation of the highly formalized notations of the employed apparatus, it was not included into this account. ARCHANGELI (1997) can be recommended as a very clear introduction into OT.

On the whole, there is a strong tendency in phonology (as well as in morphology) to analyze all phenomena by considering only their surface structure (or a couple of related surface structures as in Autosegmental Phonology) rather than to derive surface representations from underlying structures as was done before in SPE.

References

ARCHANGELI, Diana. "Optimality Theory: An Introduction to Linguistics in the 1990s". In: ARCHANGELI & LANGENDOEN (eds.), 1-32, 1997.

ARCHANGELI, Diana & D. Terence LANGENDOEN (eds.). *Optimality Theory. An Overview*. Oxford, Blackwell, 1997.

AUER, Peter. "Zur More in der Phonologie". In: RAMERS & WIESE (eds.), 3-36, 1991.

CHOMSKY, Noam. *Syntactic Structures*. The Hague, Mouton, 1957.

CHOMSKY, Noam. *Aspects of the Theory of Syntax*. Cambridge, Mass., MIT Press,1965.

CHOMSKY, Noam. "Remarks on Nominalization". In: JACOBS, Roderick A. & Peter S. ROSENBAUM (eds.). *Readings in English Transformational Grammar*. Waltham, Mass., Ginn and Company, 184-221, 1970.

CHOMSKY, Noam & Morris HALLE. *The Sound Pattern of English*. New York, Harper & Row, 1968.

CLEMENTS, George N. & Samuel J. KEYZER. *A Generative Theory of the Syllable*. Cambridge, Mass., MIT Press, 1983.

DAHL, Jürgen (ed.). *Limericks, Limericks*. Frankfurt a. M., Fischer, 1967.

EISENBERG, Peter. "Syllabische Struktur und Wortakzent". In: RAMERS & WIESE (eds.), 37-64, 1991.

EISENBERG, Peter, Karl-Heinz RAMERS & Heinz VATER (eds.). *Silbenphonologie des Deutschen*. Tübingen, Narr, 1992.

FÉRY, Caroline, 1986. "Metrische Phonologie und Wortakzent im Deutschen". In: *Studium Linguistik* 20, 16-43, 1986.

FÉRY, Caroline. "German Foot and Word Stress in OT". In: *Nordlyd* 24, 63-96, 1996.

FUDGE, Erik C. "Syllables". In: *Journal of Linguistics* 5, 253-286, 1969.

GIEGERICH, Heinz. *Metrical phonology and phonological structure: German and English*. Cambridge, University Press, 1985.

GOLDSMITH, John A. *Autosegmental Phonology*. Bloomington, Indiana University Linguistics Club, 1976.

GOLDSMITH, John A. "The Aims of Autosegmental Phonology". In: DINNSEN, Daniel (ed.). *Current Approaches to Phonological Theory*. Bloomington, Indiana University Press, 202-223, 1979.

GOLDSMITH, John A. (ed.). *The Handbook of Phonological Theory*. Oxford, Blackwell, 1995.

HALL, Tracy A. *Syllable Structure and Syllable-Related Processes*. Tübingen, Niemeyer, 1992.

HALLE, Morris & Jean-Roger VERGNAUD. "Three-Dimensional Phonology". In: *Journal of Linguistic Research* 1, 83-105, 1980.

HALLE, Morris & Jean-Roger VERGNAUD. "On the Framework of Autosegmental Phonology". In: VAN DER HULST & SMITH (eds.), 65-82, 1982.

HAYES, Bruce. "Compensatory Lengthening in Moraic Phonology". In: *Linguistic Inquiry* 20, 253-306, 1989.

HOGG, Richard & Chris B. MCCULLY. *Metrical Phonology: A Coursebook*. Cambridge, University Press, 1987.

HÖHLE, Tilman. *Lexikalistische Syntax. Die Aktiv-Passiv-Relation und andere Infinitkonstruktionen im Deutschen*. Tübingen, Niemeyer, 1978.

HOOPER, Joan Bybee. *An Introduction to Natural Generative Phonology*. New York, Academic Press, 1976.

KAGER, René. "The Metrical Theory of Word Stress". In: GOLDSMITH (ed.), 367-402, 1995.

KIECKERS, Ernst. *Die Sprachstämme der Erde*. Heidelberg, Winter, 1931.

KIPARSKY, Paul. "From cyclic phonology to lexical phonology". In: VAN DER HULST & SMITH (eds.), 131-175, 1982.

LADEFOGED, Peter. *A Course in Phonetics*. 3rd ed., New York, Harcourt, 1993.

LEBEN, William. *Suprasegmental Phonology*. PhD dissertation MIT, 1973.

LIBERMAN, Mark & Alan PRINCE. "On stress and linguistic rhythm". In: *Linguistic Inquiry* 8, 249-336, 1977.

MOULTON, William. *The Sounds of English and German*. Chicago, University Press, 1962.

NEEF, Martin. *Wortdesign. Eine deklarative Analyse der deutschen Verbflexion*. Tübingen, Stauffenburg, 1996.

NEEF, Martin. *Elemente einer deklarativen Wortgrammatik*. Hürth, Gabel, 1998.

NESPOR, Marina & Irene VOGEL. *Prosodic Phonology*. Dordrecht, Foris, 1986.

NOSKE, Roland. "Moraic vs. Constituent Syllables". In: EISENBERG, RAMERS & VATER (eds.), 284-328, 1992.

PIKE, Kenneth & Eunice PIKE. "Immediate constituents of Mazateco syllables". In: *International Journal of American Linguistics* 13, 78-91, 1947.

RAMERS, Karl Heinz. "Ambisilbische Konsonanten im Deutschen". In: EISENBERG, RAMERS & VATER (eds.), 246-283, 1992.

RAMERS, Karl Heinz & Heinz VATER. *Einführung in die Phonologie.* 4th ed., Hürth, Gabel, 1995.

RAMERS, Karl Heinz & Richard WIESE (eds.). *Prosodische Phonologie.* Göttingen, Vandenhoeck & Ruprecht, 1991.

SELKIRK, Elizabeth. *The Syntax of Words.* Cambridge, Mass., MIT Press, 1982.

TRUBETZKOY, Nikolai S. *Grundzüge der Phonologie.* Göttingen, Vandenhoeck & Ruprecht, 1939 (5th ed., 1971).

VAN DER HULST, Harry. *Syllable Structure and Stress in Dutch.* Dordrecht, Foris, 1984.

VAN DER HULST, Harry & Norval SMITH. "An overview of Autosegmental and Metrical Phonology". In: VAN DER HULST & SMITH (eds.), 1-45, 1982.

VAN DER HULST, & Norval SMITH (eds.). *The structure of phonological representations (part 1).* Dordrecht, Foris, 1982.

VATER, Heinz. "Zum Silben-Nukleus im Deutschen". In: EISENBERG, RAMERS & VATER (eds.), 100-133, 1992.

VATER, Heinz. "Zur Silbenstruktur im Deutschen". In: KRÖGER, Bernd J., Christine RIEK & Georg SACHSE (ed.). *Festschrift Georg Heike.* Frankfurt/Main, Hector, 137-149, 1998.

VENNEMANN, Theo. "Words and syllables in natural generative phonology". In: *Natural phonology parasession.* Chicago, Chicago Linguistic Society, 346-374, 1974.

WIESE, Richard. "Zur Theorie der Silbe". In: *Studium Linguistik* 20, 1-15, 1986.

WIESE, Richard (ed.). *Recent Developments in Lexical Phonology.* Düsseldorf, Heinrich-Heine-Universität (=*Theorie des Lexikons. Arbeiten des SFB 282. Nr. 56*), 1994.

WIESE, Richard. *The Phonology of German.* Oxford, Clarendon, 1996.

WILLIAMS, Edwin. "Underlying Tone in+ Margi and Igbo". In: *Linguistic Inquiry* 7, 463-484, 1976.

WURZEL, Wolfgang U. *Studien zur deutschen Lautstruktur.* Berlin, Akademie-Verlag, 1970.

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