

# German schwa in prosodic morphology<sup>1</sup>

The subsyllabic constituent of the mora (Hyman 1985, McCarthy and Prince 1986, 1989, 1990, Zec 1988, Itô 1989, Auer 1991) can account nicely for the alternation between the syllabic and non-syllabic state of the sonorant in German, as in *Atem* 'breath'/'*atmen* 'to breathe' and *Segel* 'sail', *segeln* 'to sail'/'*Segler* 'sailor', if it is assumed that, in such forms, the liquids and the nasals of the rime form a moraic constituent, but the schwa does not. The surface schwa (or the vocalized *r*) is an alternative pronunciation of the syllabic sonorant and has no influence on the prosodic structure of these words. The prosodic constituents as moras, syllables and feet are crucial for the application of morphological processes. The stems enter affixation with a moraic structure but without syllable structure; on the contrary, they enter compounding with a syllable structure. This difference explains many alternations in the phonetic forms of words involving syllabic sonorants.

## 1. Alternation between syllabic and non-syllabic sonorants

In many German bisyllabic underived stems a syllabic sonorant is the nucleus of the second syllable, like in (1). Stems ending in a nasal are given in (1 i); the stems in (1 ii) and (1 iii) have /l/ and /v/ respectively.

- (1) (i) *Atm* 'breath', *ebn* 'even', *eign* 'own', *öffn* 'open', *ordn* 'order', *rechn* 'count', *segn* 'bless', *seltn* 'rare', *trockn* 'dry', *zeichn* 'sign'.
- (ii) *bettl* 'bed', *Buckl* 'hump', *Bügl* 'bow', *dunkl* 'dark', *edl* 'noble', *handl* 'trade', *kuppl* 'make a match', *Neb* 'fog', *samm* 'collect', *Segl* 'sail', *siedl* 'dwell', *übl* 'evil', *wickl* 'wrap', *zweifl* 'doubt'.
- (iii) *eifv* 'zeal', *eitv* 'pus', *fasv* 'fiber', *fielv* 'fever', *heitev* 'cheerful', *hungv* 'hunger', *magv* 'thin', *niedv* 'below', *silbv* 'silver', *wandv* 'wander'.

In these underived stems the facultative presence of a schwa merely indicates the syllabicity of the consonant; a normal way to pronounce the words is without a schwa, with a syllabic nasal or /l/ (see Duden 1976). /r/ is usually vocalized as /v/.

1 Several persons have helped me at different stages of the realization of this paper: Grzegorz Dogil, Jochen Geilfuß, Tilman Höhle, Karl-Heinz Ramers, Arnim von Stechow, Richard Wiese and Ede Zimmermann. I thank them here. Thanks also to Tim Coleman for correcting my English.



I will show below that schwa is non-moraic in these forms, and thus that its presence adds nothing to the syllabic structure.<sup>2</sup>

The forms in (2i) serve as the basis for further processes of word formation, viz. compounding (2ii) and derivation with affixes beginning with a consonant (2iii), as well as derivation with affixes of Class I and affix-like morphemes<sup>3</sup> beginning with a vowel (2iv). For the sake of syllabification these different processes amount to the same morphological operation, namely *compounding*.

- (2) (i) *Atem* 'breath, n.', *offen* 'open, adj.', *trocken* 'dry, adj.', *Segel* 'sail, n.', *Bügel* 'bow, n.', *dunkel* 'dark, adj.', *edel* 'noble, adj.', *mager* 'thin, adj.'.  
 (ii) *Edelstein* 'precious stone', *Segelboot* 'sailboat', *Magersucht* 'anorexia'.  
 (iii) *atemlos* 'breathless', *Trockenheit* 'dryness', *Dunkelheit* 'darkness'.  
 (iv) *Segelei* 'sailing', *segelähnlich* 'resembling a sail', *fiebrig* 'sort of fever'.

In an alternative pronunciation of these stems the sonorant is non-syllabic. This happens with Class II suffixes that begin with a vowel, and with inflectional vowels or nasals<sup>4</sup>. This operation can be called *affixation*, again for the sake of syllabification.

- (3) *Trockner* 'dryer', *Segler* 'sailor', (*kurz-* oder) *langatmig* 'short or long breathed', *adlig* 'noble', *niedrig* 'low'.

However if a suffix deprived of onset is appended, the sonorant is not always non-syllabic, as in (3). In some other cases it is syllabic, as in (4):

2 Not all schwas signal the syllabicity of a consonant. There are a lot of idiosyncratic schwas as in *Ebbe* 'low tide', *Tasse* 'cup', *Vennemann*, *Bangemann*, *General*... These schwas already appear in the underlying representation of the morphemes and are moraic. If one says that all schwas are epenthetic, as Wiese (1986, 1988) does, then an additional lexical marker is needed to show where it is added; otherwise it would be impossible to predict that there is no schwa in the nominative singular of *Rat* 'advice' or *Bein* 'leg', whereas *Pate* 'godfather' and *Freude* 'joy' do contain a schwa. It is hard to escape the impression that this extra marker just represents the non-epenthetic schwa. It should also be noted that sometimes schwa is contrastive, e.g. in the minimal pair *Lena/Lehne* 'support'.

3 I do not here take part in the debate of the status of these morphemes ('affixoids' or elements of a compound).

4 According to Isačenko (1974) a *schwa mobile* (ephemeral schwa) becomes a *schwa constans* (constant schwa) before a suffix beginning with a consonant and in compounding. Derivational suffixes beginning with a vowel delete the *schwa mobile*. In view of the syllabification of derived words, it appears that all suffixes inducing resyllabification begin with a vowel, but the inverse is not true, i.e. not all suffixes beginning with a vowel induce resyllabification: *eisen-ähnlich* 'sort of iron', *eigen-artig* 'peculiar'. See (2iv) where these affixes are considered as members of prosodic compounds, and also Höhle (1982).

- (4) *segeln* 'to sail', *Umsegelung* 'sailing around, n.', *gewandert* 'wandered', *Wanderer* 'wanderer'.

Why *Segler* but *segeln*? Or *fiebrig* but *Wanderer*? To explain this alternation a theory of schwa-epenthesis has been proposed by several authors in the Lexical Phonology framework (Wiese 1986, 1988, Giegerich 1987 and Hall 1989) as developed by Kiparsky (1982). This framework is able to cover the straightforward cases in an elegant way, but Lexical Phonology fails exactly where the alternation becomes puzzling: Syllabification by affixation of Class 1 can be destroyed on a higher level; the same holds for level 2; not even on one level are stems unambiguously syllabified. Compare the following examples:

- (5) On level 1: *Atmerei* 'breathing', *Segelei* 'sailing', *Wanderei* 'walking'.  
 On level 2: *atemlos* 'breathless', *-atmig* 'breathy', *Trockenheit* 'dryness' / *Trockner* 'drying machine', *Dunkelheit* 'darkness' / *Verdunklung* 'black-out', *eitrig* 'purulent' / *Eiterung* 'suppuration', *Sammlung* 'collection' / *Einsammlung* 'gathering', *Kupplung* 'clutch' / *Verkuppelung* 'coupling'.  
*Segler* 'sailor', *niedrig* 'low'.  
 On level 3: *ich segle* 'sail, 1st pers. sg. pres.', *du segelst* 'sail, 2nd pers. sg. pres.', *trocknen* (verb, inf.) / *trockenen* 'dry, infl. adj.', etc.

Unless one considerably diminishes the explanatory power of Lexical Phonology by allowing rules having the opposite effect on the same level depending on the melodic content of the form, this approach alone cannot explain the 'schwa/zero' (in the terminology adopted here: the syllabic/non-syllabic) alternation.

Consider now the overview of the forms derived with *-er*, *-ung* and *-ig* in the (hopefully self-explanatory) table.

Only the nominal inflection has the same behaviour for all three sonorants. Clearly, besides or instead of Lexical Phonology, another framework is needed to explain these forms. Prosodic morphology is the best candidate. In section 3 it is shown how prosodic morphology works for German. First a theory of prosodic constituency is presented in the next section.



Inflection/ Deriv.	/n-m/	/l/	/r/
Verbal inflection	<i>atmen</i> NS	<i>segeln</i> S	<i>wandern/feuern</i> S
Nominal inflection	<i>Atem</i> S	<i>Segel</i> S	<i>Fieber/Feuer</i> S
Adjectival inflection	<i>eigenen</i> S	<i>dunkel/dunklen</i> S NS	<i>mageren/teuren</i> S NS
Derivation with -er	<i>Segner</i> NS	<i>Segler</i> NS	<i>Wanderer/Maurer</i> S NS
Derivation with -ung	<i>Atmung</i> NS	<i>Seg(e)lung</i> NS/S	<i>Wanderung/Feuerung</i> S
Derivation	<i>atmig</i> NS	<i>ad(e)lig</i> NS/S	<i>übrig/feurig</i> NS

NS = non-syllabic; S = syllabic

Figure 1

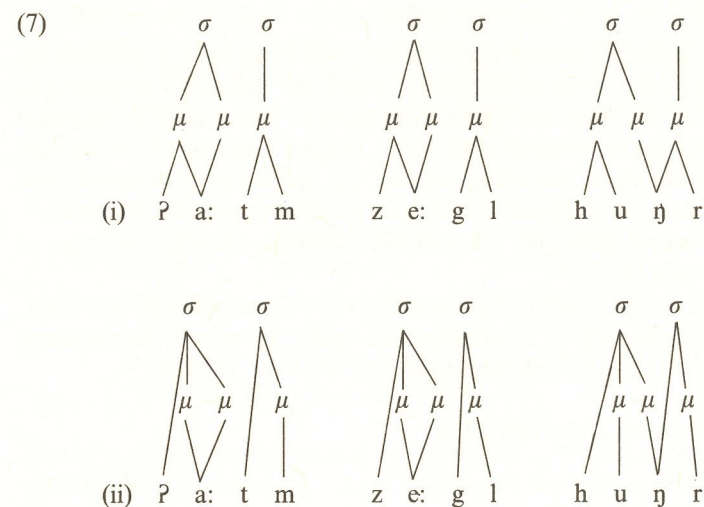
## 2. Prosodic constituency

The units used in the present chapter are the mora, the syllable and the foot. These units are motivated by numerous aspects of the phonology (see Selkirk 1984, McCarthy and Prince 1990, Hayes 1991). I will assume here that the constituents of the syllables are moras (Hyman 1985, McCarthy and Prince 1986, 1989, Zec 1988, Itô 1989, Auer 1991): a moraic structure is first assigned on a melodic string (consisting itself of melodic feature specifications like the one proposed by Sagey 1986, Dogil 1988 or McCarthy 1989): this melodic string is not introduced here, it is a temporally ordered sequencing of feature trees. Segment-sized *skeletal units* are inexistent in the theory. For arguments showing that the CV skeletal theory is confronted with many problems, see McCarthy and Prince (1989).

The moras in German are formed from the following melodic strings, where Cs and Vs stand roughly for consonants and vowels (and not for skeletal units):

- (6) ((C)C)V, ((C)C) Sonorant, C

Syllable onsets do not form their own moras. As both Zec (1988) and Hayes (1991) propose, the syllable onsets are adjoined to the following mora and not as McCarthy and Prince (1989) suggest adjoined directly to the syllable constituent. This choice has no implication for the present theory but has the advantage that strings are moraified exhaustively (see Hayes 1991: 43 for discussion). As an example, the roots of the words *Atem*, *Segel* and *Hunger* have the moraification shown in (7i), rather than those of (7ii) (long vowels consist of two moras):



I assume here the syllable theory as developed by Itô (1986, 1989). Itô states the following prosodic principles and parameters: Maximality, Directionality, Prosodic Licensing and Extraprosodicity.

*Maximality* says that a syllable, or another prosodic constituent is as large as possible. The syllable in German respects the following universal sonority hierarchy (Dogil & Luschützky 1989):

- (8) obstruents nasals approximants vowels

Vennemann (1986: 36) has given a more detailed hierarchy:

- (9) ----->  
 a e i r l m v f b p  
 o u n z s d t  
 ŋ g k

This hierarchy explains why the words *Helm* 'helmet' and *Kerl* 'guy' are monosyllabic, whereas the words *Hammel* 'ram' and *Keller* 'cellar' are bisyllabic.



The liquid /l/ cannot be peripheral to the nasal /m/ in the same syllable because /l/ is more sonorous than /m/. In the same way /r/ is more sonorous than /l/. Selkirk (1984: 116) states principle (10).

(10) Sonority Sequencing Generalization:

In any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values.

The maximality principle insures that a syllable will be as large as possible, as long as it respects the sonority hierarchy, and some principles of preferred syllabification like the Maximal Onset Principle (see below) and the Syllable Contact Principle (see Vennemann 1986, 1988). Dogil & Luschützky remark that the principle should allow 'sonority plateaus', e.g. sequences of segments with equal sonority, like, for example, Polish *spać* (to sleep) and *psuć* (to spoil).

The same principle holds for all prosodic elements: they are as large as possible (see Prince 1985).

*Directionality*: Right-to-left syllabification results in maximizing the coda, left-to-right syllabification in maximizing the onset. However, the universal Onset Principle (11) blocks syllabifications like VC.V or VCC.V:

(11) Onset Principle (Itô 1989: 223):

Avoid <sub>o</sub>[V

Three types of syllable (V, VC, C(Son)) are limited to foot-internal or -final positions and to a few function words. In German a glottal stop is inserted in the onset position foot-initially, if the syllable would begin with a vowel otherwise (see section 4).

*Prosodic Licensing* requires that all prosodic units belong to higher units:

(12) Prosodic Licensing (Itô 1986: 2):

All phonological units must be prosodically licensed, i.e., belong to higher prosodic structure (modulo extraprosodicity).

(12) insures exhaustive parsing (syllabification, pedification ...) and eliminates unlicensed elements.

*Extraprosodicity* (or extrametricality) rules final segments of a domain as extrametrical. A light syllable is mono- or bimoraic, and a heavy one is bi- or trimoraic; elements appearing at the right periphery (in the so-called appendix) will be classified as extrametrical. The syllable coda consists of maximally two positions. The fact that there are some German syllables of the form *Strumpfs* 'sock, gen. sg.' or *reibst* 'rub, 2nd pers. sg.' is due to extrametrical elements after

the coda, in Standard German limited to /ʃ/, /s/, /t/ and combinations of those in the appendix (see Féry 1989 for more details).

Not only subsyllabic components can be extrametrical, but also syllables. A well-known example comes from Latin, where it is assumed that the last syllable of a word like *spatula* is extrametrical. If stress<sup>5</sup> is right-to-left assignment of bimoraic feet (McCarthy and Prince 1990, Hayes 1991), and if *-la* does not count, then the stress will fall on the first syllable: *spátu(la)*.

Prosodic Morphology claims that not all morphological operations apply to morphologically defined terms. On the contrary, some morphological operations, typically reduplication and infixing, can apply to prosodically circumscribed domains<sup>6</sup> (McCarthy & Prince 1986, 1990). As an example, consider infixation in Ulwa (Southern Sumu), a language of Nicaragua (13).

(13) Ulwa Construct State:

a.	karasmak	karas-ka-mak	'knee/knee of'
	walahdana	walah-ka-dana	'sweat/sweat of'
b.	analaka	ana-ka-laka	'chin/chin of'
c.	baskarna	bas-ka-karna	'comb/comb of'
	kuhbil	kuh-ka-bil	'knife/knife of'
	dangpana	dang-ka-pana	'back/back of'

(from McCarthy & Prince 1990: 228)

The infix *-ka* follows the first iambic foot of the base. The iambic foot consists of a light syllable followed by a heavy syllable (a), two light syllables (b), or a single heavy syllable (c).

A further important aspect of Prosodic Morphology is the existence of prosodic templates. McCarthy & Prince show that the Arabic broken plural can be simplified considerably relatively to former accounts (e.g. Wright 1971) if a templatic morpheme is used: the prosodic constituent that specifies the operation of template mapping in the broken plural is the Arabic minimal word (a moraic trochee ( $\mu\mu$ )). For details see McCarthy and Prince (1990).

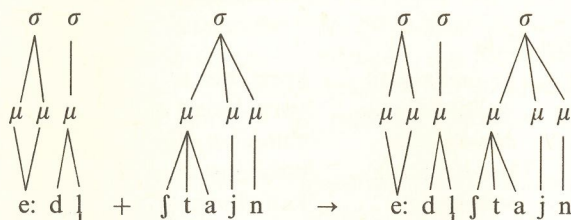
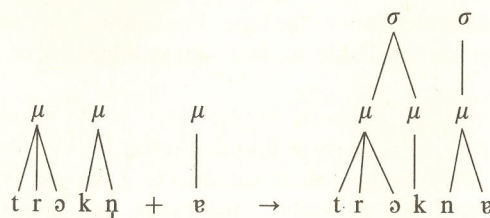
5 As Hayes (1991: 69) claims: 'characteristically, the foot type that is used in a language's prosodic morphological system is the same as that used in its stress system.'

6 McCarthy and Prince (1990) describe extrametricality as a process of factoring out a base in two parts, that is, a prosodically circumscribed constituent ( $B:\Phi$ ) and a residue ( $B/\Phi$ ), then applying a rule or a process (here the assignment of bimoraic feet) to  $B/\Phi$  or  $B:\Phi$  and then concatenating the two parts again.



## 3. Proposal

The stems of (1) are assigned a moraic structure underlyingly, in conformity with the Prosodic Licensing. This is necessary in order to prevent stray erasure, which deletes all material that is not included in the prosodic structure. However, the stems are syllabified before compounding (14i) but after affixation (14ii). Thus the stems enter affixation with a moraic structure but without syllable structure.<sup>7</sup> This assumption is crucial to understand the alternation between the syllabic and the non-syllabic state of the sonorants.

(14) i. Compounding: *Edelstein*ii. Affixing: *Trockner*

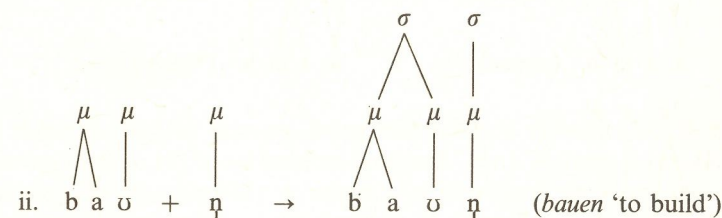
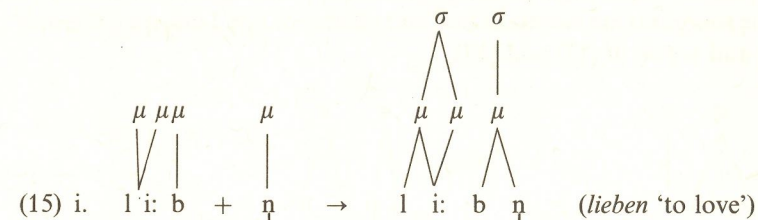
The moraification is not attributed once and for all for each stem or affix. On the contrary, it must be built for each morpheme, and in each derivation. It depends partly on the possible syllable structure, and partly on the prosodic template of the derivation (if there is one): there will be many examples of this in the next subsections.

In the remainder of this paper I will consider the effect of different inflection and derivational forms. I do not, however, consider the compounding cases here, since they are unproblematic: they are mere concatenations of fully syllabified morphemes.

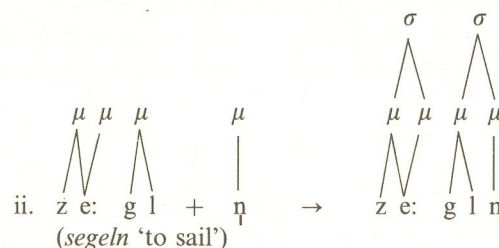
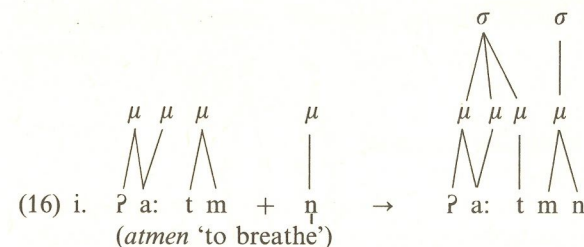
7 If one wanted to interpret the stems in (1) as one syllable (*/ātm/* and */zēgl/*, as Wurzel 1980 proposes), one would get a violation of the sonority hierarchy, i.e. something that is strongly avoided anywhere else in the language.

## 3.1. Infinitive inflection

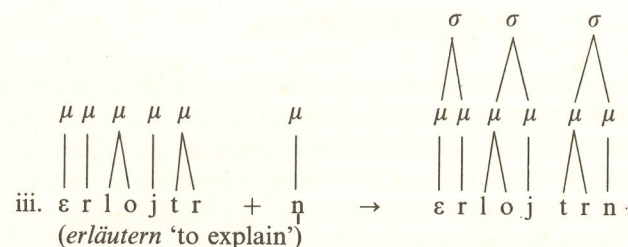
The infinitival inflection is a moraic */n/*, which is usually syllabic. Most infinitives are minimally bisyllabic. The verbs *tun* 'to do' and *sein* 'to be' are exceptions in that they are the only monosyllabic infinitives. *[baʊn]* and *[ze:n]* are possible realizations of the verbs *bauen* 'to build' and *sehen* 'to see', but the underlying forms are nonetheless bisyllabic since the bisyllabic realization is possible in these forms, but not in an underlying monosyllabic word like *Baum* 'tree'. (15) illustrates the process of affixing the infinitive for some verbs.



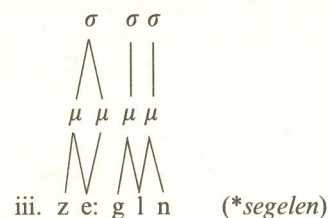
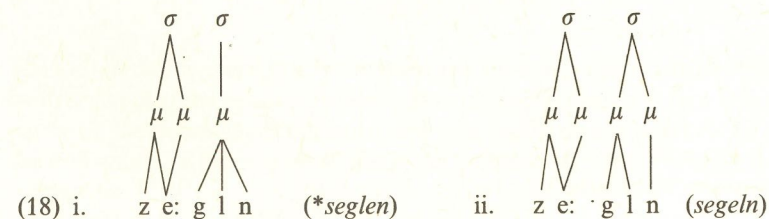
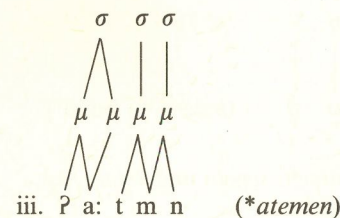
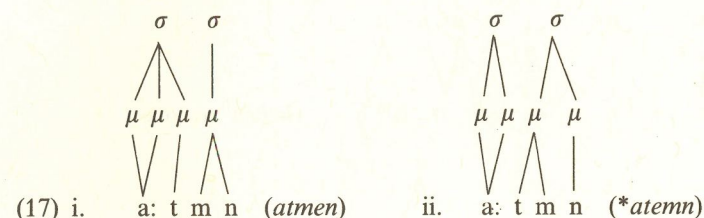
Consider now the infinitive formation of *atmen*, *segeln* und *erläutern*:







For each of these forms three possible syllabifications compete, depending on whether the sonorants are moraic or not, and syllabic or not. I illustrate this only for *atmen* and *segeln* in (17) and (18).



Without an additional principle it is impossible to decide which syllabification is the right one. However, the strong tendency for German infinitives to be bisyllabic can take the form of a prosodic template. Following Hayes (1987, 1991), who gives a universal foot typology (19), German infinitives usually consists of at least a syllabic trochee.

(19) a. Syllabic Trochee:  $\begin{array}{c} (x \cdot) \\ \sigma \sigma \end{array}$

b. Moraic Trochee:  $\begin{array}{c} (x \cdot) \quad (x) \\ \cup \cup \quad \text{or} \quad - \end{array}$

c. Iamb  $\begin{array}{c} (\cdot x) \quad (x) \\ \cup \sigma \quad \text{or} \quad - \\ (- = \text{heavy}, \cup = \text{light}) \end{array}$

(20) German infinitive template: Create a syllabic trochee.

$\begin{array}{c} (x \cdot) \\ \dots [\sigma \sigma]_{\text{Infinitive}} \end{array}$

(20) eliminates (18iii) because, being trisyllabic, it violates (20). It does not, however, allow us to choose between (18i) and (18ii). We have to invoke another principle. The directionality principle is at play here: the stems containing a liquid like *segeln* imply that the direction of syllabification is right-to-left. The same line of reasoning explains the form *erläutern*. On the other hand the form *\*atemn* is impossible because a cluster of two homosyllabic nasals in the coda is impossible in German. The only possible syllabification respecting (20) is *atmen*<sup>8</sup>.

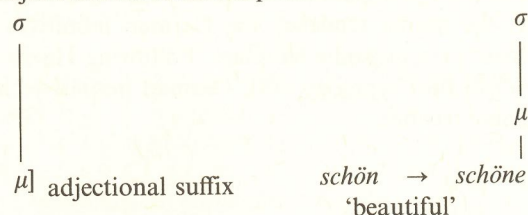
### 3.2. Adjectival inflection

The adjectival suffixes are sonorants, or schwas (or /s/); the inflection schwas are different from the schwas facultatively pronounced to emphasize the syllabicity of a sonorant: they are moraic constituents, and create an additional syllable on the stem. A prosodic template for adjective inflection (21) is needed in order to make sure that each adjectival inflected suffix creates its own syllable.

8 For some speakers this form (and, in fact, all forms having the sequence [obstruent + nasal + nasal]) is always realized with a surface schwa: *atmən*. See Höhle and Vater (1978: 173). This fact has no consequence for the present framework.



## (21) Adjectival inflection template:



The ‘celebrated minimal pair’ as Rubach (1990: 88) puts it, *Dunkeln* ‘darkenings, noun dat. pl.’/ *dunklen* ‘dark, inflected adj.’ finds a natural explanation in the prosodic morphology framework. The adjectival suffix is obligatorily syllabic, whereas the dative plural nominal inflection is not.

Compare the following data (the forms in parenthesis are alternative pronunciations):

(22) Nominals	Adjectives
Nasals	
<i>die Ebene (Ebne)</i> ‘the surface’,	<i>die ebenen (ebnen), ebensten Flächen</i> ‘the even surfaces’
<i>den Ebenen</i> ‘the surfaces, dat. pl.’	<i>die eigenen (eignen), eigensten Mützen</i> ‘the own, ownest hats’
<i>die Eigene (Eigne), den Eigenen</i>	<i>trockenere (trocknere)</i> ‘drier’
<i>Orden</i> ‘decoration’,	
<i>Atem</i> ‘breath’	
/l/	
<i>im Dunkeln</i> ‘in the dark’	<i>die dunklen, dunkleren, dunkelsten Keller</i> ‘the dark, darker, darkest cellars’
<i>den Segeln</i> ‘the sails, dat. pl.’	<i>die edlen, edleren Weine, der edelste Wein</i> ‘the noble, nobler, noblest wines’
<i>den Übeln</i> ‘the evils, dat. pl.’	<i>die üblen, übleren Kater der übelste Kater</i> ‘the bad, worse, worst hangovers’
/r/	
<i>Hunger</i> ‘hunger’,	<i>die mageren, magereren, magersten Typen,</i> ‘the thin, thinner, thinnest guys’
<i>Silber</i> ‘silver’	

Adjectives like *ebene* (or *ebenen*), *eigenen*, *dunklen*, *edlen*, *üblen*, *mageren* are built from a stem and one suffix. Forms like *trockenere*, *übleren*, *magereren*, are formed with two suffixes, each of which creates its own syllable. Forms like *ebensten* (or *ebenste*), *eigensten* are built up from the superlative-inflection *-st* plus one suffix of the form given in (21). *-st* behaves either as an appendix (if it is word-final) or as an onset, and plays no particular role in the moraic and syllabic structure of the adjectives.

Now consider the stems of these adjectives. Nasals are always syllabic and so is /v/. On the contrary, /l/ is non-syllabic except in the superlative where the (non-syllabic) formative *-st* is added directly to the stem and, of course, in case of Ø-inflection.

In contrast with non-syllabic /l/, the fact that nasals are syllabic is particularly interesting, if we compare the adjectives with the verbal inflection: the syllabicity of nasals and /l/ in verbs and adjectives are symmetrically opposed.

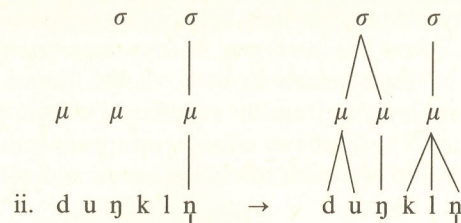
(23)	nasals	/l/
verbs	non-syllabic ( <i>trocknen</i> )	syllabic ( <i>verdunkeln</i> )
adjectives	syllabic ( <i>trockenen</i> )	non-syllabic ( <i>dunklen</i> )

The asymmetry finds an explanation along the lines taken so far: the infinitive restricts the number of syllables to two in such stems, whereas the adjectival inflection imposes no such restriction. Furthermore, the infinitive syllabifies the whole string of moras, namely the stem’s moras plus the infinitive mora from right-to-left, whereas the adjectives syllabify a string partially pre-syllabified: the inflected suffix has already the form given in (24i). The rest of the string is syllabified from right-to-left (24ii), /k/ and /l/ forming the onset of the syllable created by the adjectival suffix. The infinitive *verdunkeln* behaves as explained in the preceding subsection.

(24) i.	$\sigma$
	$\mu$
	$\eta$

9 Words like *teuer* ‘dear’ and *sauer* ‘sour’ with forms like *teures/teurer* and *saures/saurer* show that not only [ə] but also the sequence [glide (or /v/) + /v/] is avoided. *Ein schönerer Weg* ‘a more beautiful way’ is acceptable, but *?ein bittererer Wein* ‘a wine more sour’ is a bit odd (see Isačenko 1974: 155, where the latter form is even classified as ungrammatical).





As for the contrast between the non-syllabic /l/ in *dunklen* and the syllabic /r/ and /n/ in *mageren* and *eigenen*, I think that they are idiosyncratic. Some speakers say *eignen*, some say *dunkelen*, though it strikes me as a dialectal pronunciation. The form *magren* is even rarer. Maybe the fact that /r/ is almost never non-syllabic in adjectives and in verbs has to do with the fact that it is the most sonorous consonant of the language.

### 3.3. Nominal inflection

The genitive ending for masculine and neutral nominals consists of a moraic /s/ that can be syllabic or non-syllabic. The ending is non-syllabic when it is added to an unstressed syllable. In other words, the genitive ending may (but need not) be /əs/ only if it is added to a stressed syllable. (See Wurzel 1970: 176 and Wiese 1988: 154 for the same condition)<sup>10</sup>.

- |      |                            |                 |                |                 |                   |
|------|----------------------------|-----------------|----------------|-----------------|-------------------|
| (25) | <i>Schuh(e)s</i>           | 'shoe, gen.'    | <i>Atems</i>   | 'breath, gen.'  | * <i>Atemes</i>   |
|      | <i>Tor(e)s</i>             | 'gate, gen.'    | <i>Bügels</i>  | 'bow, gen.'     | * <i>Bügeles</i>  |
|      | <i>Schiff(e)s</i>          | 'ship, gen.'    | <i>Kiefers</i> | 'jaw, gen.'     | * <i>Kieferes</i> |
|      | <i>Maßes</i> <sup>11</sup> | 'measure, gen.' | <i>Königs</i>  | 'king, gen.'    | * <i>Königes</i>  |
|      |                            |                 | <i>Herings</i> | 'herring, gen.' | * <i>Heringes</i> |

Again a prosodic template of the same form as the infinitive template can be invoked to explain the restriction on the syllabicity of genitive /s/.

- (26) Nominal genitive template: Maximally create a word-final syllabic trochee.

(x .)  
 ...[σ σ]<sub>nominal genitive</sub>

<sup>10</sup> One exception: the genitive ending is /əs/ (or mute) when attached to a stem ending with /s/ or /ts/: *Zeugnisses* 'testimony, gen. sg.', *Mumpitzes* 'nonsense, gen. sg.'.

<sup>11</sup> *Filmes*, *Stares* ... are unusual, but for another reason: these are relatively recent English loanwords, and there is a general trend towards preferring the (consonantal) -s genitive.

In nominal inflection, all three sonorants of the stems behave the same way: they are syllabic. The /m/ of *Atem* is syllabic, whereas it was non-syllabic in the infinitive *atmen*. The inflection suffixes are adjoined to the fully syllabified nominals. A comparison with the dative plural inflection confirms this hypothesis:

- |      |                     |                    |
|------|---------------------|--------------------|
| (27) | <i>den Schuhen</i>  | <i>den Ebenen</i>  |
|      | <i>den Toren</i>    | <i>den Bügeln</i>  |
|      | <i>den Schiffen</i> | <i>den Kiefern</i> |
|      | <i>den Maßen</i>    |                    |
|      | <i>den Königen</i>  |                    |

The dative plural suffix behaves like the infinitive suffix: it adds a syllable to the stem, when the stem is monosyllabic like *Schuh/Schuhen* or when a non-syllabic *n* cannot be syllabified like in *Königen* or when the stem ends with a nasal, in which case a non-syllabic /n/ cannot be syllabified. The difference between adjectival and nominal inflection lies in the stems: the nominal stems are already syllabified, when the dative suffix is adjoined, whereas in the case of the adjective, it was the inflection suffix that was already syllabified. Again, as in the infinitive or the genitive, the dative prefers to be a syllabic trochee. If the suffix /n/ can be included in such a foot, like in *Bügeln*, it makes it, otherwise it creates its own syllable, like in *Ebenen*.

- (28)
- 
- Diagram illustrating the syllabic structure of the words *bügeln* and *ebenen*. The initial structure shows a syllable  $\sigma$  containing a non-syllabic /l/ ( $\mu$ ) and another syllable  $\sigma$  containing a syllabic /r/ ( $\mu$ ). The final structure shows the syllable  $\sigma$  containing a syllabic /r/ ( $\mu$ ) and another syllable  $\sigma$  containing a syllabic /n/ ( $\mu$ ).

The form *Ebenen* has a sequence of two syllabic sonorants, which is avoided in other contexts, but which is used here to distinguish the dative plural form from other forms. The avoidance of forms like \**Bügelen* and \**Kiefern* is due to the preference of a syllabic trochee.



There are certainly more German suffixes that can find a natural explanation in this theory, like the deverbal nominalization Class I suffix *-ei* or *-erei* 'ing' (29):

- (29) (i) *Wanderei* 'wandering', *Meuterei* 'mutiny', *Erläuterei* 'explanation'  
 (ii) *Bügelei* 'ironing', *Segelei* 'sailing', *Kuschelei* 'snuggling', *Bastelei* 'tinkering', *Fiselei* 'fumbling', *Wortfremdelei* 'use of loan words', *Volkstümelei* 'folklore, pej.'  
 (iii) *Atmerei* 'breathing', *Fahrerei* 'driving', *Schreiberei* 'writing', *Sauerei* 'mess', *Tollerei* 'nonsense', *Bäckerei* 'baker's shop', *Konditorei* 'confectionery', *Fischerei* 'fishery', *Metzgerei* 'butcher's shop'.

I leave this case for further research (see also Hall 1989).

#### 4. Discussion

To conclude, I compare my proposal with Rubach's recent paper. Rubach (1990) explains the difference in voicing between the obstruents in words like *Handlung* [t/d] 'act' and *handlich* [t] 'handy' in making the syllabification cyclic in a Lexical Phonology framework; his proposal amounts to saying that each level creates its own syllabification added to the ones already made at previous levels (30). Thus at level 1, the morpheme *Handel* 'trade' consists first of one syllable, and then of two syllables, whereas the morpheme *Hand* 'hand', entering in the derivation of *handlich* consists of only one syllable. At level 2, *Handlung* consists in three syllables, and it is still trisyllabic when it enters the postlexical level.

- (30)
- $\sigma$   
 h a n d

$\sigma$   
 h a n d
- \*1 (\* = extrasyllabicity: causes syllabicity of the sonorant)
- $\sigma$     $\sigma$   
 h a n   d l  
 Cycle 1: (syllabification)
- $\sigma$     $\sigma$   
 h a n   d l

$\sigma$   
 u n g

$\sigma$   
 h a n d

$\sigma$   
 l i x <sup>12</sup>
- Cycle 2:     +     +     +

12 The velar fricative /x/ in Rubach's notation is actually a palatal /ç/.



Only at the postlexical level is the /l/ of *Handlung*, which was made syllabic at Cycle 1 by Sonorant Syllabification, submitted to Sonorant Desyllabification, the effect of which is that the sonorant is non-syllabic again. Sonorant Desyllabification has to be stated individually to cover all cases given in my Table 1. *Handlich* on the other hand is made up of *hand* and *lich*. Here the case is clear: the /d/ of *Hand*, being always syllable-final, is devoiced. The difference of syllabification of previous levels is reflected in the different voicing of the obstruent. Rubach assumes that, though the ultimate syllabification puts the obstruent in the coda of *Hand*, *Handlung* still retains its voicing because Sonorant Desyllabification is ordered after Final Devoicing at the postcyclic level<sup>13</sup>.

The proposal I defend in this paper is based on a completely different approach to the morphology-phonology interface. In the framework of Prosodic Morphology presented here, there are basically two morphological operations in German: compounding and affixation. Compounding is the concatenation of two syllabified strings, and affixation is the result of adjoining a string which is not syllabified to a string already syllabified, or alternatively, concatenation of two unsyllabified strings. Besides the usual compounding and suffixation with the so-called Class I suffixes, affixation with Class II suffixes beginning with a consonant are also instances of compounding. Thus *handlich* (like *V-chen* 'little v', and the examples in (2)) is made up from the concatenation of two fully syllabified morphemes, to which all phonology has already applied, in particular Final Devoicing.

- (31)
- $\sigma$   
 $\mu$   $\mu$   $\mu$   
 h a n t

+

$\sigma$   
 $\mu$   $\mu$   
 l i ç
- $\sigma$   
 $\mu$   $\mu$   
 f a u

+

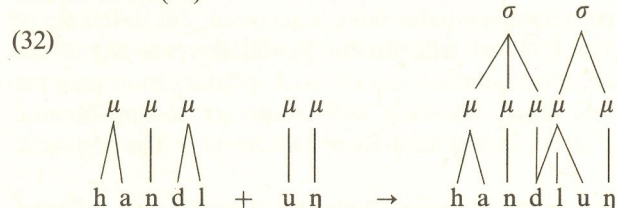
$\sigma$   
 $\mu$   
 ç ɲ
- i.                      ii.

13 Rubach's approach does not contribute to our understanding of the alternation between syllabic and consonantal sonorant which is treated as postlexical and is stated independently for each form. Rubach treats the alternations considered here as instances of Sonorant Desyllabification.

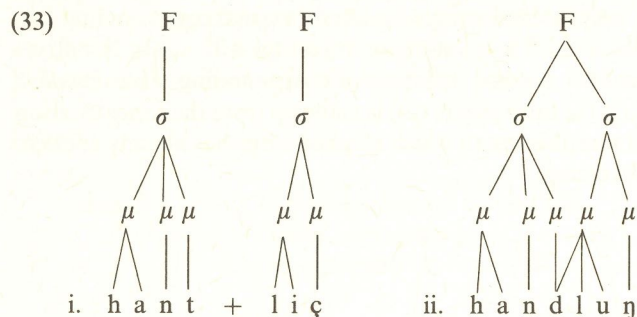


Notice that morpheme-internally the palatal fricative /ç/ cannot appear after /aw/ (*Bauch* 'belly' is pronounced with a final velar fricative /x/), but here V and *chen* are different morphemes.

Affixation, on the other hand, is an operation implying syllabification: most suffixes beginning with a vowel are subject to this process. I have shown how different inflection suffixes are affixed to stems containing a liquid or a nasal. The derivational suffix *-ung* is one of those: it takes an onset from the stem to which it is attached. I have argued that neither the stems nor the suffixes are syllabified when they attach, but that they already have a moraic structure. *Handlung* is formed as in (32):



The difference between (31) and (32) can be seen as a difference in foot structure. In (31), both *hand* and *lich* constitute a foot: /l/ is an onset, whereas in (32), the foot is made up from *handl* and *ung*: /d/ and /l/ of *handl* form a mora together. Seen under this perspective, syllabification applies in the foot-domain (33).



The foot has been shown to be a true prosodic constituent, and not only a stress-motivated entity. In German, Final Devoicing, Glottal Stop Insertion and *ng*-simplification (see Hall 1989) are rules that apply in the foot<sup>14</sup>. A glottal stop

14 There are even more such examples: /ŋ/ does not appear word-initially. However words like *hängen*, *Lunge* can be syllabified with an ambisyllabic /ŋ/. /ŋ/ is thus a possible syllable onset. Word-initial /s/ cannot be followed by a vowel. However, /s/ plus vowel is a regular syllable onset: *las-sen*, *Nüs-se*. The same holds for clusters consisting of a consonant and a glide: with a few notable exceptions (like *Fjord*), these cannot be found word-initially, although they are quite normal syllable onsets in one possible syllabification of the following words: *Ita-lien*, *Me-dien*, *Ara-bien*.

is inserted at the beginning of a foot as in *Be'amte* 'civil servant', *The'ater* 'theater', *Ru'in* 'wreck', but it is absent inside the foot as in *Theo*, *Museum* 'museum', *gehe* 'go, 1st pers.sg.pr.'. Another rule typical for syllabification in German is the aspiration of voiceless stops. Again, it applies at the beginning of a foot ([*be*] [*tʰonen*], [*ver*] [*kʰaufen*]), but if it is not the first segment of the foot, then it fails to apply ([*be*] [*stimmt*], [*warte*]). Final Devoicing can be syllable-final as assumed by Vennemann (1972, 1988), Wurzel (1980), or foot-final, or morpheme-final as assumed by Kloeke (1982). The sequence /dl/ is possible word-internal, where the /l/ clearly belongs to the second syllable, but the /d/ can be syllabified as a coda of the first syllable without being obligatorily devoiced: *edle*, *jodle*, *üble*, *Handlung* are words where /d/ can be voiced. If the syllable-end enforces the application of Final Devoicing, the realization [ɛ:dlə] would be impossible.

## 5. Conclusion

The alternation between the syllabicity and the non-syllabicity of German sonorants, in the second syllable of stems and in the inflection suffixes, finds a natural explanation in the prosodic morphology developed by McCarthy and Prince. In this framework the morphological operations are restricted, and the phonology is given a central role. The prosodic constituents as moras, syllables and feet are the domains for the application of phonology.

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