

Word-internal alignment effects in German

Renate Raffelsiefen & Caren Brinckmann
Institut für Deutsche Sprache, Mannheim

IDS Workshop "Prosodic Alignment at the Word Level"
Nov 20/21, 2008
Mannheim, Germany

Overview

- Introduction
- Unmarked prosodic organization in German words
- Alignment effects in prefixation
- Experimental evidence
- Alignment effects in suffixation
- Summary

Basic assumptions

- Languages have a finite inventory of contrastive units (phonemes).
- These units are organized into prosodic constituents (syllables, feet) at the phonological level.
- Domain boundaries of prosodic organization coincide with morphological/syntactic constituent boundaries.

Basic assumptions

- Complex words have a functor-argument structure, where the functor encodes the combinatory properties of the complex word.
- Affixes and affixoids are functors.

GP-Alignment

G []

P ()

Word

Stem

Affix

ω Pword

Σ Foot

σ Syllable

GP-Alignment

Align (GCat,E; PCat,E)

[]

{word, stem, affix, affixoid, ...}

GP-Alignment

Align (GCat,E; PCat,E)

([])

GCat: {word, stem, affix, affixoid...}

PCat: {pword, foot, syllable, ...}

Cross-linguistic variation

- Alignment of various sorts of grammatical categories with various sorts of prosodic categories
- Interaction of alignment constraints with phonological markedness constraints
- Possible category-specific phonological restrictions (neutralization of contrast)

Phonology-phonetics

- Phonemes are organized into prosodic constituents (syllables, feet) at the phonological level.
- Domain boundaries of prosodic organization coincide with morphological/syntactic constituent boundaries.
- GP-alignment **persists at the phonetic level** (although pword-internal syllable structure might be organized differently).

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Vowels: tense-lax opposition

					je	jäh	
u	y	i	o	ø	e	ɛ	a
ū	ȳ	ī	ō	œ	ɛ		a

Distribution: contrast

[mʊ:s] - [mʊs]

'Mus'

'muss'

'mush'

'must'

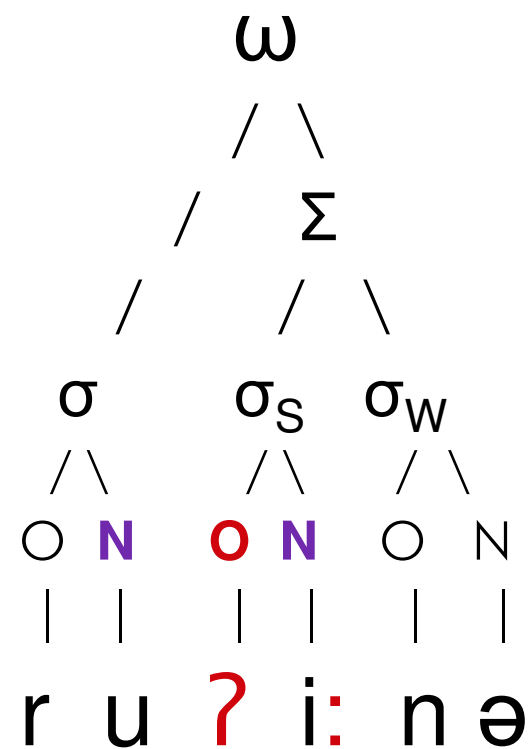
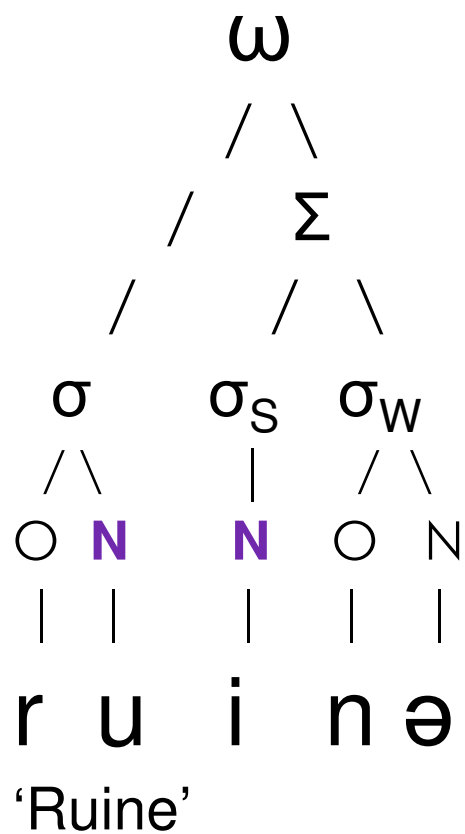
Distribution

Identical type of neutralization in **hiatus** position and in **pword-final** position: only tense vowels occur.

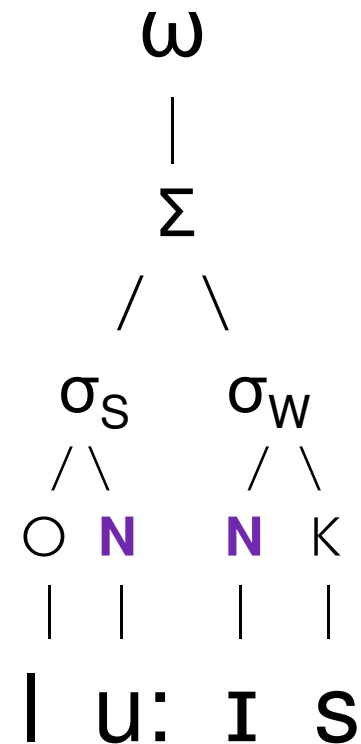
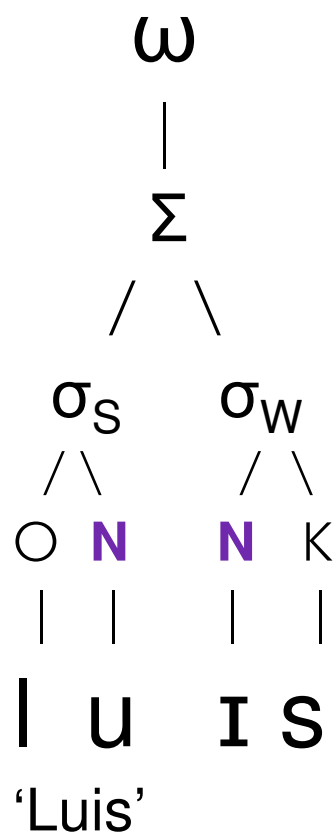
[ruí:nə] 'Ruine', [lú:ɪs] 'Luis'

[é:mu] 'Emu', [tabú:] 'Tabu'

Phonology vs. phonetics



Phonology vs. phonetics



Distribution

Identical type of neutralization in **hiatus**
position and in **pword-final** position: only
tense vowels occur.

= > necessarily **open syllable**

[ruí:nə] 'Ruine', [lu:ɪs] 'Luis'

[é:mu] 'Emu', [tabu:] 'Tabu'

Vowels: tense-lax opposition

					je	jäh	
u	y	i	o	ø	e	ɛ	a
ū	ȳ	ī	ō	œ	ɛ		a

Distribution of vowels in words involving novel prosodic grouping

Neutralization: only lax vowels occur in
necessarily **closed syllable**

[gʊs]

'GUS'

< Gemeinschaft unabhängiger Staaten

Distribution of vowels in words involving novel prosodic grouping

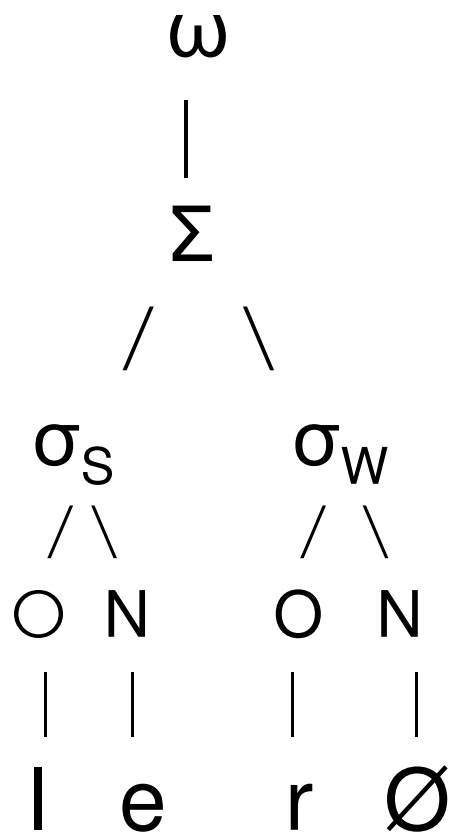
Exception: vowels occurring before word-final
r/l/n are tense

[le:r]

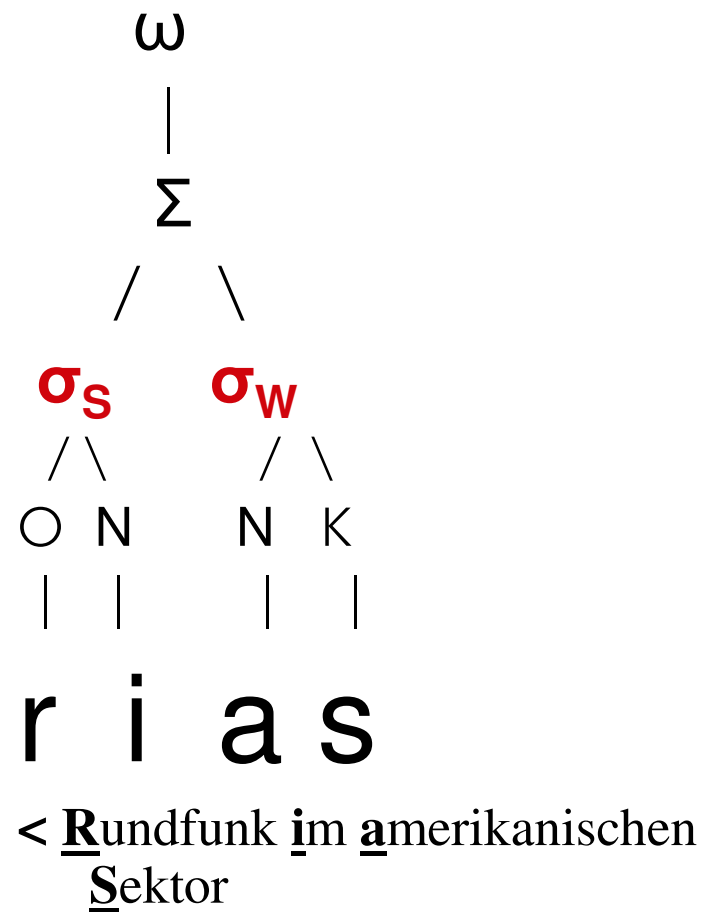
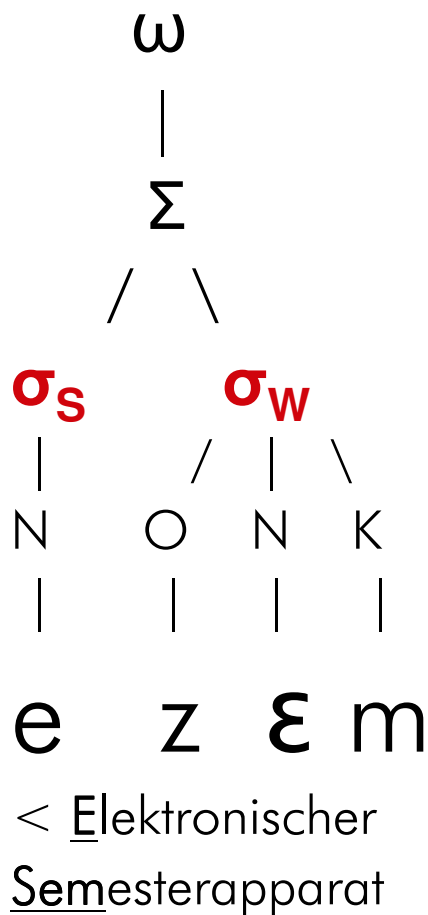
'LER'

< Lebensgestaltung Ethik Religion

Wordfinal r/l/n in German act like onsets



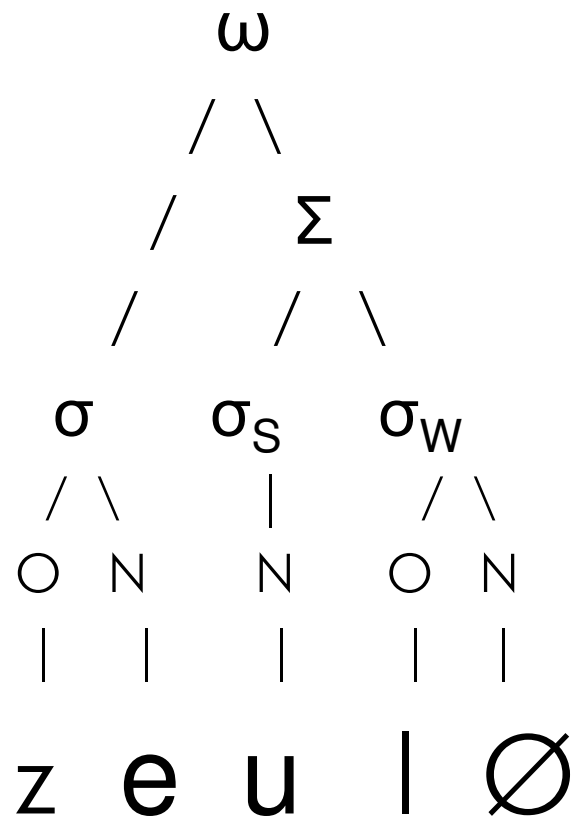
Unmarked foot structure



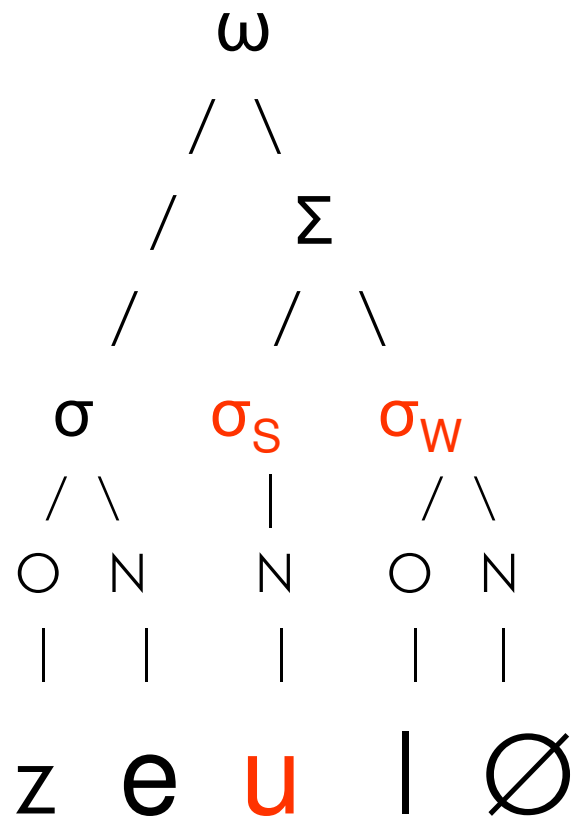
Words ending in r/l/n: [səʊl]

z e ú l

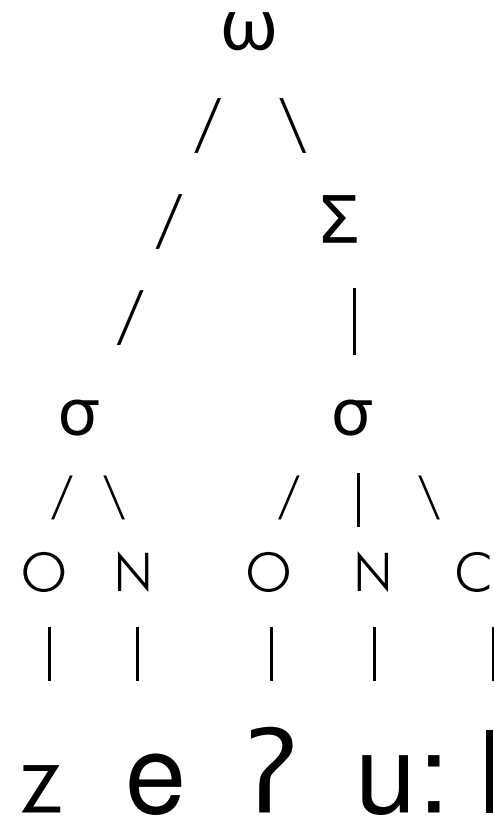
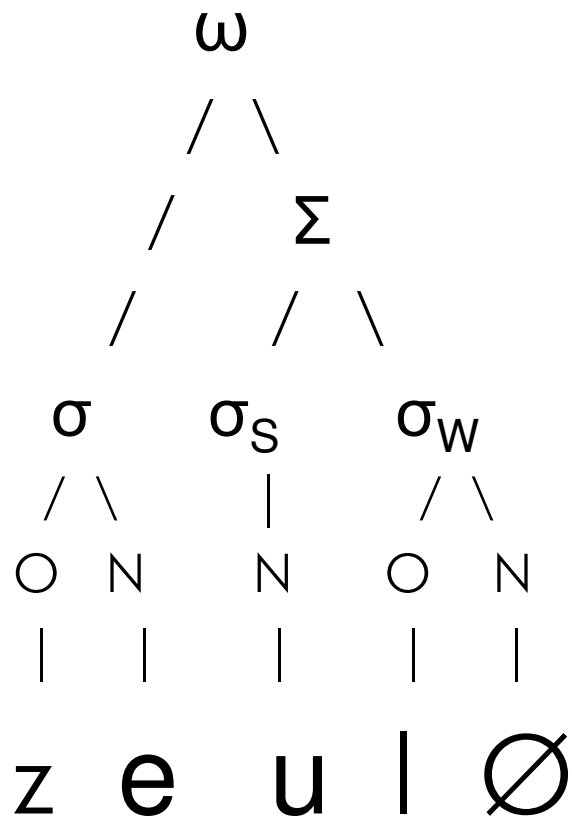
Words ending in r/l/n: [səʊl]



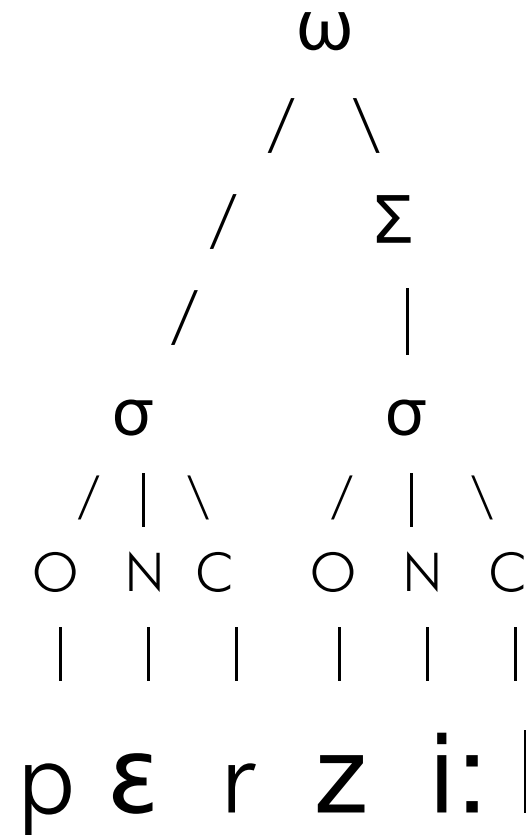
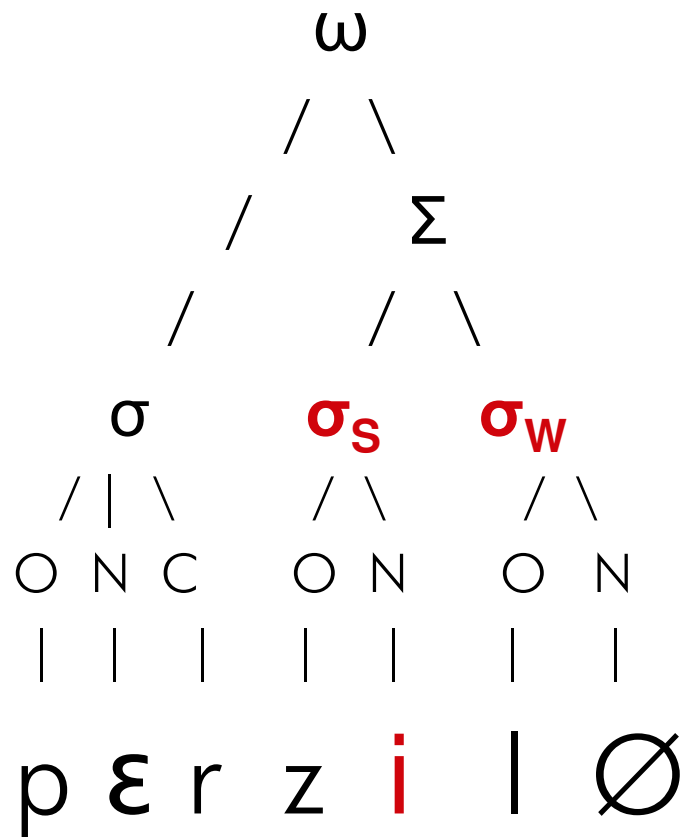
Words ending in r/l/n: [səʊl]



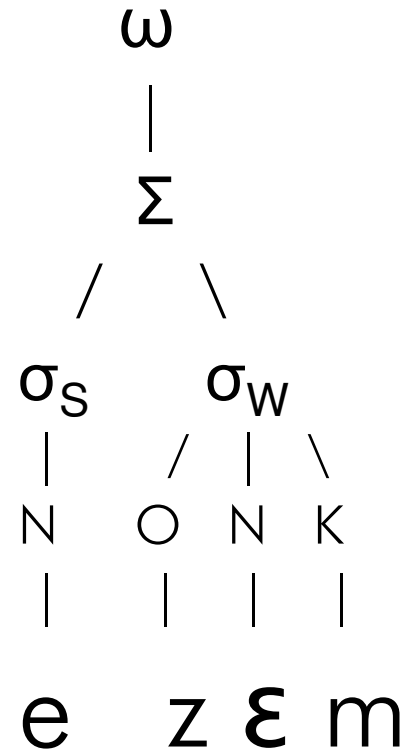
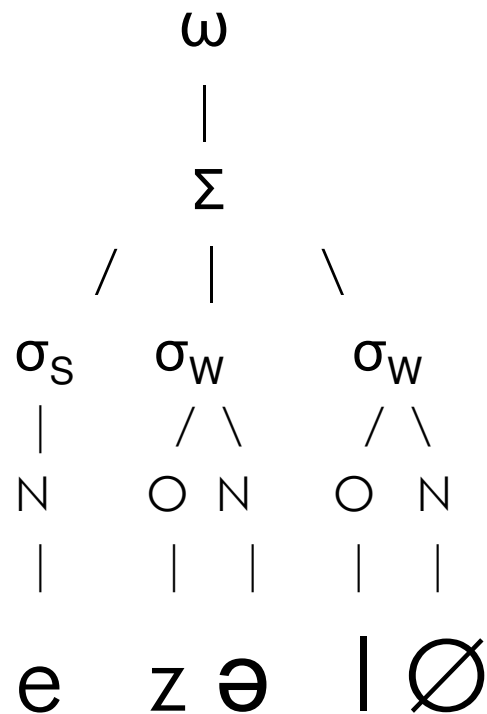
Phonology - phonetics



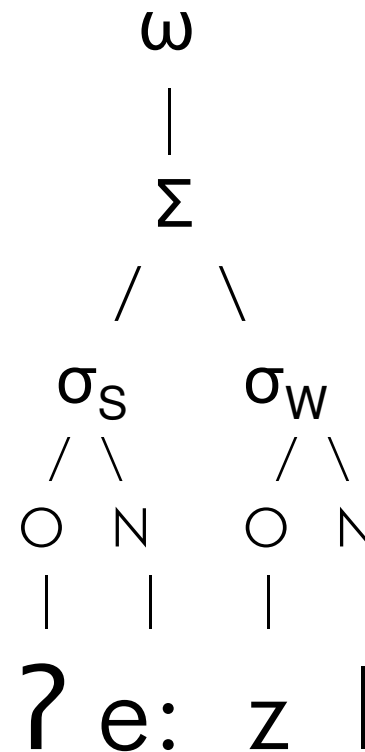
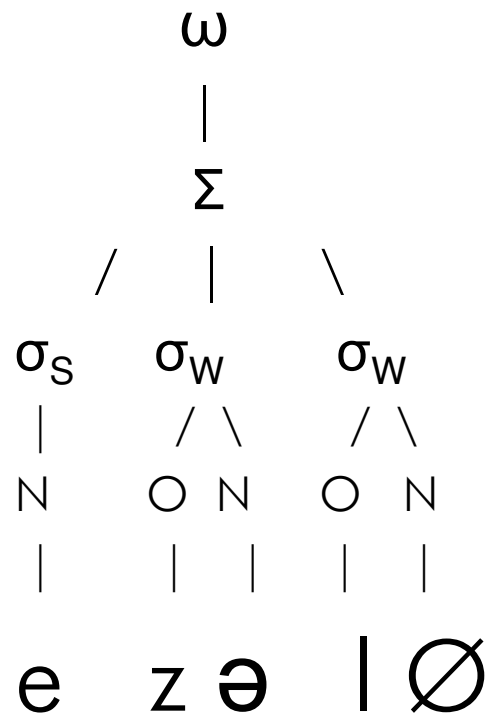
r/l/n -catalexis



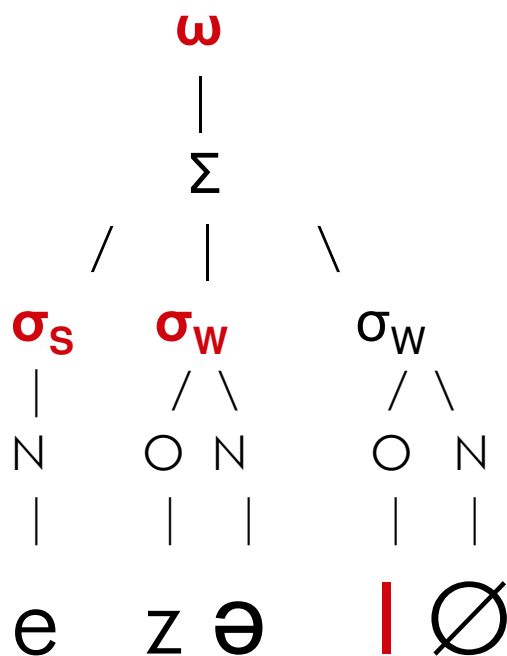
The distribution of schwa



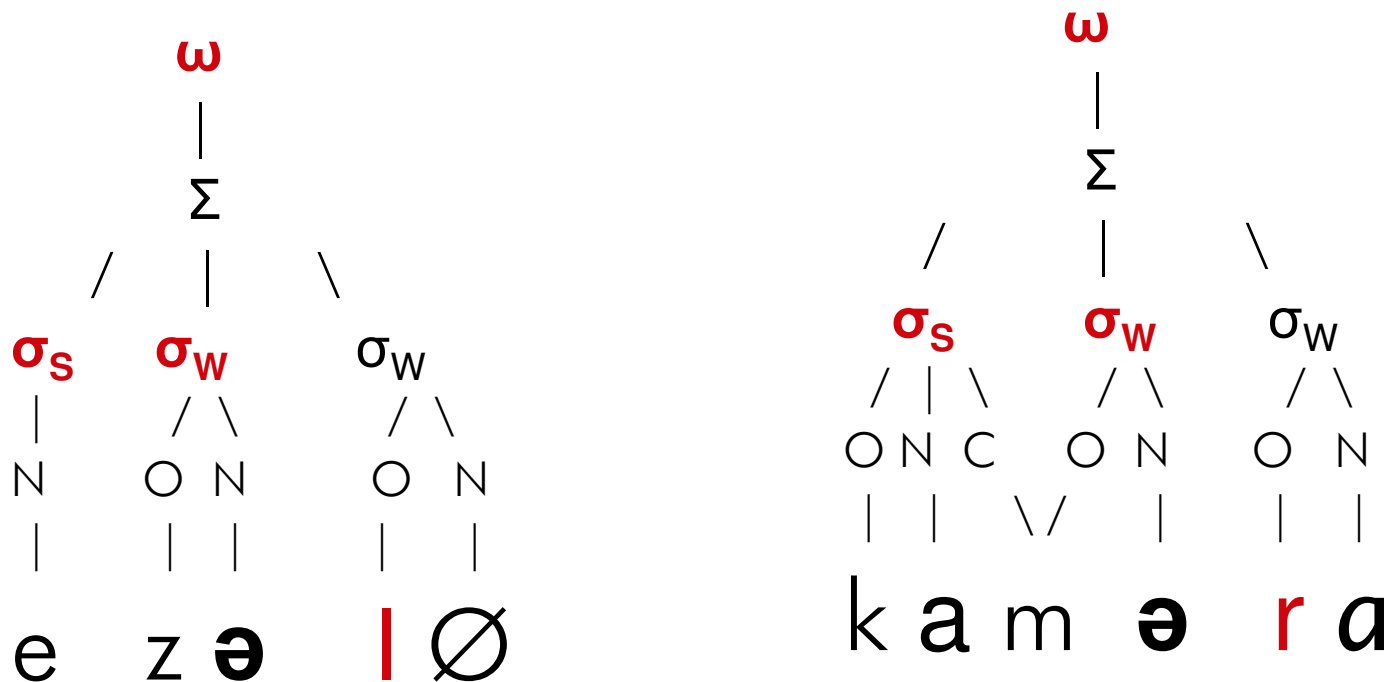
The distribution of schwa



The distribution of schwa



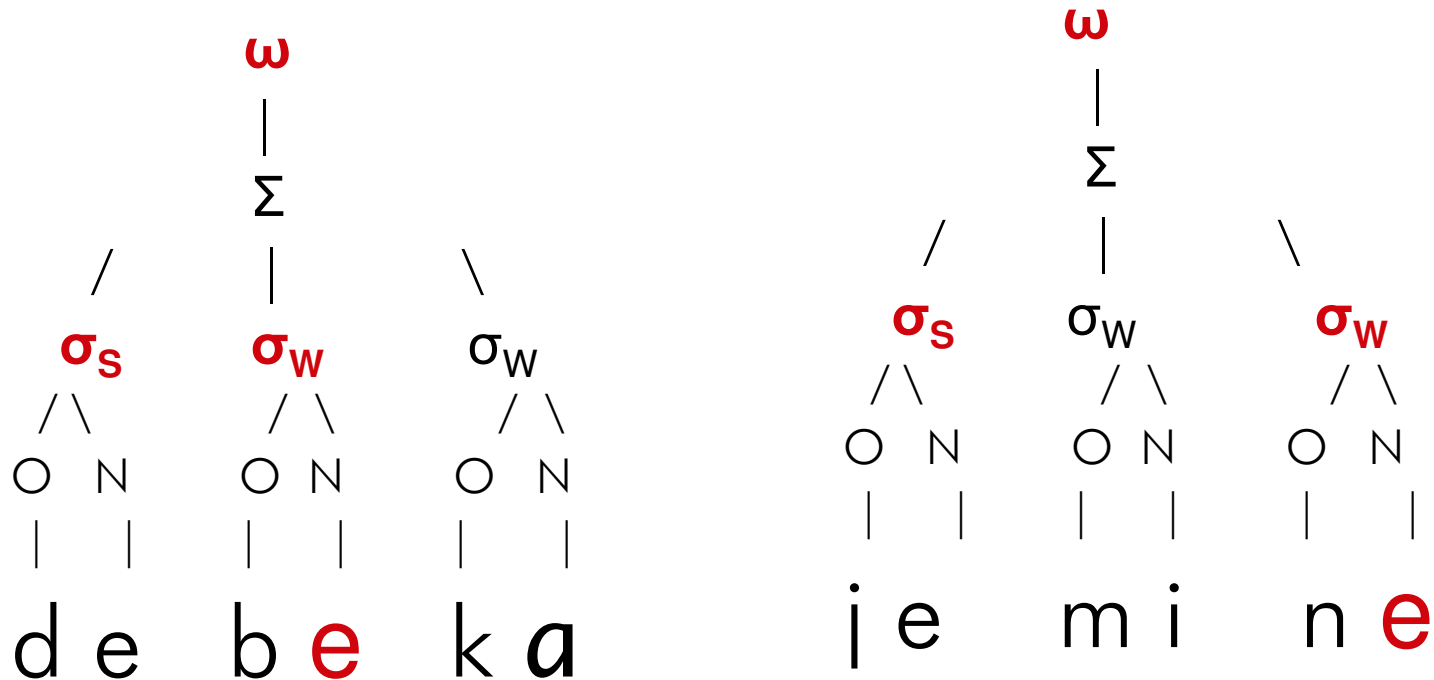
The distribution of schwa



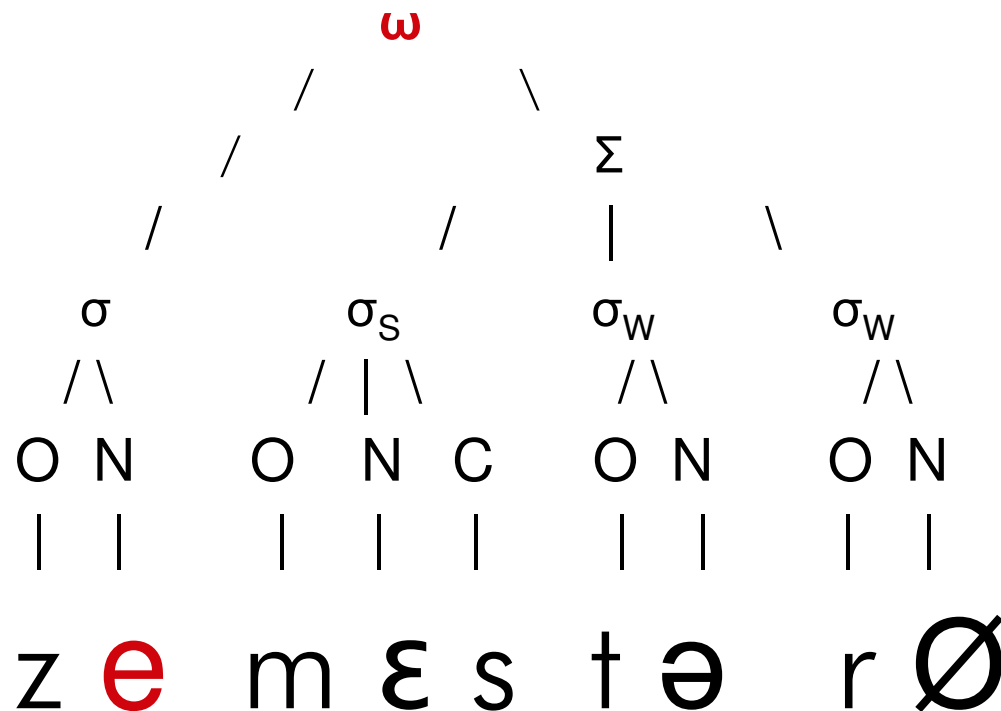
The distribution of schwa



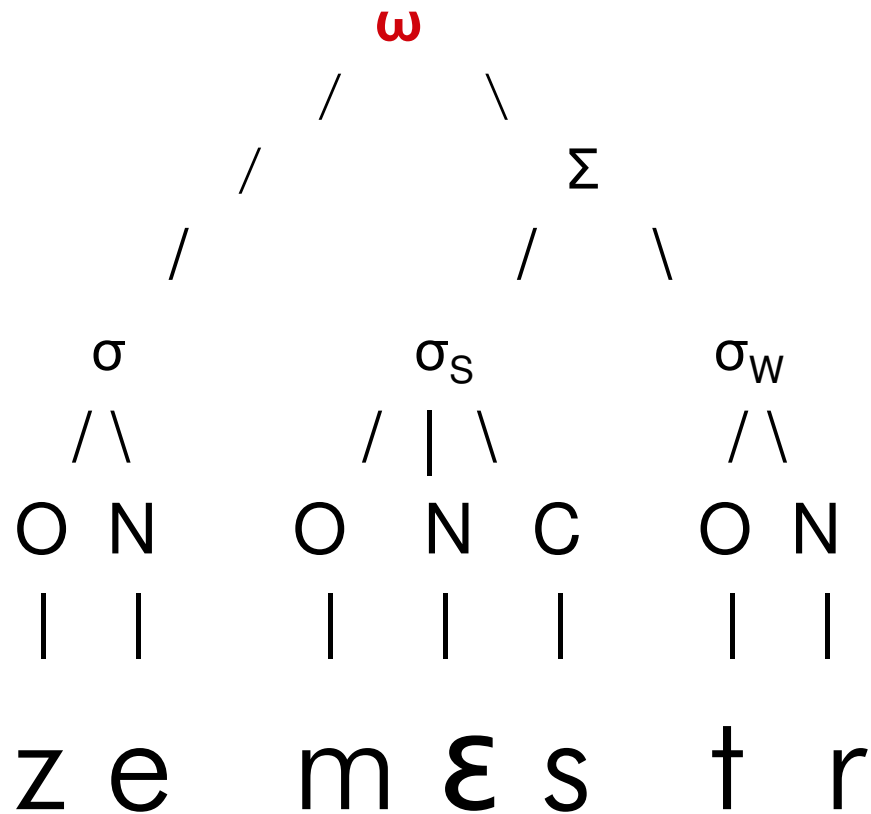
Schwa cannot occur



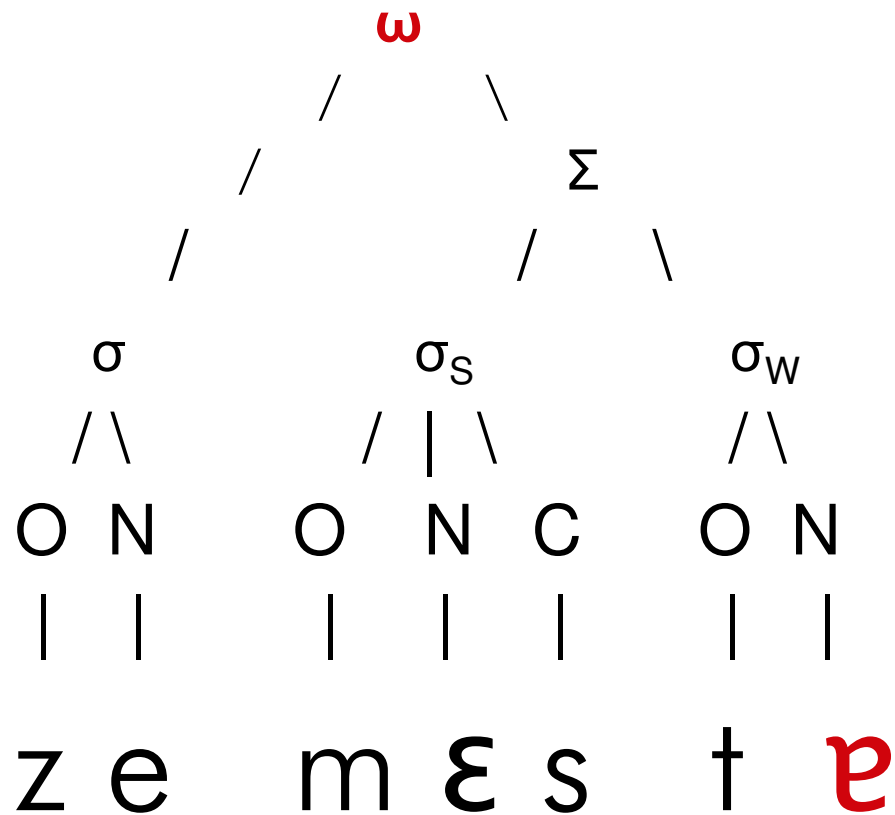
Phonology



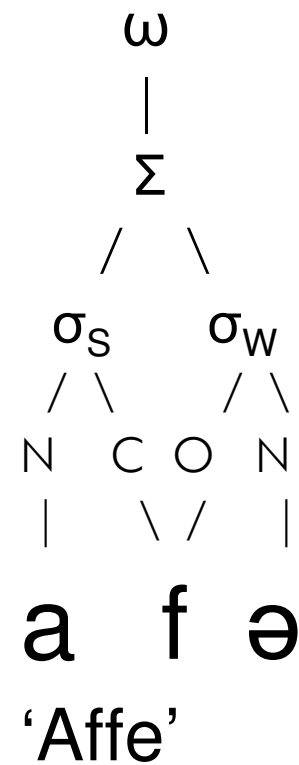
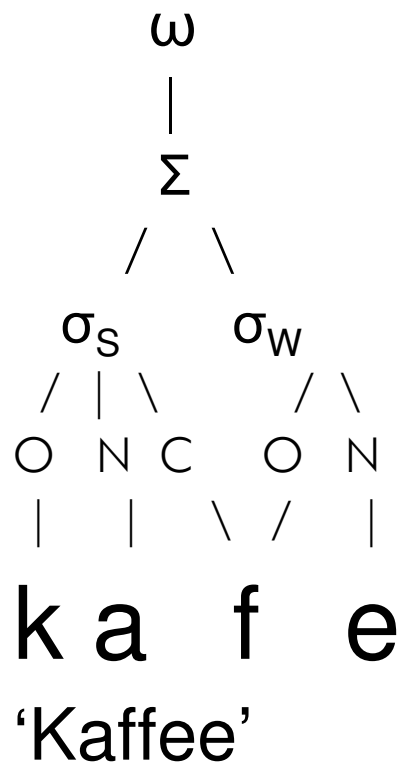
Phonetics



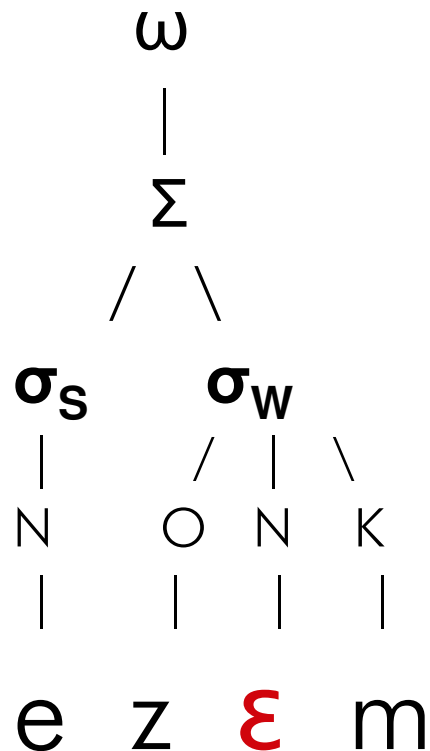
Phonetics



Near-complementary distribution between /e/ and /ə/, but:



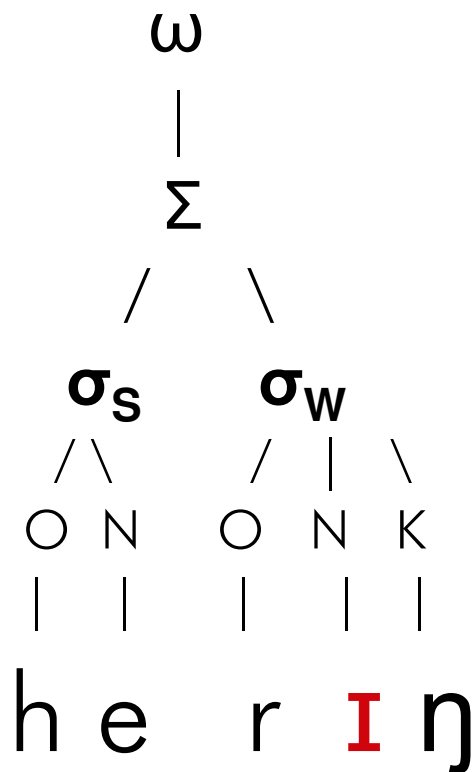
Vowels in weak closed syllables



i o z ϵ f
 z a l ϵ p
 t i b ϵ t

 l i m ϵ s

Vowels in weak closed syllables



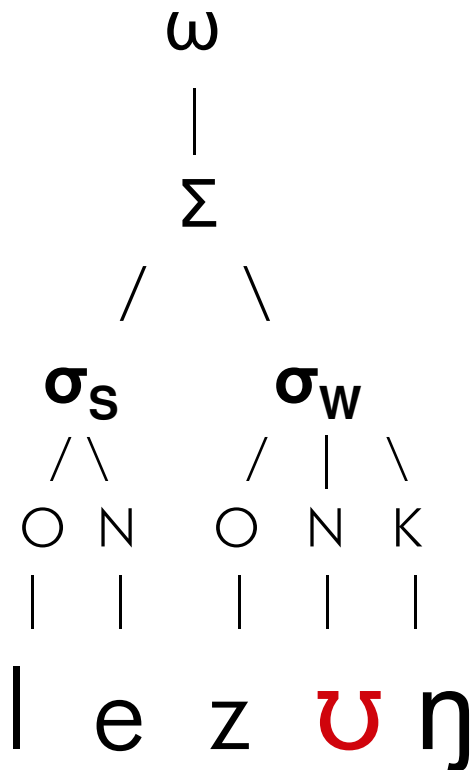
p a n **I** k

h o n **I** ζ

h a \int **I** \int

I l t **I** s

Vowels in weak closed syllables

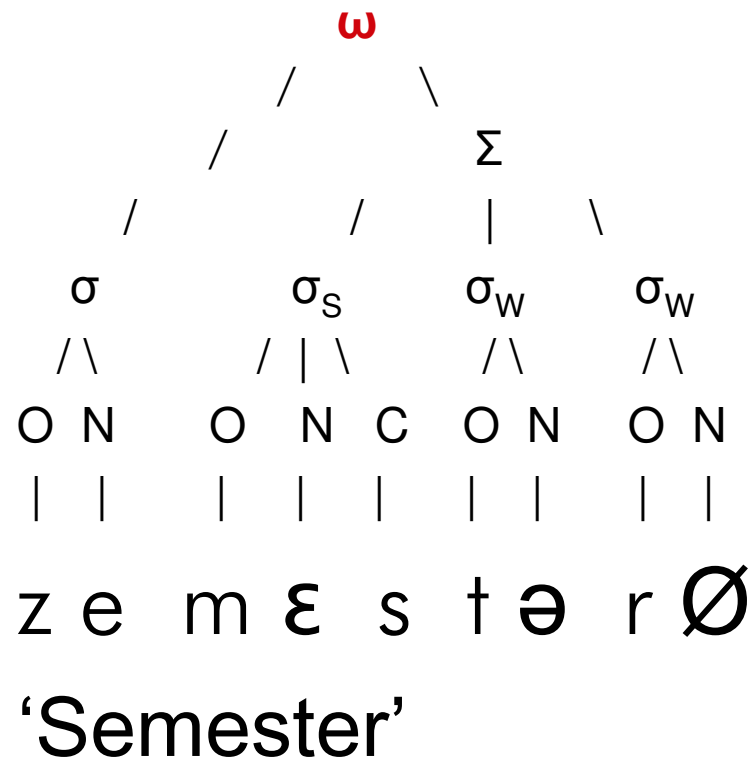


g l o b u s
 p l e n u m

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The phonology of prefixation



b ϵ m ε s ə n
 ‘bemessen’

The morphological analysis of prefixed words

[b ə m ɛ s ə n]_{Verb}

Recognition of a prefix

[[b ə]_{Pref} m ε s ə n]_{Verb}

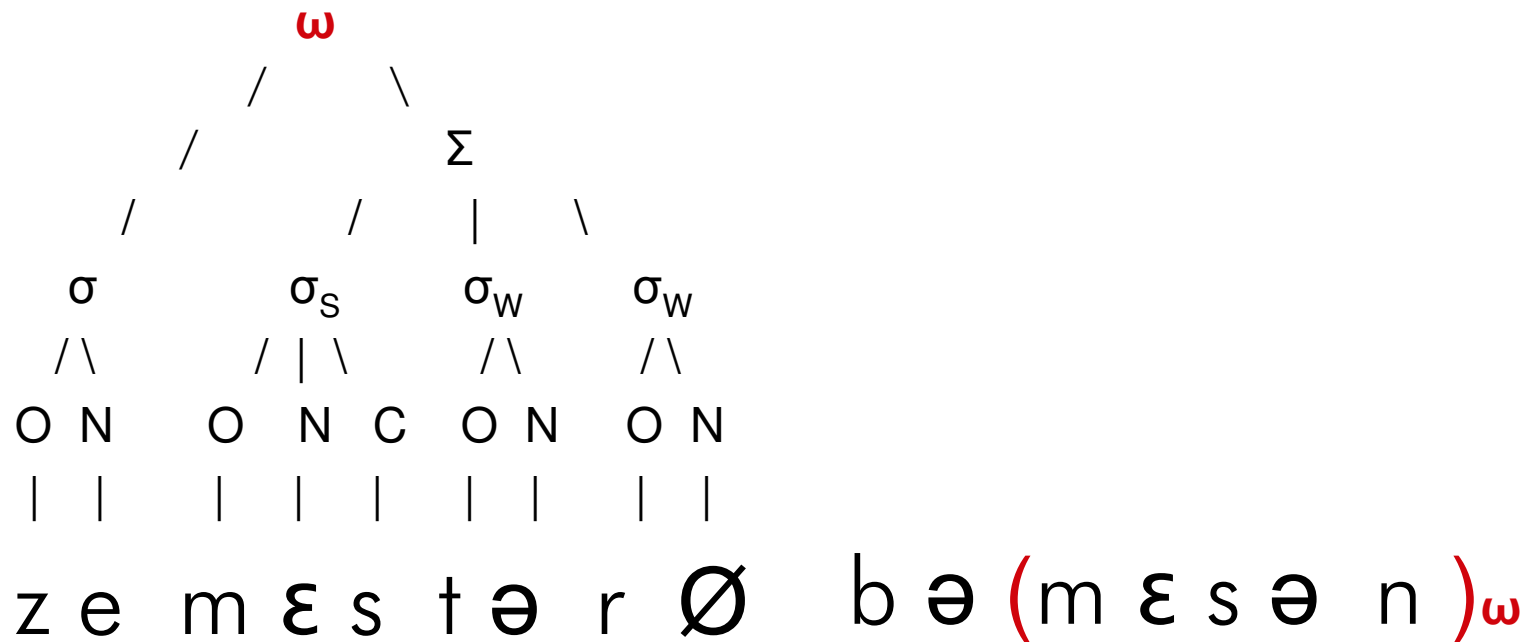
Rest: "stem"

[[b ə]_{Pref} [m ɛ s ə n]_{STEM}]_{Verb}

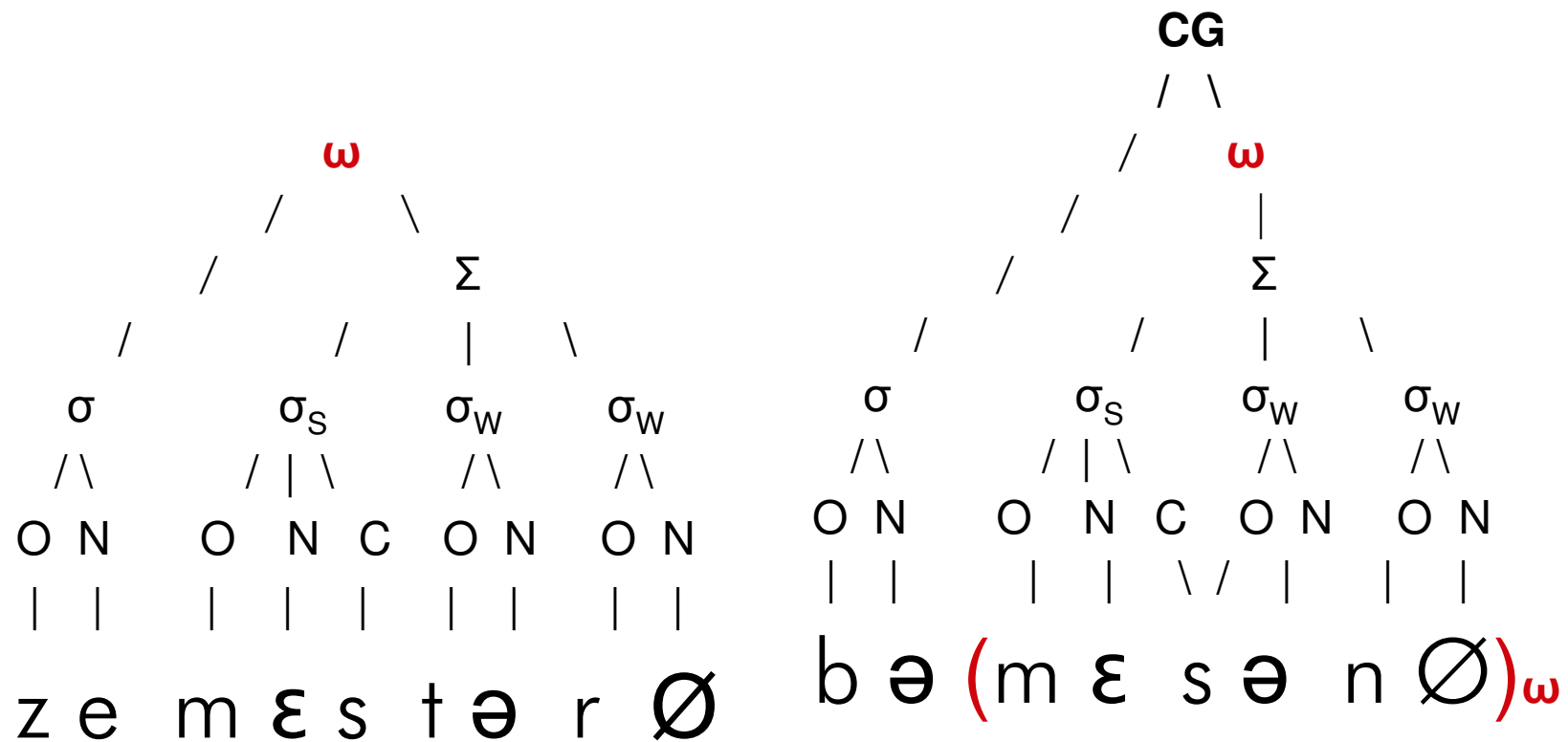
GP-alignment: Align (Stem, E, ω , E)

$[[b \ \theta]_{\text{Pref}} ([m \ \varepsilon \ s \ \theta \ n]_{\text{STEM}})_{\omega}]_{\text{Verb}}$

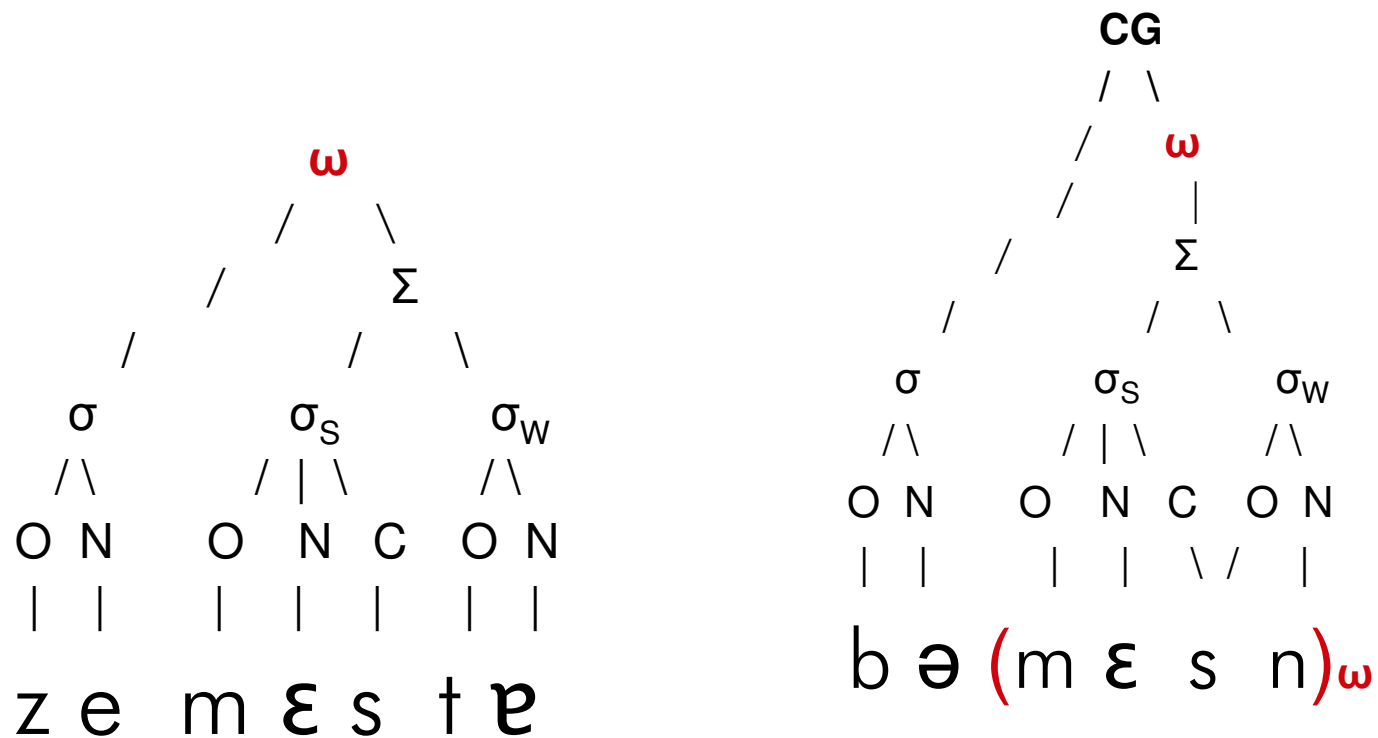
The phonology of prefixation



The phonology of prefixation



The phonetic level



The morphological analysis of prefixed words

[f ə r l i r ə n]_{verb}

‘verlieren’

Recognition of a prefix

[[f ə r]_{Pref} | i r ə n]_{Verb}

Rest: "stem"

$[[f \text{ ə } r]_{\text{Pref}} [l i r \text{ ə } n]_{\text{STEM}}]_{\text{Verb}}$

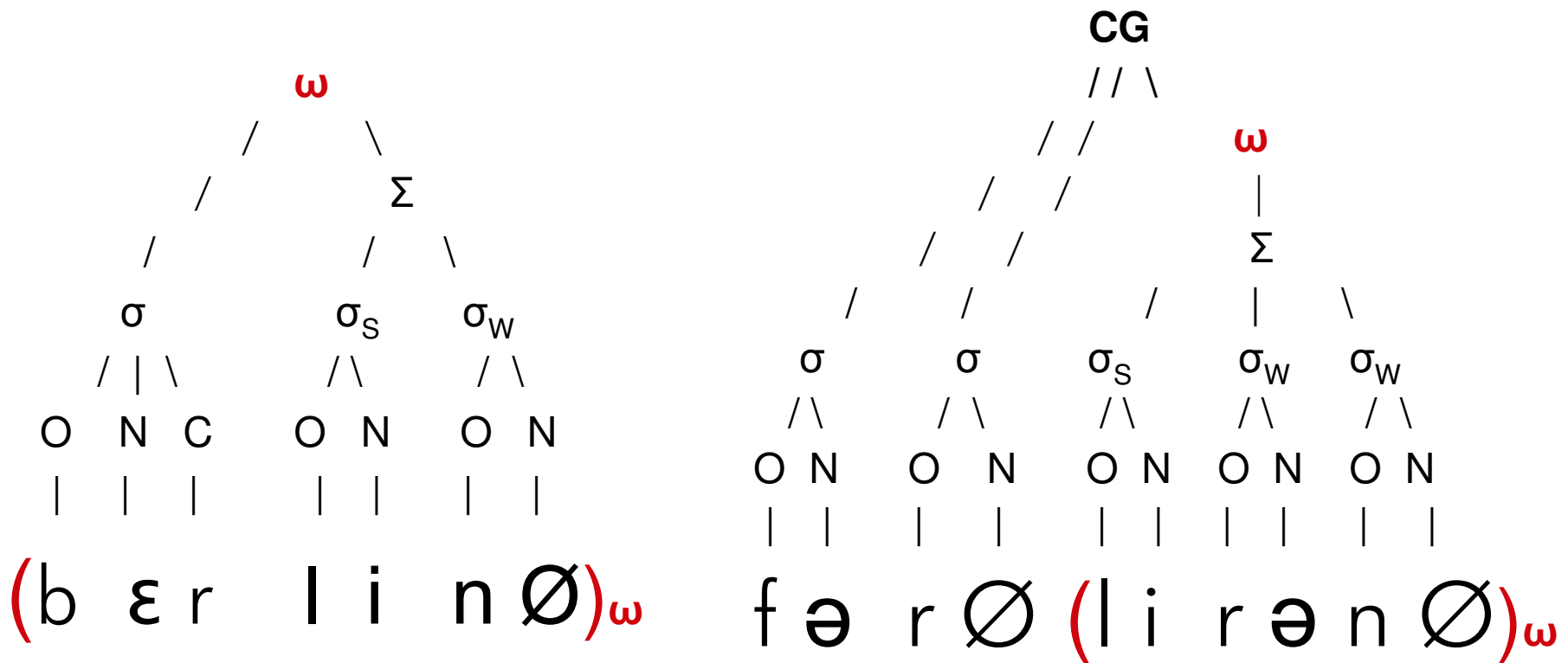
GP-alignment: Align (Stem, E, ω , E)

$[[f \text{ ə } r]_{\text{Pref}}([l \text{ i } r \text{ ə } n]_{\text{STEM}})_{\omega}]_{\text{Verb}}$

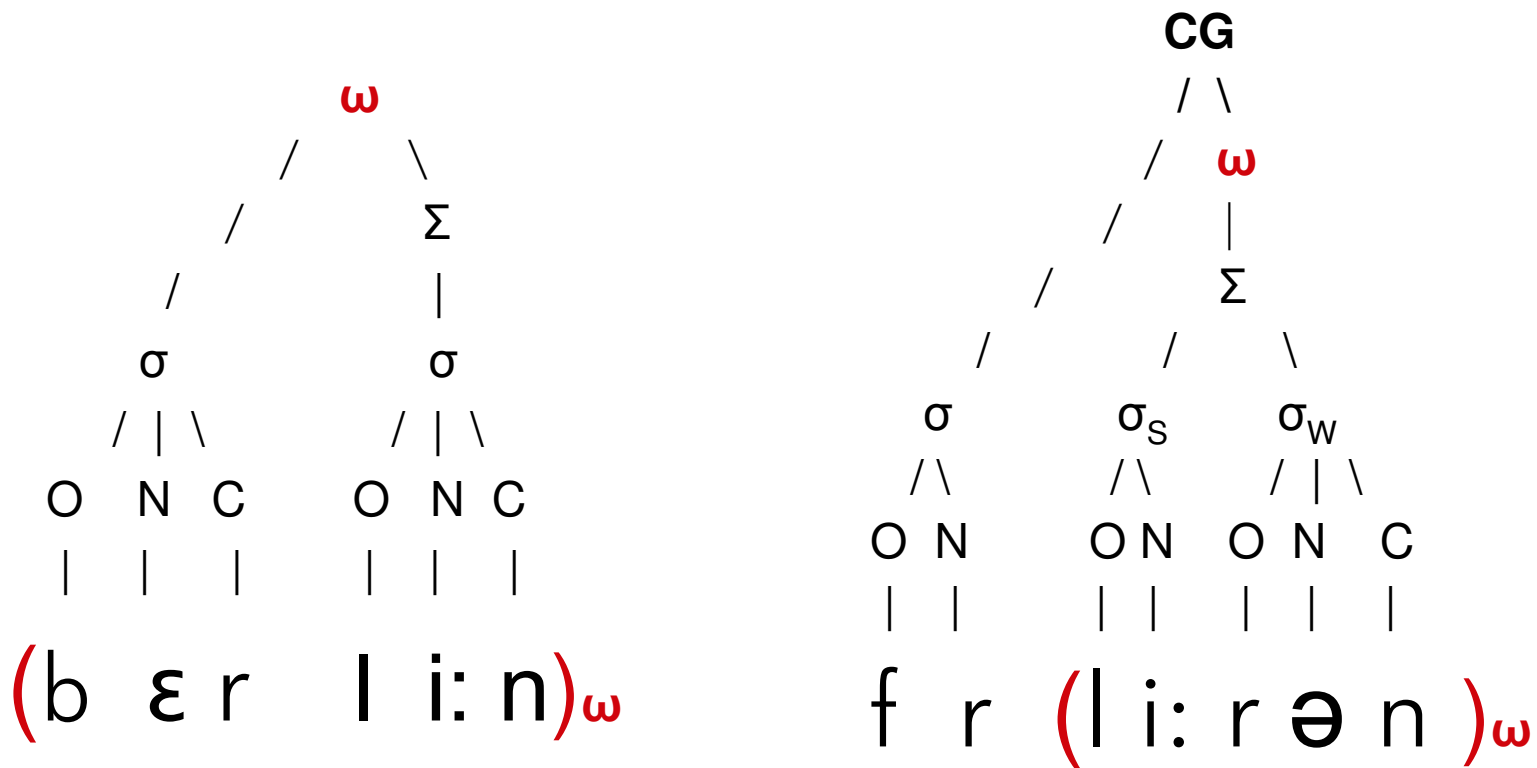
The phonology of prefixation

(b ε r l i n)_ω f ə r (l i r ə n)_ω

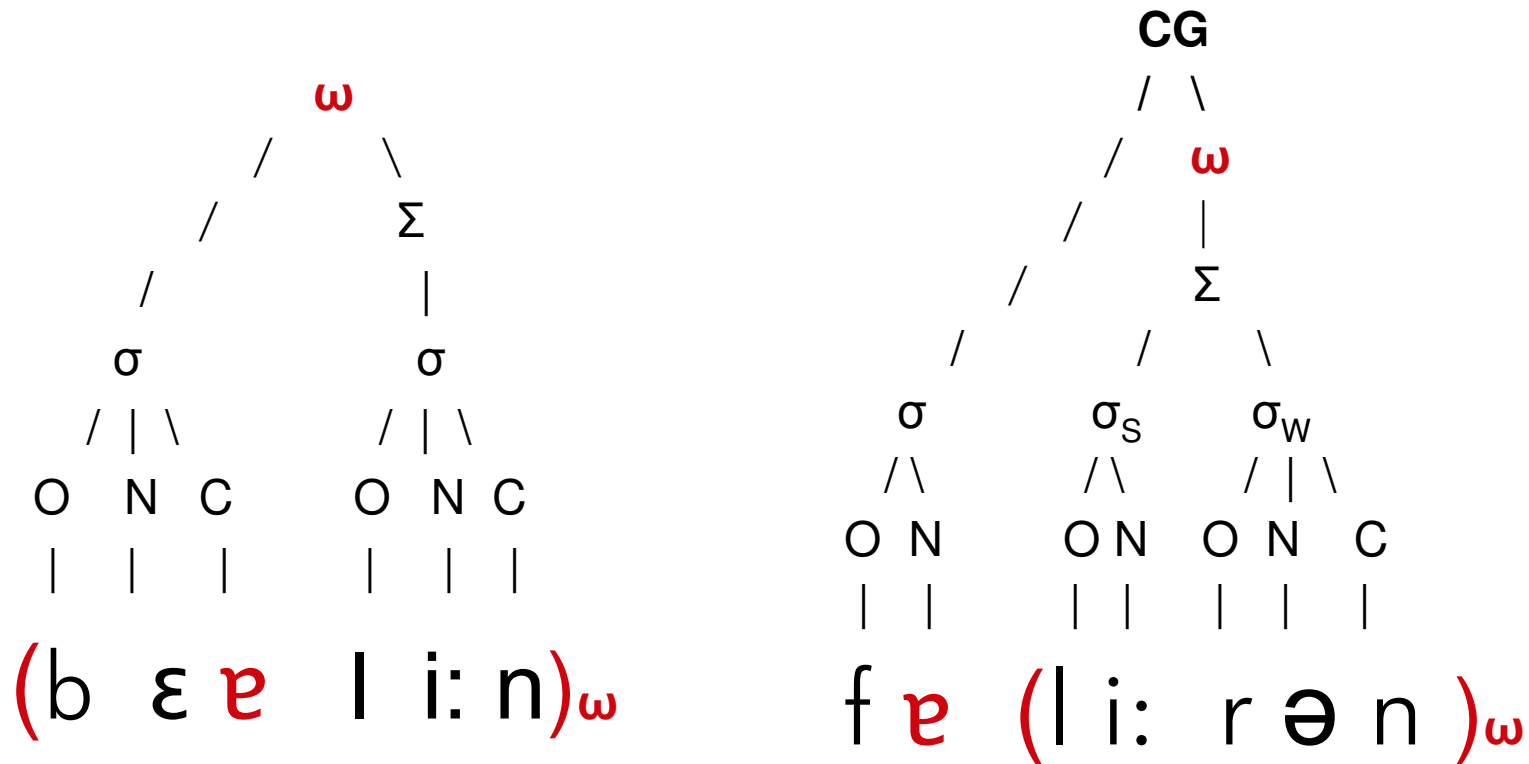
The phonology of prefixation



The phonetics



The phonetics



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- = > **Experimental evidence**
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Phonetic production experiment

Hypotheses:

- In words with a morphological boundary after $\langle C_0er \rangle$ (e.g. *Versuch, zerfetzt, Ermahnung*) / ər / is realised
 - as monophthong [e] and/or
 - with a shorter duration.
- In words without a morphological boundary after $\langle C_0er \rangle$ (e.g. *Ferment, Termin, Berliner*) / ɛr / is realised
 - as diphthong [ɛ̯e̯] or as [ɛr] and/or
 - with a longer duration.

Stimuli

- 39 target words
 - 15 without a morphological boundary after /ɛr/ ("simplexes")
vs. 24 prefixed words (prefixes: *er-*, *ver-*, *zer*)
 - stress on second or third syllable → /ɛr/ or /ər/ is always unstressed
 - controlled for word frequency (from COSMAS)
- two types of carrier sentences
 - MFCs: meaningful carrier sentences (e.g. *Die Reaktion wird vom Ferment gesteuert.* = *The reaction is controlled by the ferment.*)
 - CFCs: citation form carrier sentences (*Ich habe "Ferment" gesagt.* = *I said "ferment".*)
- in each carrier sentence target word is penultimate word and carries nuclear pitch accent
- 293 filler sentences (mainly stimuli for other research questions)

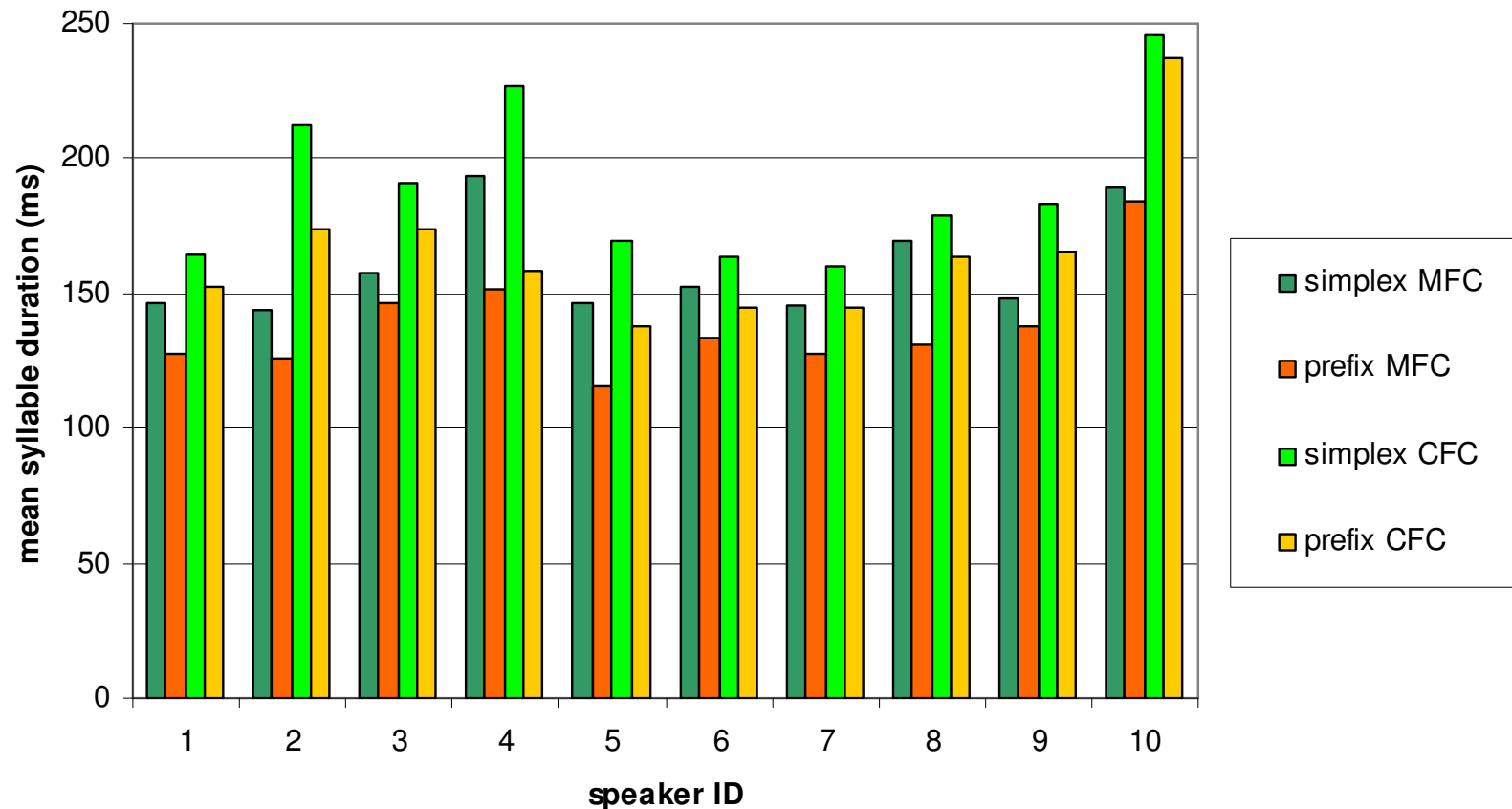
Experimental setup

- task: reading aloud
- participants:
 - 5 male, 5 female
 - native German speakers
 - different dialectal backgrounds
- order of presentation:
 - set of all MFCs followed by the set of all CFCs
 - different randomization for each participant within each set

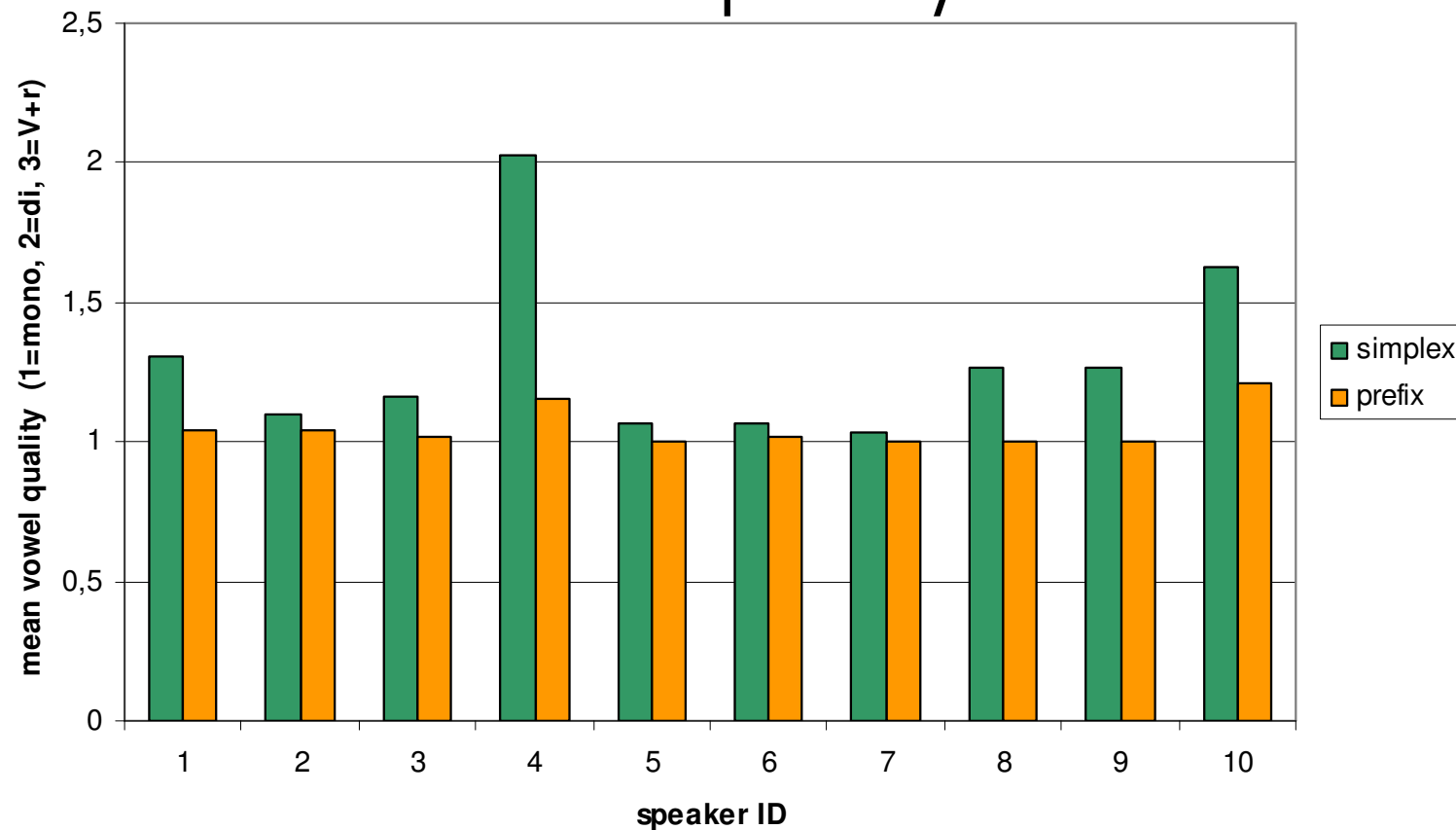
Data

- 780 realised target words
(39 target words x 10 speakers x 2 types of carrier sentences)
- automatic broad phonetic alignment of canonic transcription with MAUS (Munich AUTomatic Segmentation System)
- manual correction of segment boundaries by two phoneticians → extraction of segment and syllable durations
- auditory classification of vowel as
 - monophthong (e.g. as realised in *Berliner, versteckt, Vermahnung)*
 - diphthong (e.g. as realised in *perfekt*)
 - vowel + /r/ (e.g. as realised in *Ferment*)

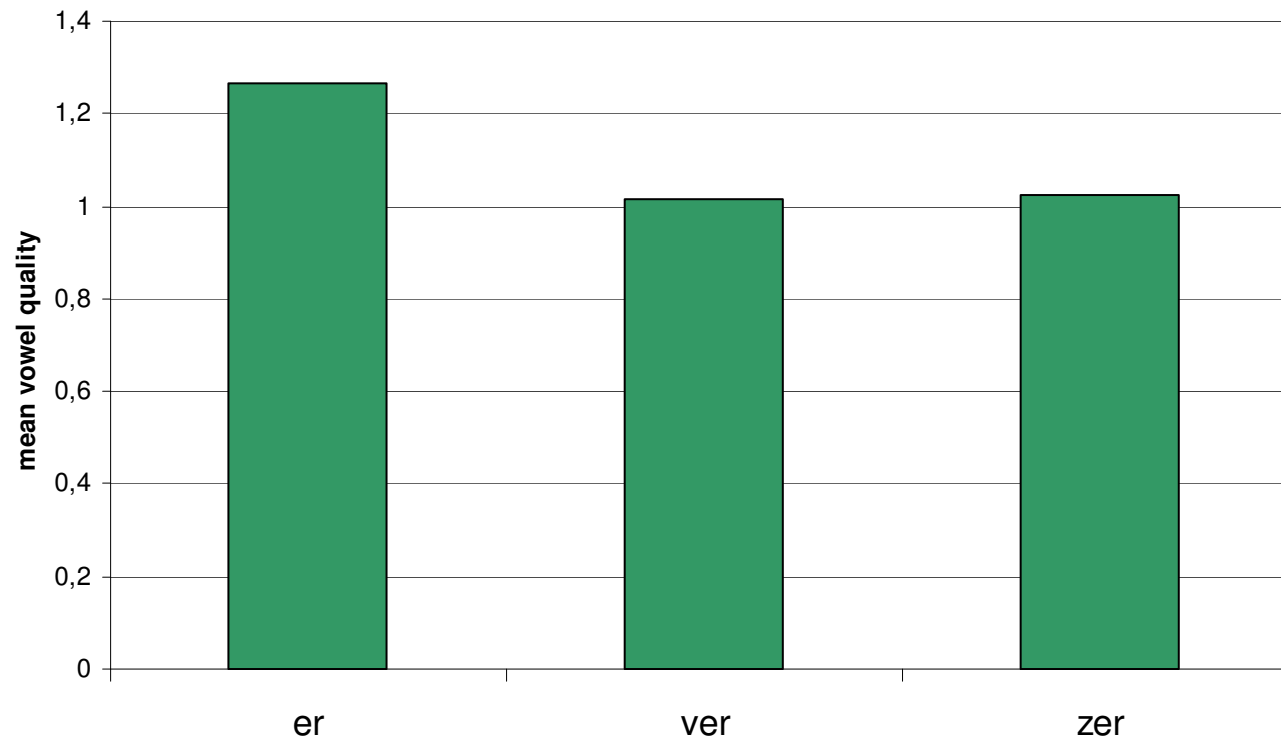
Statistically significant differences: mean syllable durations



Statistically significant differences: vowel quality



Statistically significant differences: vowel quality (*er* vs. *ver/zer*)



Hypothesis check

- In words with a morphological boundary after $\langle C_0er \rangle$ (e.g. *Versuch*, *zerfetzt*, *Ermahnung*) / ər /
 - is almost always realised as monophthong and
 - has a significantly shorter duration.
- In words without a morphological boundary after $\langle C_0er \rangle$ (e.g. *Ferment*, *Termin*, *Berliner*, ...) / ɛr /
 - is sometimes realised as diphthong or as [ɛr] and
 - has a significantly longer duration.

⇒ significant boundary effect!

The form of prefixes

bə-

gə-

fər-

t^sər-

ər-

The form of prefixes

bə-

ɛnt-

gə-

fər-

t^sər-

ər-

The form of prefixes

bə-

ɛnt-

mɪs-

gə-

ʊm-

dʊrç-

fər-

t^sər-

ər-

The form of prefixes

bə-	ɛnt-	mɪs-	hɪntər-
gə-		ʊm-	vidər-
		dʊrç-	ʊntər-
fər-			ybər-
t ^s ər-			
ər-			

The form of (verbal) prefixes

bə-

ɛnt-

mɪs-

hɪntər-

gə-

ʊm-

vidər-

dʊrç-

ʊntər-

fər-

ybər-

t^sər-

ər-

Doomed (verbal) prefixes

† fol-

vollziehen

vollbringen

vollenden

vollstrecken

vollführen

† op-

(†)obsiegen

(†)obwalten

obliegen

The form of (verbal) prefixes

bə-

ɛnt-

mɪs-

hɪntər-

gə-

ʊm-

vidər-

dʊrç-

ʊntər-

fər-

ybər-

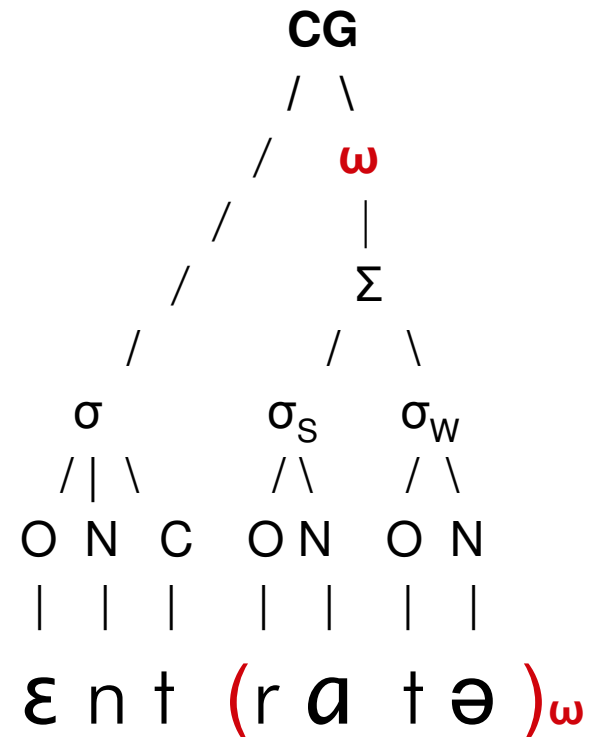
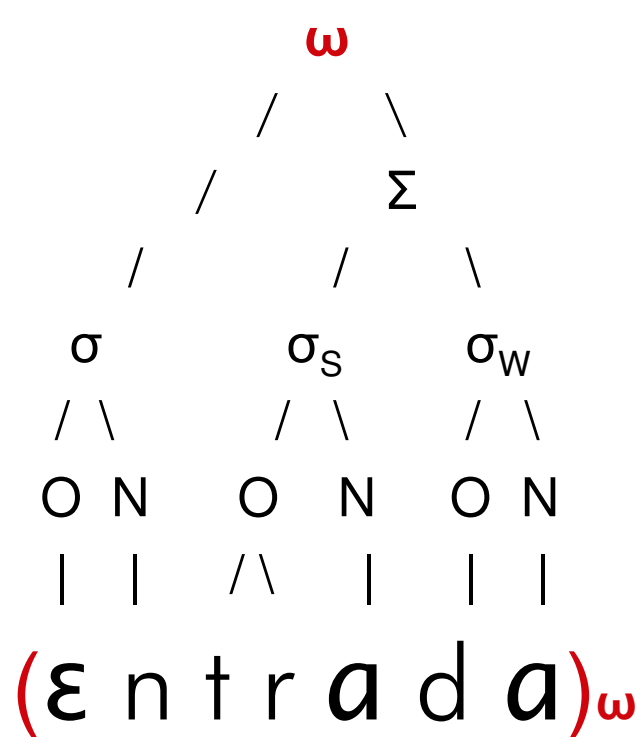
t^sər-

ər-

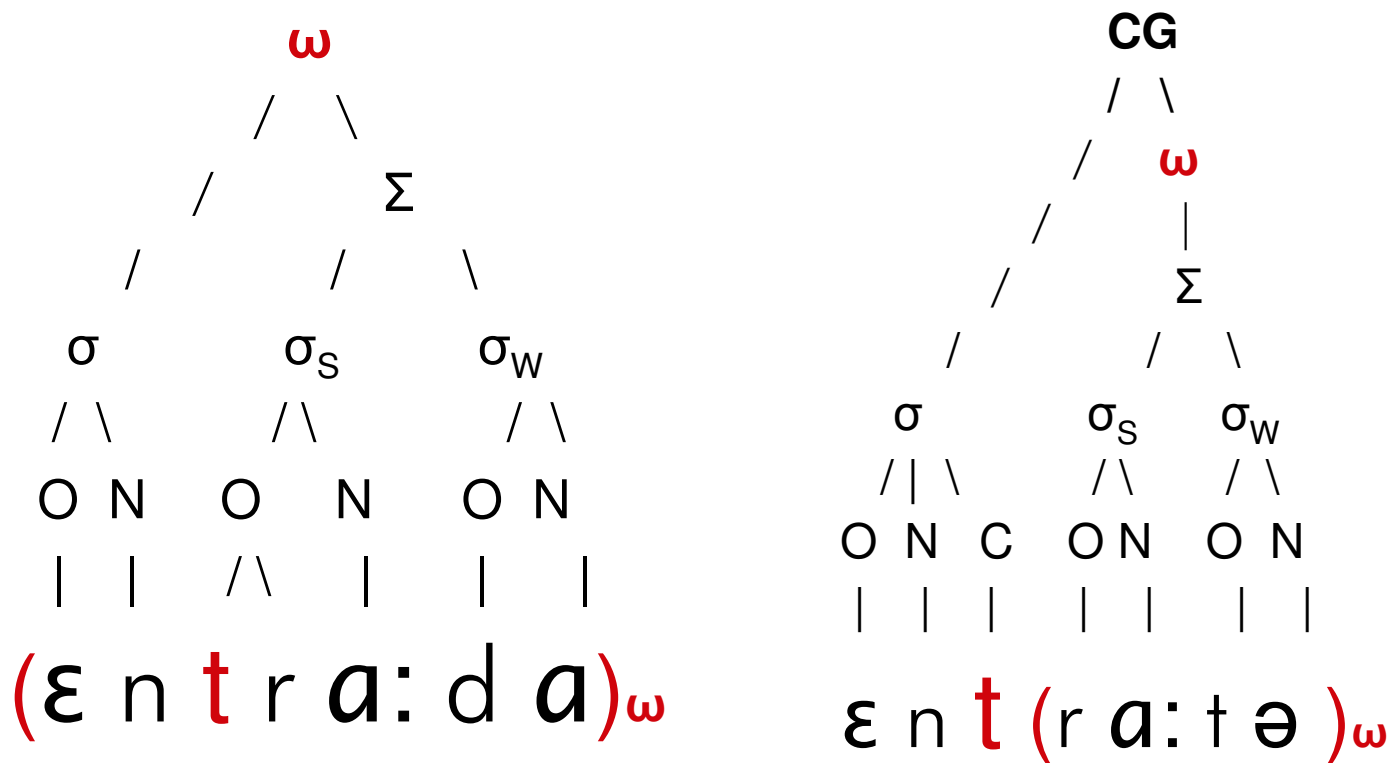
Boundary effect

$[\varepsilon \text{ n t r a d a}]_w$ $[\varepsilon \text{ n t}]_{Pr} [r \text{ a t } \emptyset]_{St}$

Boundary effect



Strictly phonetic boundary effect



Prefixes versus prefixoids

$[[\text{be}]_{\text{Pref}}([\text{ginnen}]_{\omega})_V]$ $[[([\text{an}]_{\text{Pr-oid}})_{\omega}([\text{geben}]_{\omega})_V]$

Prefixes versus prefixoids

[[be]_{Pref}[ginnen]_{St}]_v

[[an]_{Pr-oid}[geben]_{St}]_v

Vowels in prefixoids

i y u

e ø o

a

-an

-ap

-auf

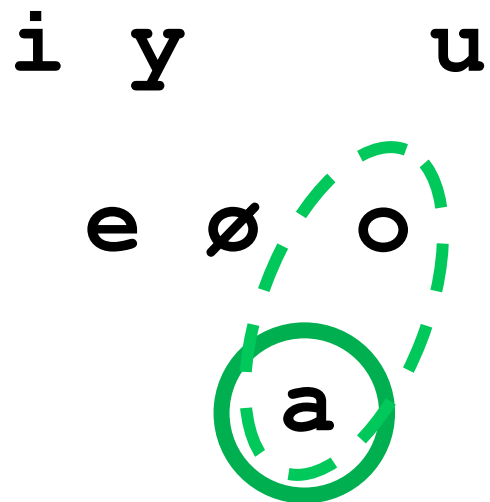
-aus

-ain

-bai

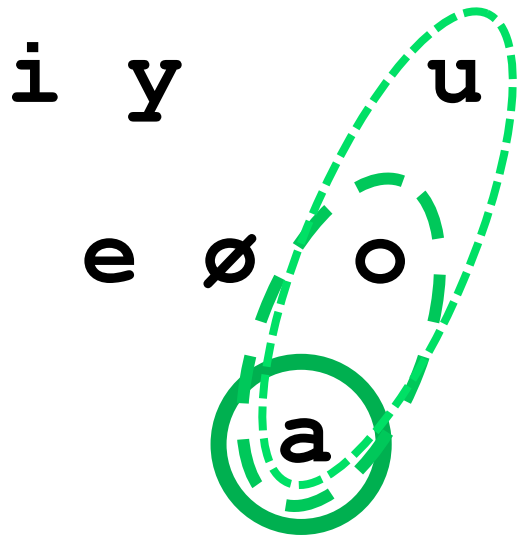
-na:x

Vowels in prefixoids



- an
 - ap
 - auf
 - aus
 - ain
 - bai
 - na:x
- for

Vowels in prefixoids



-an -for -t^su
-ap -um
-auf -dʊr ɕ
-aus -unter
-ain
-baɪ
-na:x

Prefixoids versus verbal arguments

angeben

ablehnen

aufhören

auslegen

einsehen

nachdenken

beisetzen

vorschlagen

zuhören

umsetzen

durchdrehen

danebenhauen

dazwischenfunken

dahinterklemmen

dagegenstellen

dafürhalten

mitessen

hinsehen

weggehen

hochjubeln

No restriction on the form of modifiers

[ur] Ur-enkel

[abər] Aber-glaube

[dɛs] Des-interesse

[anti] Anti-christ

[ɛrt^s] Erz-bischof

[Ir] ir-relevant

[a] a-symmetrisch

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suffixes vs. suffixoids

-chen, -lich, -ling,
-nis, -ler, -ner,
-sel -tel,

-bar, -haft, -schaft,
-sal, -sam, -fach
-heit, -voll, -los,
-tum, -mut,
?-artig, ?-weise
?-halber

The form of suffixes: catalectic consonants

lər

nər

zəl

təl

çən

lɪç

lɪŋ

nɪs

The form of suffixes: catalectic

consonants

l^ər

n^ər

z^əl

t^əl

ç^ən

lɪç

lɪŋ

nɪs

The form of suffixes: other cases

l^ər

n^ər

z^əl

t^əl

ç^ən

lɪç

lɪŋ

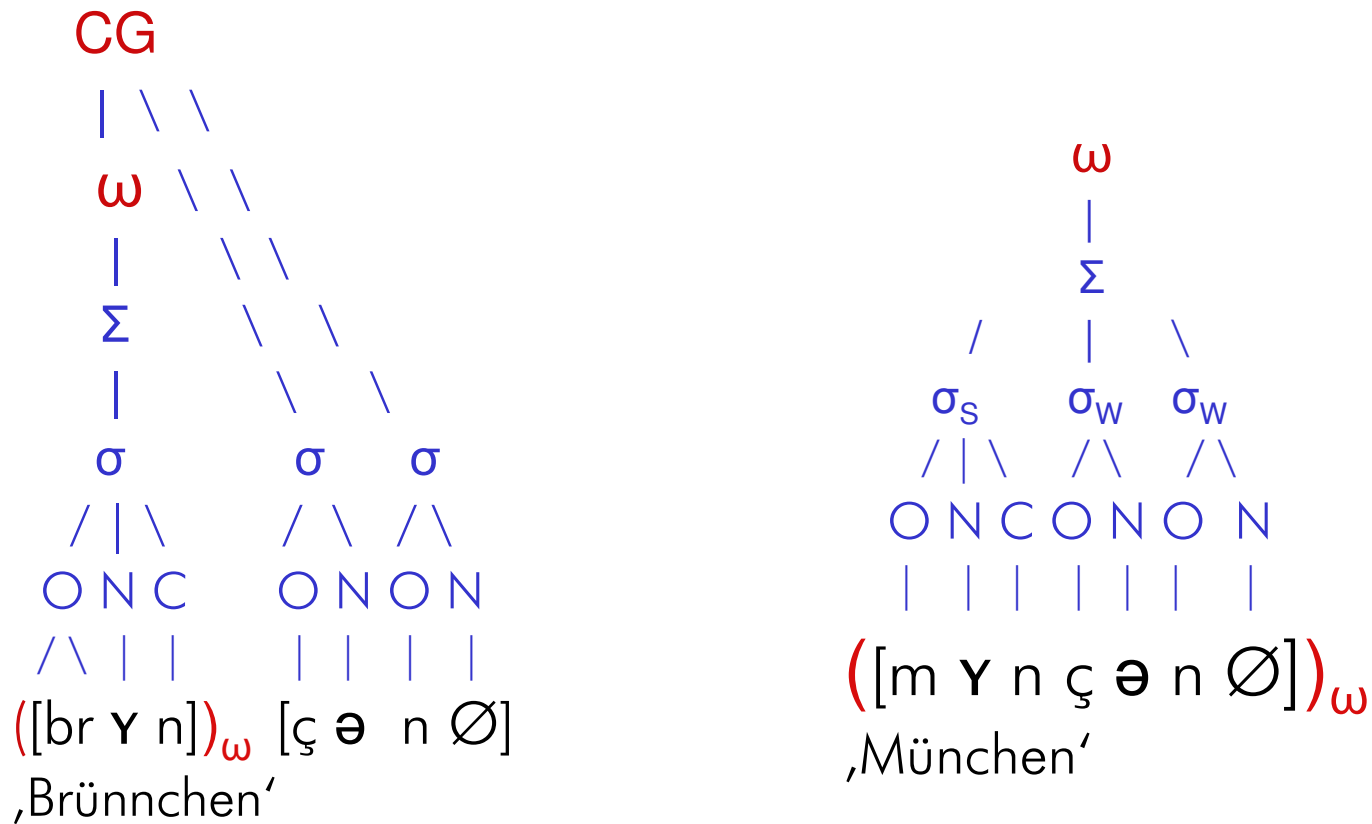
nɪs

The form of suffixes: other cases

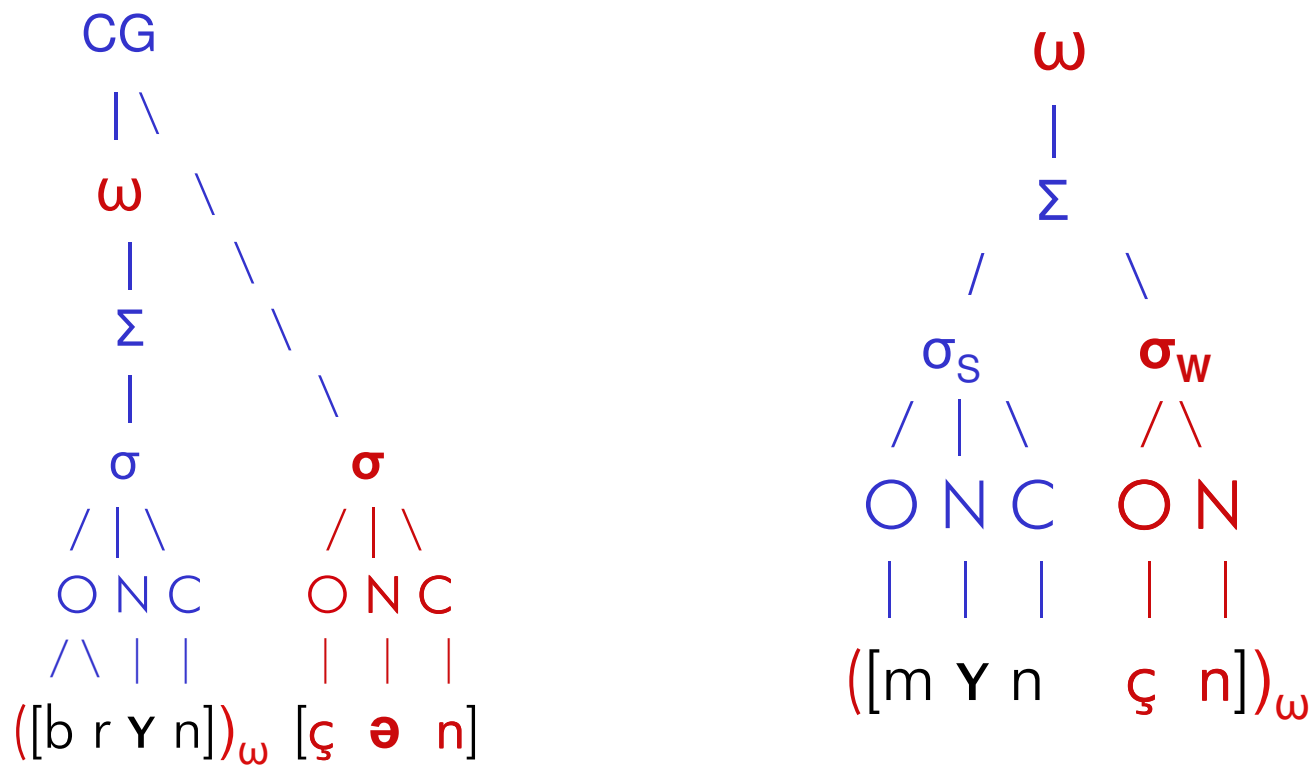
l_ər
n_ər
z_əl
t_əl
ç_ən

l_Iç
l_Iŋ
n_Is

GP-alignment



Reflex of alignment at the phonetic level

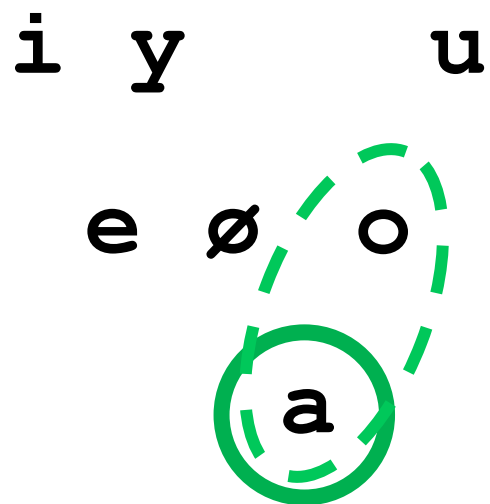


The form of suffixoids

i y u
e ø o
a

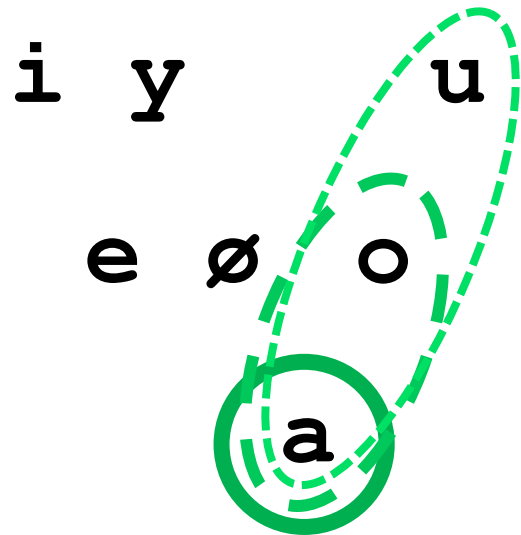
-bar
-zal
-zam
-haft
-fajt
-fax
-mal
-hait
-artig
-vaize

The form of suffixoids



-bar -fol
-zal -los
-zam
-haft
-faft
-fax
-mal
-hait
-artig
-vaize

The form of suffixoids



-bar **-fol** **-tum**
-zal **-los** **-mut**
-zam
-haft
-fajt
-fax
-mal
-hait
-artig
-vaize

Distinct selectional properties

suffixoids
combine with
suffixoidstems

suffixes
combine with
suffixstems

Relevance of inflectional paradigm

suffixoidstem

suffixstem

Relevant:

{*Arzt*, *Ärzte*}

⇒ *Ärzteschaft*

{*Bauer*, *Bauern*}

⇒ *Bauern*tum

{*Christ*, *Christen*}

⇒ *Christen*heit

Barely relevant:

Arzt ⇒ *ärztlich*

Bauer ⇒ *bäuerlich*

Umlaut

suffixoidstem

suffixstem

Tends to be preferred:

Never chosen!

Stölzling ~ Stolzling

Säuernis ~ Sauernis

knäpplich ~ knapplich

Frisürchen ~

Frisurchen

Rohkötler ~

Rohkostler

Variation in new formations

suffixoidstem

suffixstem

Rare

Common

wochen-haft

wochen-los

wochen-weise

wöchent-lich

Wöchel-chen

Variation in new formations

suffixoidstem

suffixstem

Rare

(semantically
motivated)

arzt-los

ärzte-los

Variation in new formations

suffixoidstem

suffixstem

Rare

(semantically
motivated)

Never any semantic
significance

arzt-los

ärzte-los

endings: -ə, -ən

suffixoidstem

suffixstem

siebenen-fach

daumenen-los

Offenen-heit

Do not

occur

Endung: -ə, -ən

suffixoidstem

suffixstem

siebenen-fach
daumenen-los
Offenen-heit

sieb∅-tel
Däum∅-ling
öffent-lich

Juncture: C_i-C_i
suffixoidstem suffixstem

leb-bar

Papst-tum

ziel-los

zwölf-fach

Does not
occur

Juncture: C_i-C_i

suffixoidstem

suffixstem

leb-bar

Papst-tum

ziel-los

zwölf-fach

Kennt-nis

hundert-s-tel

Bäch-el-chen

öl-lich/-ig

Odd man out:

[laɪn] - *'lein'*

Hunde-lein
Hünd-lein

Suffixoids

Combinatory properties similar to those of final compound members

Few exceptions

compound stem: Glückskäfer

suffixoid stem: glücklos

Suffixoids

Suffixoids evolve from the stock of final compound members (functors) subject to phonological restrictions (a,o,u).

Affixoids

Suffixoids evolve from the stock of final compound members (functors) subject to phonological restrictions (a,o,u).

Prefixoids evolve from the stock of prepositions (functors) subject to phonological restrictions (a,o,u).

Summary

All argument categories (e.g. stems) form separate pwords and exhibit no phonological restrictions.

The same holds for modifiers.

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= > also true for English

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= > English: only affixes

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Affixes do not form separate pwords:
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form clitics.

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=> **Also true for English**

Summary

Functor categories come in two types:
affixes and affixoids.

Affixoids form separate pwords.

There are severe restrictions on form:
only back vowels are permitted

Summary

GP-alignment constraints refer to
the phonological level
(they “apply” in the lexicon)
but appear to persist at the phonetic
level (in careful pronunciation).

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Thank you!

<http://www.ids-mannheim.de/gra/wortphonologie.html>